The Economics of the Agricultural Sector

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THE INDUSTRIAL INSTITUTE FOR ECONOMIC AND SOCIAL RESEARCH

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The Industrial Institute for Economic and Social Research

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Institutions (Within brackets the Swedish name)

The Agricultural College (Lantbrukshögskolan)
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The Ministry of Finance (Finansdepartementet)
The National Agricultural Marketing Board (Statens Jordbruksnämnd)
The National Board of Agriculture (Lantbruksstyrelsen)
The National Institute of Economic Research (Konjunkturinstitutet)
The Swedish Agricultural Research Institute (Jordbrukets Utredningsinstitut)

FOREWORD

The analysis of problems in different sectors of the economy represents an important part of the research done by the Swedish Industrial Institute for Economic and Social Research. Considerable attention has thereby been devoted to agriculture. One reason for this lies in the serious adjustment problems encountered by agriculture with the industrialization of society, as well as the importance of the factors of production - especially labour - that are in the agricultural sector. The powerful influence that the state has come to exert on the economic conditions of agriculture has added prominence to the economic problems of this sector.

The following study is aimed at an analysis of the factors determining the economic situation and development of agriculture. An attempt has been made to penetrate the problems theoretically as well as to compare the theories with empirical material: the first of these ambitions has entailed some theoretical developments, while the second has required extensive processing of data. For the convenience of the reader, technical details regarding theoretical deductions and empirical calculations have been relegated to appendices.

Some of the principal ideas expounded in this study, especially as regards the effects of agricultural policy, have already been put forward in a book, entitled »Jordbrukspolitikens mål och medel» (The Ends and Means of Agricultural Policy). The present study aims at a considerably more penetrating analysis of the influence of agricultural policy – of price policy in particular – on the economics of the agricultural sector. Environmental problems are, however, not analyzed.

The authors are Associate Professor Odd Gulbrandsen of the Uppsala College of Agriculture and Professor Assar Lindbeck of the Institute for International Economic Studies. Fil.kand. Karl Göran Mäler of the Stockholm School of Economics has compiled two of the appendices and helped to edit the entire study, especially Chapters 4 and 10. Fil.lic. Gunnar Österberg has on behalf of the Institute made a study of the economic gains resulting from the transfer of labour between different sectors during the post-war years. As the problems of of the agricultural sector, and of agricultural policy, are quite similar in most West-European countries, we hope that the study shall also be of interest outside Sweden.

This publication is a translation of the book in Swedish entitled *Jordbruksnäringens ekonomi.* The translation and printing were financed by the Swedish Council for Social Science Research. The translation has been made by Mr Patrick Hort.

Stockholm, December 1972.

Lars Nabseth

INTRODUCTION

THE BACKGROUND TO AGRICULTURAL POLICY

The problems of the agricultural sector have long occupied a prominent position in discussions of economic policy. Formerly, of course, this was due to the dominant role of agriculture in the economy as a whole. But even though the agricultural sector has shrunk during the last hundred years from about 40 to 3 per cent of the gross national product (GNP) and the number of persons employed in agriculture from about 70 to 6 per cent of the total labour force, the interest aroused by questions of agricultural policy has by no means diminished.

One explanation for this is probably to be found in the fundamental importance of food – and food prices – to the households. But there is also another explanation, namely the acute problems of social adjustment resulting from the drastic reduction of the agricultural sector: people have had to change their jobs, homes and ways of life; depopulation has resulted in an amenity crisis in the provision of services in rural areas; the surviving agricultural population is characterized by a rising average age and low-wage groups; changes in the cultivated traditional landscape, and so on. Two additional factors have appeared in recent years; the spectre of world famine and the problems related to the developing countries' interests as exporters of agricultural produce.

The reasons for the special difficulties encountered by agriculture in the economic growth process are by now quite familiar. Rising incomes result in only a slow increase in the demand for agricultural products; that is, the income elasticity of agricultural products is low, particularly in countries with high income levels. This has been the case in Sweden, particularly since the 1920's. In Sweden's case also a slow rate of population increase has limited the growth of demand. The increase in the demand for food that does occur is primarily a demand for higher quality, increased processing, better packaging and so on, factors which do little to increase the demand for agricultural products as such.

Since agricultural productivity, in line with that of other sectors, tends to rise by two or three per cent annually, supply tends to increase faster than demand, unless factors of production rapidly leave the sector. Such a movement out of the sector has not taken place at a sufficient rate to avoid excess supply on the domestic market.

These problems might not have become serious if Sweden had been able to develop a large net export of agricultural products. But the international position of Swedish agriculture has not made this economically feasible. On the contrary, import regulations have had to be employed in order to protect domestic agriculture from foreign competition and so reserve at least the bulk of the home market for the benefit of Swedish farmers. At the same time, however, the excess supply has made it difficult to guarantee the home prices that have been aimed at. Since the price elasticity of demand for agricultural products is low, even a relatively slight excess of supply can result in drastic price cuts and, accordingly, to reductions in farmers' earnings. In order to maintain as far as possible the domestic prices for which import regulations are intended, a great deal of the home surplus has been sold abroad at prices appreciably below those on the home market, The resultant »export losses» have to some extent had to be borne by the farmers themselves.

New techniques and changes in relative prices, especially wage increases in relation to the price of machinery and raw materials, have made it profitable to replace labour with capital and raw materials. The decreased demand for factors of production in agriculture has therefore become particularly great as regards labour which has accentuated the social problems of the sector.

Thus agricultural earnings are caught in a kind of cross-fire consisting of foreign competition and a slow rise of domestic demand as well as a combination of increasing productivity and the imperfect mobility of factors of production. This has limited the possibility of improving earnings by means of price increases. Nor has increased productivity resulted in any particularly rapid rise in earnings, owing to the tendency for so many factors of production to remain in the sector, thus reducing incomes per factor.

THE ORIGIN AND DEVELOPMENT OF AGRICULTURAL POLICY IN SWEDEN

The severe competition from abroad dates back almost a hundred years. The first international »price shock» for Swedish agriculture came in the 1880's with the appearance of cheap North American grain on the European market. This, it will be recalled, led to the introduction of grain tariffs in practically every country in Europe. Due, however, to the transfer of resources into livestock production, coupled with the rise in domestic demand resulting from the industrialization of the country, there was no serious agricultural crisis until after the First World War.

The recovers of world trade in the 1920's and 1930's led to a drastic fall in prices from the exceedingly high level they had reached during the war years. This trend was accentuated during the depression, due to reduced demand for agricultural commodities. An elaborate system of price regulations was then introduced to protect agriculture. This included various kinds of quantitative

regulations – monopoly, licences, milling control and support buying – as well as price control measures – tariffs, levies, taxes, excise duties, price supports and export subsidies. The price regulation system set up at that time to screen off the Swedish market and reserve it for Swedish agriculture at guaranteed prices has survived more or less intact to this day.

In framing subsequent agricultural policy, the Swedish government has encountered considerable difficulty in striking a balance between the interests of the farmers and those of society ensuring guaranteed prices and incomes on the one hand and the promotion of greater efficiency on the other. This dilemma is reflected in the principles of agricultural policy laid down by the Riksdag in 1947. On this occasion price regulations were regarded primarily as a means of guaranteeing farmers' incomes: the income objective was now ranked first among the goals of agricultural policy, the principal aim being to safeguard the earnings of »standard farms» – i.e. farms with 10–20 hectares of arable land, then as now the average acreage in Sweden. Farmers of such units were to be assured of incomes at the same level as other, comparable population groups, mainly the rural industrial workers. Another motive for price support, following the experiences of the Second World War, was to maintain the volume of production so as to guarantee an adequate food supply in the event of an emergency – this can be described as the emergency or *production objective.*

Even while this policy was being formed, available forecasts indicated that there was a long-term risk of a domestic output surplus. One contributing factor was the ambitious scale of the income objective which involved keeping prices so high that they could stimulate production to reach, in the long run, a level for above the emergency requirements. There was also the risk of perpetuating an economically inefficient structure of farms, since the standard farm whose earnings and profitability were to be secured was smaller than what was then regarded as the efficient unit, namely the so-called norm farm of 20–30 hectares arable. A government rationalization policy was therefore initiated to limit these risks by means of government credits and investment subsidies, government purchase and sale of land to ease the amalgamation of small farms and so on. Regional agricultural boards were set up to administer the operations and the National Board of Agriculture shuldered the central authority. Thus administrative rationalization was connected with an *efficiency objective* for the agricultural sector.

This rationalization programme was combined with the land purchase legislation enacted previously and designed primarily to preserve agricultural land for the agricultural population, besides safeguarding small and medium-size family farms. This was directly in line with earlier economic policy as manifested in the good husbandry and anti-corporation laws passed at the turn of the century.

Thus the agricultural policy of the post-war period may be characterized by three prime objectives:

1. Income parity for the agricultural population (especially owners of »standard farms») in relation to other social groups (the *income objective*).
2. A certain production capacity in agriculture (the *production objective*).
3. The effective use of available resources – especially in agriculture (the *efficiency objective*).

Three main instruments of policy have been applied to these ends:

1. Price controls on agricultural products.
2. Special land purchase legislation for agriculture.
3. State-sponsored rationalization through administrative channels.

Price regulation came gradually to be augmented by a system of price differentiation in favour of certain groups – primarily small farmers and farmers in northern Sweden. Support was primarily applied to milk, the staple product of these groups. To limit the stimulus to production, this support has been gradually modified to include acreage subsidies and other forms of aid not immediately related to the volume of production.
Of recent years a fourth instrument, that of labour market policy, has been applied to ease the transfer of farmers to other sectors of the economy. This policy has included such measures as farm purchase, deficiency payments and unemployment benefits to farmers seeking alternative employment.

THE REGULATION OF MARKETS AND PRICES

Price regulation has become the central instrument of agricultural policy. The most important form of price regulation is the protection provided, especially since 1956, by means of import duties. In 1956 a system was introduced of so-called median prices, whereby the domestic price is kept at the desired level above the world market price, i.e. the median price. To reduce the inconvenience to trade and administration of frequent changes in import duties, these are left unchanged in principle as long as domestic prices, determined by world prices and import duties, remain within certain limits on either side of the median price; generally changes within an interval of 20–30 per cent between the limits has been accepted for an individual product.

Import regulation has been supplemented by other forms of support, mainly by subsidies which are financed out of the government budget and by means of revenue from import duties and levies on domestic production. The levy system is administered by regulating associations which allocate clearing funds. These funds, financed by the proceeds of regulation, are used to promote the export of domestic surpluses which would otherwise depress prices and thus frustrate the purpose of the import regulation. Grain, oil crops, dairy products, meat, pork and eggs are among the products to which this system is applied.

A clearing system also exists for sugar, the object here being to use the revenue of the import duties to finance a higher price for domestic sugar production than the height of the import duty alone would provide. Certain food processing industries such as chocolate and biscuit factories are reimbursed for the price increase incurred by them as a result of regulation, so as to prevent regulation drastically impairing their international competiveness.

As already mentioned, import duties and levies on domestic production are the two main types of charges. Whereas import duties in principle raise domestic prices above those of the world market, levies on domestic production decrease prices paid to producers, unless import duties are raised to a corresponding degree (hence the earlier application of what were known as compensation levies). Milling (cereals) and slaughter charges are two examples of levies on production.

There are also a number of market regulations applied in conjunction with or apart from these price controls. Of these the economically most important are the cereal, fat and milk regulations.

The three main objectives of cereal regulation are to guarantee stable prices during the regulation year, to finance stockpiling during the year and to guarantee Swedish cereals a home market. Speculation is prevented by the regulation body (the Swedish cereal trade board) offering a guaranteed price. Storage financing is eased by government credits and by a seasonally differentiated compensation for the storage cost incurred by farmers built into the guaranteed price. The market guarantee is need to prevent imports when prices are low and to secure the sale of Swedish cereals even though it is inferior to the grades on the international market. It is obtained by mixing in a fixed proportion of homegrown grain in milling; this in turn is arranged by negotiations between the regulating authorities and the milling industry (with the implicit threat of compulsory milling quotas).

The principal aim of fat and milk regulation is to provide a domestic outlet for milk – about half of the total production – not used for consumption, cream or cheese. Most of the residue has to be made into butter. Owing to the competition from margarine, however, it is not possible to sell the butter on the home market at a price high enough to cover the clearing price that is supposed to be paid to the producers for the milk used in butter production. Instead a high price is charged for milk for consumption, the demand for which is not very price sensitive. The profit is used for subsidies to keep down the price of butter. Thus a system of price differentiation is used to exploit the different price elasticity of various products with a view to increasing farmers' incomes.

Fat regulation also comprises guaranteed market for domestic oil crops. The point here is that high quality margarine cannot be based exclusively on homegrown oils. An agreement between the government and the margarine industry

provides for the purchase by the latter, in the event of abundant harvest, of larger quantities of oil crops than the industry itself requires. The surplus thus acquired is sold abroad.

The market regulations have been further reinforced by the transformation of the agricultural processing industry into a cartel with government participation. Sugar has long been the exclusive preserve of a single concern, Svenska Sockerfabriks AB (SSA), now a subsidiary of AB Cardo. Most other products have come to be marketed on a cooperative footing through agricultural associations. Oil crops are collected by Sveriges Oljeväxtintressenter (SOI). The Swedish Dairies Association (SMR) accounts for 99 per cent of milk collection and processing, the Swedish Farmers' Meat Marketing Association (SS) for some 85 per cent of slaughtering and the Swedish Farmers' Purchasing and Marketing Association (SLR) for about 70 per cent of cereal collection and some 30 per cent of flour production. The most important feature in the formation of cartels has consisted of regional marketing agreements coupled with a refusal to deliver finished products outside the regions, and market guarantees for farmers coupled with compulsory delivery and uniform pricing.

This cartel formation has been supported by the government because it has eased the administration of agricultural regulation, the simplified administration and control connected with the disbursement of export and other state subsidies, clearing between products and firms and the collection of dues. This administration is directed and supervised by a government body, the National Agricultural Marketing Board.

THE PRESENT ROLE OF AGRICULTURE IN THE ECONOMY

What then are the principal characteristics of the agricultural sector so largely determined by this regulatory apparatus?

The following figures will serve to illustrate the present role of agriculture in the economy. The value of total production (1968) is in the order of Sw.kr. 6 billion, of which Sw.kr. 4 billion constitute the contribution of agriculture to GNP, i.e. about 3 per cent. Deducting the support to agriculture, i.e. measuring the contribution of agriculture to GNP in international prices, leaves about Sw.kr. 1 1/2 billion or some 1 1/2 per cent of GNP. Less than 1/10th of expenditure for total private consumption in Sweden goes to pay for products delivered by agriculture: however, food (including the processing and distribution of agricultural produce) amounts to about 1/3rd of the total expenditure of private households.

But farms also sell forest products – about 60 per cent of all forest production in the country, corresponding to a value of almost Sw.kr. 1 1/2 billion per annum. The contribution to the national product is not much less; since no price support is given to forest production, the contribution made by agricult-

ural forestry, measured in international prices, is almost as large as that of agricultural production.

The agricultural population also derives considerable income from activities in other sectors. On average, 1/3rd of farmers' total incomes are derived from other sources than farms (including forests). The 1960 census showed that only 2/3rds of all farmers and 60 per cent of their employees, were principally employed in agriculture. It should also be borne in mind that there is a fairly larg group who are employed part-time in agriculture but are not registered by the official statistics as agricultural population. As a result of the »mixed» employment, the number of people occupied with agriculture is considerably larger tha the supply of man-years might suggest. Whereas this supply can be estimated at around 200 000 man-years, some 6 per cent of the total volume of labour in Sweden, the number of people making a labour contribution to agriculture is estimated at almost twice this number. Again there is probably work done in agriculture that never finds its way into the statistics, e.g. holiday employment. Because of the personal links that exist between the agricultural population and people active in other sectors this labour-input may be significant. (Large grou of the population have left the land during past years; the total agricultural pop ulation is now estimated at 1/2 million as compared with about 2 million 20 years ago.)

One characteristic feature of agriculture is that most of the work – in term of volume about 3/4ths – is done by the managers, 90 per cent of whom also own the land.[1] Nearly all farms are family firms; only 1/7th of the work is do by employed labour and only a few thousand out of a total of 180 000 units have more than one employee. The farmers also provide most of the working capital; liabilities in the agricultural sector are on average no more than 1/4th of the total market value of assets; the average wealth of farmers is Sw.kr. 150 000, most of it invested in their farms. Capital investment in agriculture is also considerable compared to the total wealth of society as a whole. About 1/3rd of all taxable wealth in excess of Sw.kr. 100 000 among the gainfully em ployed population in Sweden is to be found in agriculture. Some 60 per cent of agricultural assets comprise real estate.

The capital assets of agriculture comprise vast areas of land. Farmers have at their disposal some 15 million hectares (including forests), an area corresponc ing to over half the total land area of the country (excluding impediments). Of this area about 3 million hectares are used for arable farming.

PROBLEMS TO BE ANALYZED

As is seen from the preceding survey, the problems of the agricultural sector are manifold. In this study we shall confine our attention to general economic aspects. Thus problems of business economics or environment preservation will

[1] However, part of the enterprise is often leased. About 1/3rd of arable land is held in this way.

not be considered in any detail. In agriculture, as in other sectors of a market economy, price formation and price policies are particularly important economic variables, and as such merit a central position in our analysis.

Part 1 contains an analysis of agricultural productivity (Chapter 1). This analysis serves to show that agricultural productivity is low compared to that of other sectors, and accordingly one is moved to ask why. The main factors that have been studied in this context are international prices (Chapter 2), the size of the agricultural sector and the structure of farms (Chapter 3).

Part 2 is devoted to an analysis of the effect of prices and productivity on the profitability of agriculture and on the prices of its factors of production. Particular attention is here given to the formation of land prices and its relation to the capitalization of profits (Chapter 4). A study is also made of income, wealth and living standards in agriculture. An attempt is thereby made to find out why factors of production remain within the agricultural sector despite low profitability (Chapter 5).

The low productivity of agriculture in relation to other sectors indicates that society can gain, especially in the long run, not only by the rationalization of agriculture but also by the transfer of factors of production from agriculture to other sectors. Part 3 begins with an analysis of the gains to the economy resulting from the reduction of the agricultural labour force in recent years. An attempt is made to ascertain the cost of the present scale of agricultural production as compared to the agricultural sector that would »survive» free trade (Chapter 6). This is followed by an estimate of the cost of an effectively organized agricultural sector large enough, given emergency reserves, to keep the population supplied with food during a blockade lasting several years (Chapter 7).

Part 4 is principally concerned with price policy as a means of attaining agricultural objectives. Firstly, the relation between the volume of production and the price level is studied, calculating the supply elasticity of agricultural production (Chapter 8). Secondly, the effects of price changes on profitability and incomes are analyzed, with reference to the entire agricultural sector and to different-sized farms – both in the short and the long run (Chapter 9). Thirdly, an »optimum» price system is derived, aiming at allocating to agriculture the least costly amount of resources, required for agriculture to meet emergencies; the analysis concerns the price level, the price relations between products and the respective merits of a high-price and a low-price system (Chapter 10).

A great deal of this study is based on special surveys presented in 11 appendices. These deal with theoretical analyses as well as the processing of statistical data. The most important theoretical analyses are concerned with methods for measuring changes in productivity (Appendix A), the formation of agricultural land prices (Appendix C), the determinants of an optimum price policy given the emergency role of agriculture (Appendix J) and methods for the

theoretical selection of the most efficient system of support in terms of the government expenditure involved (Appendix K). The reports on the statistical processing refer to calculation principles as well as the results that form the basis of the main text but which it has been found more convenient to present separately.

PART ONE

THE EFFICIENCY AND COMPETITIVENESS OF AGRICULTURE

CHAPTER ONE

COMPARISONS OF PRODUCTIVITY IN AGRICULTURE AND OTHER SECTORS

THE LEVEL OF PRODUCTIVITY

In discussion of economic policy, agriculture is often alleged to be less efficient than other sectors of the Swedish economy. This suggests that it would be economical to transfer factors of production from agriculture to other sectors.

Allegations of this kind are based on comparisons of productivity, i.e. the ratio between production and the input of factors of production. Empirical comparisons of sectoral productivity are usually based on labour productivity, i.e. the sectors' value added (contribution to GNP) per person employed. A comparison of this kind is given in Table 1. It indicates that labour productivity in agriculture as a whole is approximately half the average of other sectors valued at domestic prices. Measured in international prices which are a more appropriate yardstick for purposes of efficiency assessment, labour productivity of agriculture is hardly one-quarter of that of other sectors. Agricultural productivity measured in international prices is much lower than in domestic prices because this sector is far more protected than others. Total agricultural protection – including import duties, price controls and state subsidies – is estimated at 60–70 per cent of its output value in international prices. The corresponding figure for the industrial sector is 5–10 per cent.[1]

These figures denote what is commonly referred to as »nominal» protection. The support given to the value added of a sector, known as »effective» or »processing» protection, is generally higher than nominal protection. This is because raw materials and other intermediary products are less protected than final products. Effective protection – protection of final product minus protection of raw material inputs, expressed as a percentage of value added – is about 150 per cent for agriculture as compared to some 15 per cent for industry.

Many problems are attached to productivity comparisons. In order for labour productivity to be a suitable measure the sectors which are compared must have about the same capital intensity (capital per person employed). On the whole,

[1] The average tariff protection of industry is generally put at about 8 per cent (Table 7, p. 38). Allowing for the fact that exports are hardly protected at all and that they represent some 30 per cent of the total sales value of industry, actual industrial protection is reduced to about 5 per cent. Even allowing for state subsidies such as regional incentives and investment funds, support to industry still does not exceed 10 per cent of the value of output.

Table 1. *Labour productivity in agriculture and other sectors, 1960 and 1967*

	Domestic prices		International prices	
	1960	1967	1960	1967
	Billion Sw.kr.			
Receipts from farming	4.43	5.85	3.42	3.44
minus				
costs of goods and services purchased	1.55	2.17	1.43	1.97
of which: agricultural goods	0.43	0.60	0.36	0.48
other	1.12	1.57	1.07	1.49
Gross value added in agriculture	2.88	3.68	1.99	1.47
Sales value in industry	50.0	84.3	46.3	78.1
Gross value added in industry	21.5	40.0	19.1	35.9
GNP at factor costs	62.7	116.4	51.6	106.6
Labour productivity (gross value added per man-year)	Sw.kr. per man-year			
Agriculture	8 500	19 400	5 900	7 700
Other sectors	19 500	35 700	18 200	33 000
Industry	23 600	44 000	1 000	39 000
Other sectors excl. industry	17 800	32 300	17 000	30 800
All sectors	18 400	34 600	16 900	31 700
Labour force	1000's of man-years			
Agriculture	340	190		
Other sectors	3 060	3 160		
Industry	910	910		
Other sectors excl. industry	2 150	2 250		
All sectors	3 400	3 360		

Sources: Agriculture – income of the agricultural population calculated by the National Agricultural Marketing Board; labour force according to Appendix A.

Industry – *Sveriges Officiella Statistik*, Industri (Industry) 1960 and 1965. The values for 1967 derived from the Central Bureau of Statistics' indices of production and wholesale prices and, in the case of labour force, from employment figures from the Bureau' s labour force surveys.

All sectors – GNP according to the Revised Budget Statement 1968; labour force according to the Central Bureau of Statistics' labour force surveys.

In interpreting the data, it should be born in mind that 1967 was a year of economic recession but 1960 a boom year. Values in international prices have been calculated on the assumption that support to agriculture was 50 per cent in 1960 and 70 per cent in 1967, to agricultural raw materials 20 and 25 per cent respectively, to industry 8 per cent and to industrial raw materials and to other goods and services 5 per cent.

agriculture and industry satisfy this requirement. The replacement cost of real capital per man-year in 1965 can be put at around Sw.kr. 70 000 for both sectors.[2] In other sectors, capital intensity is probably lower including as they do

[2] According to fire insurance values, industrial real capital in 1965 amounted to about Sw.kr. 60 billion, i.e. Sw.kr. 66 000 per man-year.

A corresponding estimate for agriculture is unreliable, since the real estate values comprise both building and land values, of which the latter are influenced by the anticipated economic returns. Furthermore, a great deal of agricultural buildings would not be worth replacing. The current aggregate value of agricultural capital resources in 1965 amounted to about Sw.kr. 26 billion, land included. Given an estimated value of Sw.kr. 3 000 per hectare on natural land, the present value of agricultural real capital *excluding land* would be about 17 billion, i.e. Sw.kr. 71 000 per man-year.

a large proportion of services of low capital intensity. Thus, labour productivity hardly underestimates the productivity of agriculture in comparison to other sectors. (Labour productivity should not, however, be used to measure the productivity of agriculture relative to particular industries such as mining and sectors such as parts of the services sector, whose capital intensity differs radically from that of agriculture.)

Against comparisons of productivity evaluated in international prices can be argued that support to Swedish agriculture may affect these prices. As will be shown in the next section, world market prices would probably rise by one or a few per cent if Swedish agriculture were to be deprived of its price support, owing to the subsequent rise in Swedish import demand. The agricultural productivity figures given in Table 1, measured in international prices, are therefore probably a few percentage points too low.

A more significant problem is the error in estimates of the number of man-years, especially for agriculture. One reason for this has already been mentioned, namely that people occupied in agriculture are also active in other sectors, such as forestry and the maintenance of buildings and plant, not directly concerned with the production of food. Other reasons are that a great deal of agricultural work is done by part-time employees, and that the official labour force statistics include a number of »partially» employable persons such as retired people.

The productivity figures quoted in Table 1 are based on an estimate of the numbers of man-years made by the National Agricultural Marketing Board with the help of data from the sample survey of persons engaged in agriculture on June 1st every year made by the Central Bureau of Statistics. Deducting from this estimate the work which farmers are estimated to have put in on their own forests, we arrive at a total of 190 000 year-workers for 1967, corresponding to 6 per cent of the total number of man-years in the country.

We have also tried to estimate the input of labour from other sources, as statistics on Farmers' tax returns and on book-keeping accounts (the so-called Jordbruksekonomiska undersökningen, abbreviated to JEU). This estimate gives a volume of 320 000 man-years for 1964 as opposed to 260 000 according to the National Agricultural Marketing Board's material. The main reason for the discrepancy between the two estimates is that JEU assumes an average of 2 600 »full» working hours per year per farmer, whereas the Board reckons with about 1 900 hours. Apart from this difference in estimated working hours, there is no significant discrepancy between the two estimates (see further Appendix A). It is also worth mentioning that a rough inventory of persons occupied in agriculture, made in 1966 by the Swedish Agricultural Research Institute, showed 215 000 persons thus employed. The number of man-years according to estimates based on the Board's material for that year was about 220 000. Thus these two sets of data also agree quite well.

The labour input of farmers reported by JEU points to another important factor for interpreting differences in productivity. In order to attain the labour productivity shown in the table (per man-year), farmers, who comprise about 70 per cent of those occupied in agriculture, are obliged – according to the JEU data – to accept less leisure than is normal in other sectors.

In a later chapter (Chapter 5) it will be seen that the conclusions regarding agricultural productivity as compared to that of other sectors are substantially unchanged if productivity is estimated in terms of profitability instead of using labour productivity figures.

THE PRODUCTIVITY TREND

Comparing the figures in Table 1 for labour productivity in 1960 and 1967, one has the impression that productivity (in domestic prices) has risen far more rapidly in agriculture than in industry. But this table refers only to current prices. If allowance is made for the more favourable development of agricultural as opposed to industrial prices (Diagram 2, p. 34), and the productivity trend is measured in constant prices, the agricultural and industrial productivity turn out to have increased at the same rate between 1960 and 1967. During the first half of the 1950's, on the other hand, agricultural productivity, measured in constant prices rose somewhat more rapidly than industrial productivity. Thus between 1947 and 1955 agricultural labour productivity rose by 4 1/2 per cent annually, the corresponding figure for industry being 3 per cent. Since 1955 labour productivity has risen by about 5 per cent annually in both sectors (Table 2).[3]

The rise of labour productivity in both sectors is partly due to increased capital intensity. Consequently the net productivity increase, i.e. the rise in production which (according to current methods of analysis) cannot be attributed to increased labour and capital input, has proceeded far less rapidly than the labour productivity, increasing according to our estimates (Table 2) by just over 3 per cent per annum in both sectors during the last decade. Thus the productivity gap between agriculture and industry has shown no signs of closing.[4]

As already observed, the rise in agricultural productivity was coupled with a rapid fall in labour input, while the volume of production, value added and the volume of capital changed only slightly (Table 2). Meanwhile the composition of the capital stock has changed, as the proportion of machinery has increased – from 4 per cent in 1945 to 14 per cent in 1965 – while the proportion of livestock and buildings has diminished.[5] This has resulted in a higher rate of capital turnover and consequently, given the unchanged quantity of capital, a higher level of reinvestment. There has also been a tendency in recent years for the acreage of arable land to diminish more rapidly -- about 50 000 hectares per annum during the last few years as opposed to about 30 000 per annum during the first half of the 1960's, 20 000 per annum during the 1950's and 5 000 per annum during the 1940's.[6]

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[3] For purposes of this comparison we have tried to select periods beginning and ending with years showing similar business trends and meteorological conditions.

[4] The definitions of productivity on which the productivity figures quoted here are based are given in Appendix A, in which other definitions of productivity are also discussed.

[5] According to data quoted in Appendix G.

[6] According to the censuses of agriculture and, since 1965, the acreage inventories.

Table 2. *Growth of productivity in agriculture and industry, 1947–66*

		Percentage change per annum[a]	
		1947–55	1956–66
Gross value added			
	agriculture	+ 0.5	− 0.1
	industry	+ 3.4	+ 6.7
Labour volume			
	agriculture	− 4.0	− 4.8
	industry	+ 0.6	+ 1.4
Capital volume[b]			
	agriculture	+ 0.4	− 0.2
	industry	+ 6.1	+ 5.1
Labour productivity			
	agriculture	+ 4.5	+ 4.7
	industry	+ 2.9	+ 5.3
Net productivity			
Alt. 1[c]	agriculture	+ 3.1	+ 2.9
	industry	+ 0.6	+ 3.4
Alt. 2[d]	agriculture	+ 3.2	+ 3.3
	industry	+ 0.6	+ 3.8

[a] Calculated according to a formula for compound interest along the regression line.

[b] This calculation is particularly uncertain.

[c] Calculated from the formula $Q/(\alpha L + \beta C)$, where Q = value added, L = labour, C = capital, $\alpha = 0.7$ for agriculture and 0.6 for industry, and $\beta = 1-\alpha$.

[d] Calculated from a series of trend values, A_t, derived with the aid of the equation $(Q/L)_t = A_t(C/L)_t^b$, where $b = 0.3$ for agriculture and 0.4 for industry, t = time and the value of A_t for each year in question is determined as the value that makes the two sides of the equation equal.

Source: Appendix A, which also gives the principles underlying the calculations.

Throughout the post-war period the labour force has diminished by about 20 000 man-years annually. Expressed as a percentage, this decrease has accellerated in recent years. During the 1940's the agricultural labour force fell in volume by 1–3 per cent annually, during the 1950's by 3–5 per cent annually while during the 1960's the annual rate has been 5–8 per cent.

Most of the people who left the land in the 1940's and 1950's were agricultural labourers and young persons. In recent years, however, more and more farmers have tended to go over to other sectors and few new farmers have come to take their place. Whereas the net decrease in the number of farmers in the early 1950's was 3 000 per annum or 50 per cent of the total annual fall in the labour force, it was at the end of the 1960's about 10 000 per annum or half the total annual fall in the labour force.

The predominance of young persons among those leaving the land has resulted in a rise in the average age of those employed in agriculture (Table 3). The change in the age structure of the labour force as a whole is primarily due to the increased proportion of farmers in the total agricultural labour force – about 70 per cent at the end of the 1960's as against approximately 50 per cent in 1945. Normally a farmer does not take charge of his farm until he is about 30, but often remains active long after attaining »normal» retiring age.

Consequently one is bound to assume that there has been a fall in the physical work capacity of the agricultural labour force. Although the continuing progress of mechanization has reduced the demands put on physical work capacity, the change in age structure in recent years has probably tended to impede a rapid rise in productivity.

What other causes can be found for the low productivity of agriculture and its failure to close the productivity gap vis-à-vis industry? In the next two chapters we shall be mainly concerned with three explanations. The first of these is connected with levels and trends in world prices; even the most efficiently organized agricultural enterprises in the agriculturally most favourable parts of the country have found it difficult to compete with other sectors at world market prices of the last few decades (Chapter 2). The second explanation is that, given the present size of the agricultural sector, low-yield land is bound to be cultivated. The third explanation is that the structure of farm holdings is grossly inefficient. (The latter two explanations are discussed in Chapter 3.)

Table 3. *Labour participation in agriculture by age groups, 1945, 1960 and 1965*

Age group years	Farmers			Employees[a]			Assisting members of family[b]		
	1945	1960	1965	1945	1960	1965	1945	1960	1965
	1000's of persons								
15–29	17.9	7.4	5.7	50.7	17.4	13.3	91.9	33.0	19.7
30–44	105.6	54.3	36.7	45.2	20.2	15.2	22.2	9.6	6.6
45–64	173.8	121.4	99.2	37.5	32.1	27.7	6.2	6.2	7.4
over 64	63.2	33.7	28.9	7.4	6.0	5.2	1.0	2.2	3.1
Total	360.5	216.8	170.5	140.8	75.7	61.4	121.3	51.0	36.8

[a] Excl. assisting members of family.

[b] Excl. married women.

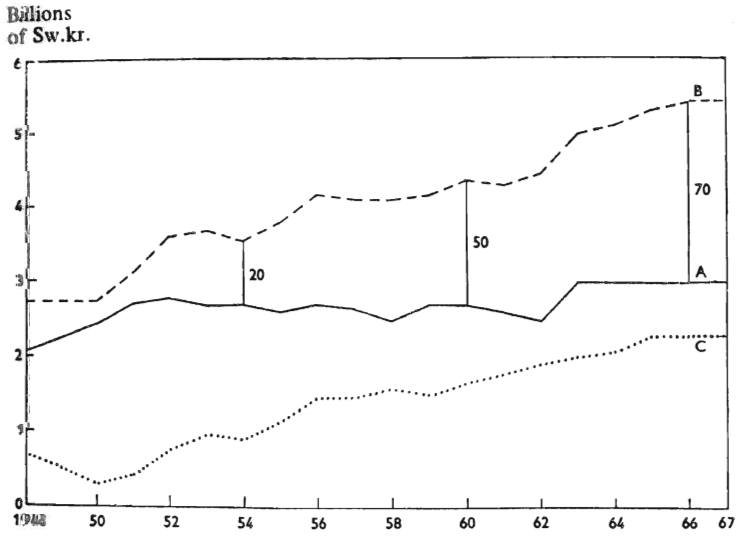
Sources: Sveriges Officiella Statistik, Folkräkningen (Population census) 1945: IX, 1960:IX, 1965.

CHAPTER TWO

THE WORLD MARKET AND THE COMPETITIVENESS OF SWEDISH AGRICULTURE

During the world economic crisis at the beginning of the 1930's, Swedish agriculture, like that of most other countries in Western Europe, was screened off from the world market, with the result that domestic agricultural prices came to exceed those obtaining on the world market. During and immediately after the Second World War, however, world agricultural prices rose steeply while domestic prices were restrained by means of price controls. World prices rose particularly steeply during the Korean war in the early 1950's. Consequently Swedish agricultural protection at that time was kept fairly low. World market prices of agricultural products consumed in Sweden have thereafter remained fairly constant in nominal terms (Diagram 1).

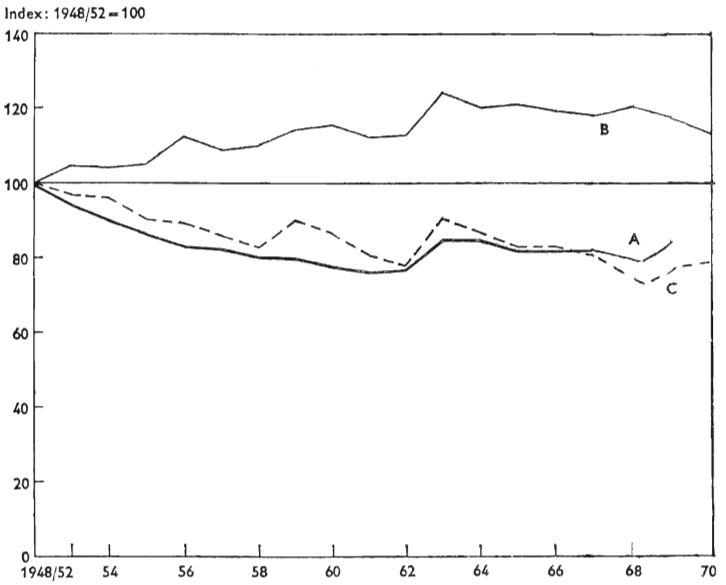
Diagram 1. *Additional expenditures (at wholesale price level) on food consumption due to border protection, 1948–67*



A —— Value of domestic consumption at world market prices
B – – – Value of domestic consumption at Swedish wholesale prices
C ····· Additional expenditures for domestic consumption

Source: Table 1, Appendix B.

Diagram 2. *Agricultural and industrial prices, 1948/52–70*



A —— Total world trade

B —— Swedish products, national comparison

C - - - Swedish products, international comparison

Sources: A – index for unit export values for food and feed, divided by the corresponding index for industrial goods. FAO, *The State of Food and Agriculture*, 1967.

B – wholesale price index for Swedish agricultural products according to appendix B, divided by the wholesale price index for industrial goods according to the Central Bureau of Statistics.

C – index of world market prices for Swedish agricultural products according to Appendix B, divided by the wholesale price index for industrial goods according to the Central Bureau of Statistics.

Domestic agricultural prices in Sweden, by contrast, have closely adhered to the general price trend (of consumer prices) in the country. This has been achieved by means of steadily rising price support. Whereas during the early 1950's the price support enjoyed by agriculture was not significantly greater than that given to industry by about 1954 it had risen to 20 per cent, by 1960 to 50 per cent and by 1967 to just over 70 per cent (Diagram 1). As will be shown in greater detail in Chapter 5, agricultural incomes (wages apart) have not risen very much more rapidly than incomes in other sectors, in spite of this increased support.

It is often contended in the debate on agricultural policy that world market prices are an inappropriate criterion of the competitiveness of Swedish agriculture, the reason being that the world market for agricultural produce is not to be relied upon for continuous imports. This in turn is put down to the effect of dumping on prices. We shall therefore consider the nature of the world market and the development of agricultural prices as compared to other commodity prices on the world market.

Table 4. *Change in volume and prices on the world market, 1948–66*

Commodity	Percentage change 1948/52–1966	
	volume	price
Vegetable products	+ 110	— 7
Wheat	+ 124	— 14
Potatoes	+ 29	+ 58
Sugar	+ 55	— 3
Edible oils	+ 73	— 16
Feed grains	+ 327	— 5
Oilcakes	+ 399	+ 18
Animal products	+ 97	+ 40
Butter	+ 60	— 4
Cheese	— 136	+ 35
Dried milk	+ 130	— 11
Beef	+ 131	+ 122
Pork	+ 153	+ 42
Eggs	— 21	— 8
Total	+ 115	+ 2

Source: Appendix B.

A comparison of world market prices for agricultural and industrial products, weighted by world trade volumes, suggests that agricultural prices have fallen in relation to industrial prices (curve A in Diagram 2). The same conclusion results from comparing world market prices of agricultural and industrial commodities produced by Sweden, weighted by the Swedish volume of production (curve C in Diagram 2). Thus the international price trends have favoured Swedish industrial commodities at the expense of Swedish agricultural products, and this has tended to impair the *international* competitiveness of Swedish agriculture vis-à-vis that of industry. Owing, however, to the increased domestic price support given to agriculture, the *national* prices of agricultural products have risen in relation to industrial prices (curve B in the diagram), i.e. reversed the international trend of relative prices.

Price trends for individual agricultural products on the world market since the beginning of the 1950's have been marked by a rise in livestock product prices in relation to crop prices. Edible oils and wheat are among the crops that have fallen in price, while beef has registered the greatest price rise for livestock products. But not all livestock products have gone up, dried milk (Table 4) is one important exception.

AGRICULTURAL SUPPORT IN WESTERN EUROPE

The price trend on the world market is to be attributed to factors affecting both output and demand. Ever since the nineteenth century, the main flow of world trade in agricultural commodities has been to Europe from countries

which, once colonies, are now generally divided into developing countries and transoceanic developed countries (the USA, Canada, Australia, New Zealand). In spite of the disruptive effect on this pattern of the depression of the 1930's, more than 40 per cent of world exports of agricultural products were still coming to Western Europe at the beginning of the 1950's. Since then, however, the proportion of agricultural exports destined for Western Europe has fallen off considerably, with the result that Western European net imports of agricultural produce now comprise only one-quarter of world exports (Table 5).

One important reason for this reduction is the gradual increase of domestic support throughout almost the whole of Western Europe during this period, which has encouraged farmers to make use of the steadily increasing marketing opportunities for their products at home. Consumption of agricultural products in Western Europe has risen by about 2 1/2 per cent annually since the beginning of the 1950's, but the proportion of this market allotted to agricultural imports from outside Europe has not increased; throughout this period, Western Europe has remained about 90 per cent self-sufficient.[1]

The Western European bid for self-sufficiency has been felt most by exporters of wheat and sugar. The proportion of imported edible oils and feed consumed in Western Europe has remained much the same (Table 6). Net imports of live-

Table 5. *World market for agricultural products and Western Europe's import share, 1934–66*

Commodity	Value of world exports in 1958–62 prices				Western Europe's share of world imports			
	1934–38	1948–52	1958–62	1966	1934–38	1948–52	1958–62	1966
	Billions of Sw.kr.				Per cent			
Wheat, rice and potatoes	11.0	11.3	14.8	22.1	40	43	24	12
Sugar and edible oils	11.2	10.8	15.9	17.8	44	47	40	40
Feed grains and oilcakes	3.9	3.3	7.4	14.3	91	76	71	56
Milk products	3.5	3.8	5.7	7.7	31	18	–2	–13
Beef, pork and eggs	5.3	4.6	8.0	9.3	33	24	0	11
Total	34.9	33.8	51.8	71.2	45	42	29	25

Source: Quantities according to FAO, *The State of Food and Agriculture*, 1967 have been multiplied by mean prices for 1958–62 according to the same source. For further details see Appendix B.

[1] See Appendix B.

Table 6. *Food consumption and share of imports in Western Europe, 1934–66*

Commodity	Consumption				Share of imports			
	1934–38	1948–52	1958–62	1966	1934–38	1948–52	1958–62	1966
	Billions of Sw.kr.				Per cent			
Cereals	50.0	51.6	58.1	56.3	23	28	17	12
Feed grains	46.4	40.5	63.9	85.2	24	19	24	26
Sugar	6.6	8.0	11.2	12.8	40	36	28	28
Edible oils	3.0	3.1	4.0	4.5	70	65	68	68
Milk	81.5	78.6	100.5	112.2	6	2	–2	0
Beef and pork	10.1	8.6	14.0	17.6	8	7	3	3

Source: See Appendix B. Potatoes and eggs are not listed because their share of imports was 0 throughout.

stock products have never been very large. The feed trend suggests that the increased consumption of livestock products (e.g. meat and pork, consumption of which has doubled in 15 years) has been largely catered for by Western European producers, partly as a result of current price policies. This trend has been assisted by the fact that feed is not subject to the same protectionist price policy as other crops such as wheat and sugar beet. Consequently non-European exports of agricultural products have not only been restricted but have been kept to a lower degree of processing.

Table 7 gives a rough estimate of the level of price support in different countries. According to these estimates, which cover the principal agricultural products, price support in Western Europe as a whole in 1966–67 was of the order of 50 per cent, compared to about 40 per cent in the mid-1950's. Two countries appear to have a far lower level of price support than the remainder of Western Europe, namely Ireland and Denmark, where the figure is about 15 per cent. Sweden seems to be one of the countries where support is greatest and where it is increasing most rapidly. The table shows a price support of just over 50 per cent in the EEC, i.e. a somewhat lower level than in Sweden. The difference is, however, less appreciable if one allows for production cost subsidies within the EEC. Great Britain is one of the few Western European countries to have reduced support since the middle of the 1950's.

But it is not the absolute level of price support so much as its size in comparison to the price support given to other sectors that influences the use of resources. Resources in a market economy are governed by *relative*, not by absolute prices. In order to give a rough idea of relative price support, Table 7 also shows import duties on industrial products during the period 1960–62. These estimates, which are extremely rough and should be used with great caution, suggest that price support to agriculture (the ratio of agricultural price

Table 7. *The level of price support in various countries*
Per cent

Country	Price support for agricultural products 1956/57	1966/67	1968/69	Industrial tariffs 1960/62	Relative support 1966/67
Benelux	25	51	74	13	33
France	34	43	66	19	20
W. Germany	40	58	69	8	46
Italy	44	73	78	20	44
E.E.C.	36	53	69	15	33
Great Britain	47	32	31	19	11
Denmark	9	12	19	7	5
Norway	50	70	102	13	50
Sweden	40	63	80	8	51
Switzerland	76	86	103	9	71
Austria	30	32	39	18	12
Portugal	30	74	98	30	34
EFTA	40	39	46		
Finland	97	97	93		
Ireland	6	17	22		
Spain	40	66	60		
Greece	44	66	82		
W. Europe	38	50	62		
U.S.A.	21	18		21	−2
Canada	25	12		16	−3
Australia		0		10 à 30	−10 à −30
New Zealand		0		20 à 40	−20 à −40

Sources and methods of calculation: The price support for agricultural products concerns the average for wheat, sugar, milk, beef, pork and eggs, calculated with the aid of data on the level of producer prices in Western Europe (*Jordbruksekonomiska meddelanden* (The Journal of Agricultural Economics) 7–8, 1965, p. 241, and 7–8, 1968, p. 161, and 6, 197 p. 135). For Sweden, price support is calculated to 40 per cent in 1956/57, 63 per cent i 1966/67, and 80 per cent 1968/69. The calculations for the U.S.A., Canada, New Zealand and Australia are based on national statistics. The weights used are Western Europe's total production of the commodity in question and, for other countries, the volume of domestic production. Industrial tariffs comprise simple (unweighted) averages of tariffs on 14 major commodity groups, covering chemicals, leather, rubber, timber and paper, textiles, stones and jewelry, machinery, building materials, clothes and instruments, according to *Political and Economic Planning: Atlantic Tariffs and Trade*, London 1962.

support to import duties on industrial products) was about 30 per cent in the whole of Western Europe.[2]

[2] Industrial tariffs have been reduced somewhat since 1960–62, especially within the trad blocks. Moreover, a large proportion of industrial output is exported and accordingly gains nothing by protection. Both these circumstances imply that the figures in Table 7 tend to underrate support to agriculture in relation to support to industry. On the other hand mar countries subsidize their industries for purposes of regional development and to boost exports: this goes part of the way towards redressing the balance.

The table indicates that relative price support is highest in Switzerland, Norway, West Germany and Sweden and low in Denmark, Austria and Great Britain. It is also interesting to note that relative price support for agricultural products in the USA and Canada, included here for purposes of comparison, seems to be nil or, if anything, negative.[3] Relative support to agriculture in the other major agricultural exporting countries, Australia and New Zealand, is definitely negative. (The support to agriculture has increased somewhat during the last ten years in Australia, however.) The same applies to a number of developing countries exporting agricultural products on a large scale.

THE EFFECTS OF AGRICULTURAL SUPPORT IN NON-EUROPEAN COUNTRIES

The extensive and growing agricultural protection practised in Western Europe has had at least three negative effects on the export situation of the developing countries and the developed agricultural countries. Firstly the demand for foodstuff in Western Europe has been inhibited by high prices, thus reducing the market for foodstuffs (compared to the alternative of no protection). In view of the small price elasticity of the traditional, high-calory agricultural products, it is probably the most sophisticated and exclusive items that have suffered most through the fall in demand. This category includes certain kinds of meat and tropical products exported by countries outside Europe.

Secondly, agricultural support has increased domestic production, thus preventing non-European exporters from increasing their share of the European market. If for instance half the increased consumption of agricultural products in Western Europe since the early 1950's had consisted of imports – as might well have been the case if price supports had not been raised – agricultural imports would have more than doubled, which means it would have increased by almost as much as world trade in agricultural products outside Western Europe.[4]

Such a rise in world trade would, moreover, almost inevitably lead to increase world prices. Thus the third and most serious negative effect of Western European protectionism from the point of view of the exporting countries is that it has frozen world market prices. The principal sufferers have of course been countries exporting agricultural products, whose entire economy is very much dependent on agricultural production and exports. This is particularly the case

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[3] At the same time heavy support can be given in these countries to less valuable items such as sugar beet and certain livestock products.

[4] The agricultural consumption of Western Europe, calculated at world market prices, can be estimated to 180 billion Sw.kr. in 1966. The increase in consumption since the beginning of the 1950's is approximately 30 per cent or around 40 billion Sw.kr. Net imports of Western Europe in the early 1950's were 15 billion Sw.kr. in 1966 prices. World trade outside Western Europe has increased from 25 to 60 billion Sw.kr. in 1966 prices during the same period (for methods of calculation, see Appendix B).

number of developing countries, which on average are dependent on agricultural products (including tropical products) for 3/4ths of their total export revenues (excluding fuels) and 40–55 per cent of their national product.[5] According to FAO estimates, the prices of the developing countries' agricultural exports (including tropical products) fell by 20 per cent between 1952–54 and 1962–64; compared to industrial commodities the fall in prices is of the order of 30 per cent.[6]

Both the reduced volume of exports and depressed prices have retarded the growth of the developing countries' foreign exchange receipts. This in turn has limited their ability to carry out programmes of industrial and social development. Western European protectionism has thus tended to thwart the purposes of the increased aid being given to the developing countries. The Western European outflow of foreign exchange in the form of assistance to the developing countries is approximately Sw.kr. 11 billion (including loans),[7] which corresponds to the foreign exchange receipts that the developing countries would gain if they could increase their share of the Western European market for agricultural products by 6 per cent at current world market prices. In fact a smaller increase would suffice, since increased import demand in Western Europe would raise world market prices, and the developing countries would doubtless gain more by higher export prices than they lost by increased import prices.[8]

The feasibility of this mechanism would depend on the ability of the developing countries to increase their production to match the rise in international demand. Their capacity to do so is evident from the difficulty experienced by

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[5] FAO, *Trade in Agricultural Commodities in the United Nations Development Decade.* Vol. I, Part I, Rome 1964, p. 3.

[6] FAO, *The State of Food and Agriculture*, 1965, p. 40.

[7] OECD, *Development Assistance Efforts and Policies of the Members of the Development Assistance Committee*, 1967, Review, Paris 1967. Capital exports from Western Europe (including private capital movements) amount to Sw.kr. 20 billion. (The capital outflow from the developing countries on the other hand is not fully known.)

[8] Sugar, edible fats and beef are staple exports of the developing countries. The increase in the developing countries' export revenues resulting from free trade in Western Europe would be partly dependent on the rise in world market prices brought about by the resultant increase in Western European demand for agricultural products.

Thus, according to a rough estimate by R.H. Snape, contract-free sugar prices on the world market could rise by 33 to 50 per cent, giving an increase of between 15 and 20 per cent in the average export price. R.H. Snape, »Some Effects of Protection in World Sugar Industry», *Economica,* Vol. XXX (1963), pp. 63–73. If support to domestic sugar industries and sugar beet cultivation were to be abolished throughout Western Europe, the total sugar export revenues of the developing countries would rise by something in the region of Sw.kr. 8 billion, given the above-mentioned price rise.

The estimate is based on the following assumptions: Western European sugar production 8 billion kg., present world exports 15 billion kg., world market price 65 öre per kg. prior to an abolition of support.

many of them today in marketing their production abroad without further depressing prices; the sugar-producing countries are a case in point. The rise in prices resulting from greater Western European demand would therefore stimulate increased production in many of the developing countries, thus enabling them to concentrate their production in a manner more consonant with their natural advantages and increase their foreign exchange resources. In many cases national income would rise and permit higher consumption standards. The allocation of this increased standard between food and other commodities would depend among other things on the magnitude of the rise in food prices.

Thus Western European protectionism has tended to frustrate the efforts being made to secure a higher standard of incomes for the developing countries even as regards foodstuffs. The less the developing countries are permitted to export their special food products, the lower the purchasing power and demand of their populations for (practically) all commodities including foodstuffs for their own consumption.

Apart from cutting down protection, Western Europe can of course further contribute towards an increase in the demand for foodstuffs by means of aid to finance the developing countries' imports of foodstuffs which they do not produce in sufficient quantities to cater for their consumption requirements. In principle the funds provided for this kind of assistance would be best applied if used to purchase foodstuffs whereever they are cheapest, which in most cases on the world market.[9]

By thus reducing protection and financing aid consignments, Western Europe could help increase demand in the developing countries and so reduce the level of world starvation. World market prices would then rise and with them global food production, both in the developing countries and in the transoceanic developed countries. Production capacity in the latter countries has been kept deliberately low on account of the depressed level of world prices. One extreme example of this policy is the USA, where during the 1950's efforts were made to secure producers higher prices than those applying on the world market. This policy failed, notwithstanding vigorous efforts to give away excess production and reduce the cultivated acreage by means of the so-called Soil Bank. Consequently the USA was forced during the first half of the 1960's to reduce domestic prices nearer the world market level with a view to limiting the production of its most important export commodity, wheat. There is probably a great deal of unexploited production capacity in the developed agricultural countries as well; this excess capacity could be utilized better if prices were higher, as witness the under-exploited acreage of such countries as Australia and the effect of fertilization projects in New Zealand. These assumptions are confirmed by FAO projections made with the assistance of expertise from these and other

[9] Cf. our argument in *Jordbrukspolitikens mål och medel* (The Aims and Means of Agricultural Policy), Stockholm 1968, pp. 34–39.

countries.[10]

Additional help will probably be required from the affluent countries if the developing nations are to achieve a significant growth of production in the event of price rises; this could for instance take the form of technical and organizational aid to raise yields and to rationalize production, storage and distribution of foodstuffs. Another important prerequisite for radically increasing the developing countries' food production is in many cases institutional changes to improve the incomes of farmers and others engaged in agriculture – e.g. by means of land reforms and the rationalization of distribution systems. Even now one can discern a definite increase in the agricultural production of many of the developing countries, due among other things to the technical aid they have received to date. Export outlets are at the end of the 1960's tending to pose more serious problems than production insufficencies.

NON-EUROPEAN AGRICULTURAL EXPORT PRICES

It is often contended in defence of Western European protectionism that it has been forced upon its practitioners by the increasing tendency of world trade to degenerate into a small dumping market.

A closer inspection reveals, however, that this diagnosis is primarily applicable to the behaviour of the majority of Western European countries on the world market. As we have already seen, even the USA once figured to a certain extent as a dumping exporter. The other main exporters – most of them developing and transoceanic developed countries – have generally had to adjust their domestic production to world market prices. As can be seen from Table 8, these countries account for most of the world's exports of edible oils, wheat, sugar, feed grains, beef and butter; together these products comprise more than 80 per cent of the world's trade in agricultural foodstuffs (excluding fruit and tropical products). World trade in the first three of these products also comprises a considerable proportion of world production (20–30 per cent). On the other hand it is items such as pork, eggs and certain milk products that are prone to dumping. World trade in these products is considerably influenced by Western European output. They would, however, not be imported by Sweden and the other Western European countries if protection were to be reduced, and accordingly the tendency for these products to be dumped is not a valid argument for the retention of protectionism in Western Europe.

Since non-European agricultural exporters generally adapt domestic prices to match world market prices, their producers are paid far lower prices than their Western European counterparts. A few comparisons with Swedish prices in 1966 will serve to illustrate this. The Canadian producer price for wheat that year was 26 öre per kg., while in Sweden it was 55 öre; moreover the Swedish product was generally of inferior quality to the Canadian. Barley prices in the two

[10] FAO, *Agricultural Commodities* – Projections for 1975 and 1985. Rome 1967.

Table 8. *Size and composition of world trade*[a] *in certain agricultural products, 1966*

Commodity	Percentage of world trade		World trade as a percentage of world production
	Exports from transoceanic countries incl. developing countries	Consumption in Sweden	
Sugar	92	2	26
Wheat	89	1	20
Feed grains	83	8	8
Edible oils	79	2	25
Meat (beef, mutton & poultry)	44	4	8
Milk	40[b]	8	11[b]
butter	47	10	16[c]
dried milk	39	..	..
cheese	23	10	17[c]
Potatoes	23[d]	35	1
Eggs	16	48	1
Pork	8[d]	23	4

[a] Excl. exports from Eastern block.

[b] Based on data from 22 countries with a major production.

[c] Calculated milk input for world exports of butter, cheese and dried milk, the amount of milk required being assumed to be 25.9 and 12 kg respectively per kg. export commodity.

[d] Refers to 1965.

Sources: FAO, *The State of Food and Agriculture* 1967, *Commodity Review* 1967, and *Trade Yearbook* 1966.
Jordbruksekonomiska meddelanden (The Journal of Agricultural Economics) 1968:1–2.

countries were 29 and 47 öre per kg. respectively. The producer price for milk in New Zealand was 32 öre per kg. as compared to 54 öre in Sweden. The wholesale price of beef in Australia was 310 öre per kg. as against 620 in Sweden.[11] (The difference in *producer prices* was probably still larger, bearing in mind the great distances between the Australian farms and the markets where wholesale prices are quoted.) As regards edible oil prices, we can mention that the producer price for ground nuts in Nigeria in 1966 was 61 öre per kg. while in Sweden the producer price of rapeseed was 85 öre per kg. (Ground nuts and rapeseed contain roughly the same proportion of oil.) Sugar prices are more difficult to compare, but the figures in Table 9 indicate that the main exporters' producer and export prices were at most half the price paid to Swedish producers. Furthermore the information available suggests that the price of sugar cane in Cuba is half the price of refined sugar, i.e. about 30 öre per kg. sugar

[11] Swedish wholesale prices denote quoted wholesale prices less slaughter levies.

at the prices obtained during years not-affected by international crises.[12] The corresponding price of Swedish beet sugar in recent years has been about 70 öre per kg. Further examples of prices can be found in Table 9.

The figures quoted here are by no means exact, but they do at least serve to indicate the difference between the prices paid to the main exporters and to Swedish producers. Apart from edible oils, we can safely say that Swedish producer prices are more than double the producer prices in the principal exporting countries mentioned here. The difference is larger than the price support percentage (70 per cent) referred to earlier, since the costs of distribution and freight from the exporting to the importing country have to be added when comparing producer prices.

Table 9. *World market prices and producers' prices in Sweden and in the main exporting countries, 1966*

Commodity	Mean export price	Producers' price in Sweden	Producers' prices in main exporting countries								Main exporting countries' share of world export in 1965
	öre per kg.										per cent
Wheat	33	55	U.S.A.	31	Canada	26	Australia	31[e]			71
Barley	36	47	France	42	U.S.A.	25	Canada	29			47
Maize	30	67[a]	U.S.A.	26	Argentina	17	Mexico	39[e]			77
Groundnuts	102	85[b]	Nigeria	61[e]	Senegal	58[e]	Sudan	80[i]			65
Sugar[c]	51	125[a]	Cuba	43[ad]	Australia	51[i]	Philippines	62[a]			40
Butter,	426	580[a]	New Zealand	513	Denmark	540	Australia	448[e]			60
milk[f]	.	54		32[f]		33		27[f]			·
Beef	418	620[h]	New Zealand	236[a]	Argentina	270[a]	Australia	310[a]			41
Pork	455	498	Denmark	361	Netherlands	400	Yugoslavia	211[e]			64
Eggs[g]	310	343	Netherlands	317	China	286[i]	Poland	228[i]			45

[a] Wholesale prices. [b] Rapeseed. [c] Crude sugar.

[d] Price in 1959, when the world market price was roughly the same as in 1966. The quotation for export in 1966 for all Caribbean ports was 21 öre per kg.

[e] 1965/66. [f] 1964. [g] 1965.

[h] Wholesale price minus the slaughter charge.

[i] Export price.

Sources: Mean export prices – FAO, *The State of Food and Agriculture* 1967. Producers' prices for main exporting countries in 1966 – *Monthly Bulletin of Agricultural Economics and Statistics* 1967, 1968; FAO, *Committee on Commodity Problems, Developments in Agricultural Price Stabilization and Support Policies* 1961–66, CCP 67/9; 1965 and earlier – FAO, *Production Yearbook* 1966.
Producers' prices in Sweden – *Jordbruksekonomiska Meddelanden* (The Journal of Agricultural Economics).
Main exporting countries' share of world exports – FAO, *Trade Yearbook* 1966.

[12] *Source:* See p. 45, n. 13.

One is moved to ask how these low export prices can cover the exporting countries' costs of production, bearing in mind the meagre recompense that Swedish prices afford for the production factors invested in Swedish agriculture. A fairly definite answer to this question can be arrived at in the case of countries with developed economies and relatively small agricultural sectors by comparing the profitability of their agriculture with that of other sectors. In countries such as the USA, Canada and New Zealand the profitability ratio between agriculture and industry is practically the same as in Sweden, even though agriculture in these countries does not receive greater support, or even receives less support than industry, while in Sweden, as we have already seen, the support given to agriculture is 50–60 per cent greater than that given to industry.

As regards countries where the agricultural sector predominates, especially the developing countries, it is hardly feasible to calculate production costs in this way since in many cases there would be no alternative use for factors of production released from agriculture. In countries of this kind the price of the factors of production in agriculture is determined by the prices of agricultural products on the world market. This price mechanism has actually been institutionalized in some countries by agreements governing wages and the distribution of profits. Thus in Cuba a system has applied since the 1930's whereby 47 per cent of the price of sugar goes to the farmer and 48 per cent to the factory. Plantation workers' wages are also expressed in terms of the value of a given number of kg. raw sugar per working day.[13]

Since most of the supply on the world market is dominated by exporting countries whose prices approximate world market prices, it would be absurd to say that the world market in agricultural products is characterized by dumping. This is particularly true as regards edible fats, cerale, sugar and beef. In other words Sweden, in common with most other Western European countries, is at a fundamental competitive disadvantage as far as these products are concerned.

On the other hand one is often justified in talking of dumping as regards certain milk products, such as cheese and dried milk, and grain-based livestock products such as pork, eggs and broilers, which are predominantly Western European exports. Surplus consignments, arising when domestic production support outstrips domestic demand, are often put onto the world market. However, feed grain constitutes such a large proportion (70–85 per cent) of the production costs of grain-based livestock products that the price formation of the latter has little effect on the localization of world agricultural production. Also Western Europe probably enjoys certain comparative advantages in this kind of livestock production, the effective management of which calls for advanced industrial technology.

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[13] *Cuba. Agriculture and Planning 1963–64.* University of Miami 1965, p. 97, where the minimum wage is given as 50 lbs of sugar per 8-hour day, i.e. 2.8 kg. per hour, which corresponds to 1.40 – 1.80 Sw.kr. per hour at the prices prevailing.

WORLD MARKET PRICES UNDER FREE TRADE

Since the competitiveness of Swedish agriculture should be judged in terms of the world market prices that would result from the abolition of protection, it is worth trying to estimate the prices which would then apply. We have made a number of rough estimates to this end.

Our first question concerns the effects on world market prices of the unilateral abolition of price support in Sweden. As can be seen from Table 8, total consumption in Sweden comprises only about 1 per cent of world trade in such commodities as wheat, sugar and edible oils. Even a very radical reduction of Sweden's output of these products, together with the resultant increase in Swedish imports, would have no significant effect on world market prices. A certain price rise might be expected in the case of feed grain and milk products, Swedish consumption of which amounts to approximately 1/10th of world trade; at a very rough estimate feed grain prices would rise by up to 5 per cent and milk products by 15 or 20 per cent. Swedish consumption accounts for a sizeable proportion of world trade in pork and eggs. Since, as we have already observed, the world market prices for these products are mainly deter mined by the price of feed grain, Swedish purchases would not have any really significant effect on prices. The world market prices of all products would on average rise only by a few per cent if price support were to be abolished in Sweden, at the same time as domestic prices would fall by about 40 per cent.

Our second question concerns the effect on world prices of an abolition of protection throughout Western Europe. In spite of the difficulties involved in answering this question, we have attempted to illustrate the problem with the aid of a schematic estimate.[14] We have assumed an average Western European support level of 50 per cent. In other respects we have taken as our starting point the conditions applying in the mid-1960's. The estimate tries to allow for the effects of price changes on both consumption and production. The result of the estimate depends of course on what assumptions are made concerning the elasticity of output and demand. »Reasonable» assumptions in this respect have led us to conclude that world market prices would rise by 20 to 30 per cent if support to agriculture were abolished throughout Western Europe. As far as Sweden is concerned, this would imply a 20–30 per cent reduction of current prices of agricultural prices.

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[14] The estimate is set out in greater detail in Appendix B. More detailed product-by-product studies, made by Gulbrandsen in collaboration with the FAO, are now under compilation.

CHAPTER THREE

THE PRODUCTIVITY, SIZE AND STRUCTURE OF AGRICULTURE

In this chapter we shall be concerned with the problems of efficiency connected with the size and structure of farm holdings in the agricultural sector.

THE SIZE OF THE SECTOR

As is well known, the quality of the factors of production in agriculture varies widely. This is particularly true of land, owing to variations in natural conditions (fertility, climate, site). Since the amount of inferior soil that has to be cultivated varies in proportion to the size of the sector, agricultural productivity (both on average and marginally) is inversely related to the size of the sector, all other factors being equal.

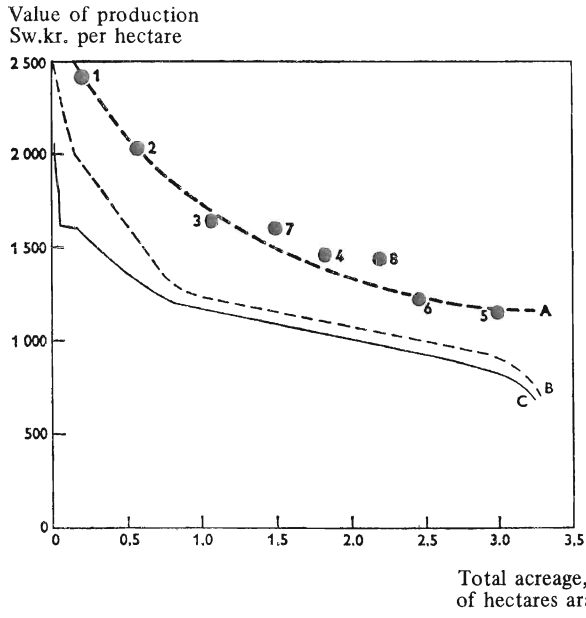
The importance of the agricultural sector's size in determining productivity can be illustrated by studying regional variations in yield and profitability in Sweden. Regional yield variations are shown in Diagram 3, which specifies variations in crop value and net production per unit area in Sweden. The curves in the diagram have been obtained by ranking the areas in order of yield per hectare and cumulating their total arable acreage. The diagram shows crop values (curve B) ranging from about Sw.kr. 2 500 to about Sw.kr. 1 250 per hectare over the first million hectares of arable land. After this the crop value falls far more slowly as acreage increases, almost in a straight line down to about Sw.kr. 900 per hectare at a total acreage of 3 million hectares, thus falling rapidly again for the remaining 0.2 million hectares cultivated during the year in question (1964).

Net output[1] per unit area, which is higher than crop value on account of livestock production, seems to have followed the same course, though a more rudimentary regional classification of the data gives a schematic picture in the diagram (curve A). However, this curve provides a less satisfactory gauge of variations in land yield due to variations in the level of livestock production, capital intensity and structure of farm holdings.

Regional variations in yield are, however, not solely due to varying natural conditions; they are also affected by price policy. To illustrate this, the crop values have been re-calculated in terms of the prices that would apply if the price

[1] Defined as gross output minus agricultural inputs.

Diagram 3. *Marginal yield in agriculture (regression between value of production per hectare and total acreage)*



● Net production per hectare, average per farm region based on JEU 1963[a]

A - - - Regression estimates for the same

B - - - Value of standard yield per hectare according to data on compensation for crop damage in 1964[b]

C —— Calculated value of harvest per hectare according to same source as in B with uniform price support[b]

[a] The observations refer to the regions listed in Diagram 4.

[b] Curve based on data from about 400 farming districts.

Source: Appendix G.

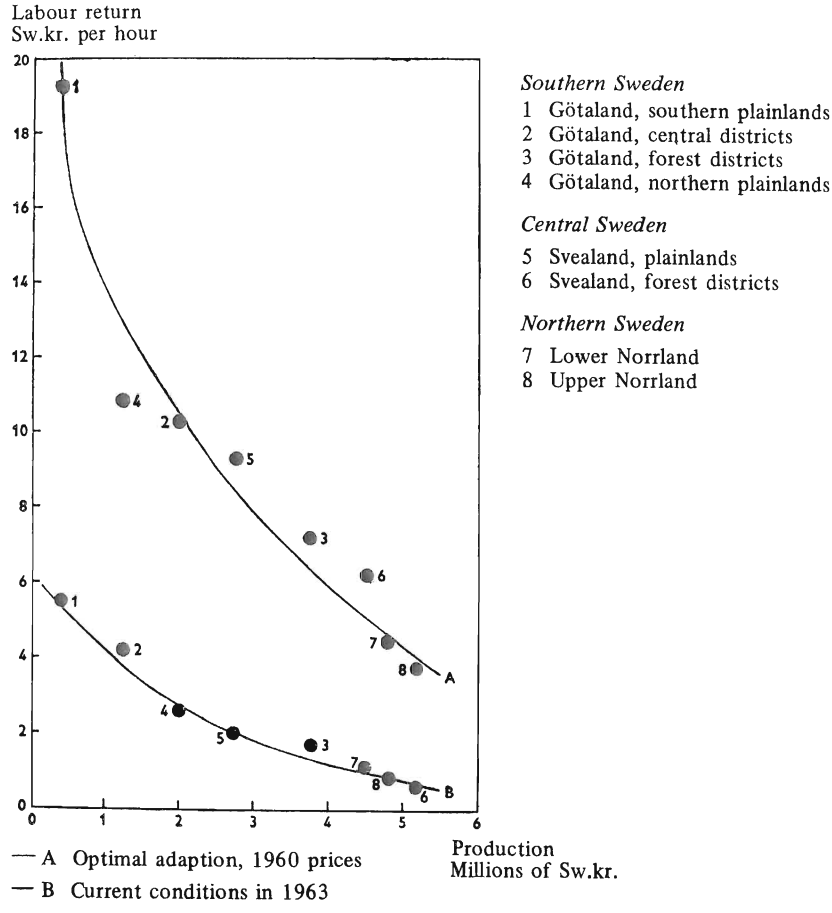
ratios between different agricultural products were adjusted to price ratios on the world market. This curve (C in the diagram) follows much the same course as the other two.

Variations in profitability are illustrated in Diagram 4 on the same lines as hectare yield, though profitability has been related to the volume of production instead of to area, since the former provides a more direct gauge of the size of the agricultural sector. Following the general practice in agricultural economics, labour return per man-hour, computed at a given rate of interest on invested capital, has been used to gauge profitability.

If a comparison using such a measure of profitability is to show the variation in productivity between different parts of the country, allowance must be made

for the fact that these variations are reflected in the value of real estate. If interest charges are calculated on the basis of the market value of farms, charges will be high in areas with good natural conditions; this can be observed by comparing real estate prices in the estimatically most favourable part of southern Sweden and central Sweden. (An analysis of the capitalization problem is given in Chapter 4.) Differences in labour return will thus lead to an under-estimate of regional variations in productivity, which are completely or partially capitalized in the real estate values of farms. To solve this problem we have tried to eliminate the distorting effect of capitalization on productivity comparisons by calculating labour return at real estate values without any capitalization for regional differences in natural conditions. This has been done by applying a measure of opportunity costs instead of market values for the assets incorporated in real estate.[2] Allowance has been made in Diagram 4, unlike Diagram 3, for regional variations in capital investment.

Diagram 4. *Marginal profitability (regression between labour return and total volume of production measured at opportunity costs for land)*



Source: Appendix G.

[2] As shown in more detail in Appendix G, the opportunity value of land construction and buildings has been put at half the replacement value. The land itself has been valued at forest rates.

Regional differences in profitability are illustrated in Diagram 4 by two curves, one referring to current average conditions (curve B), the other referring to a conceivably optimal layout of one-family farms (curve A). The optimal layout is here taken to mean the adaptation of size and production lines to give maximum labour return at current prices if the best techniques available are applied.[3] The two curves differ appreciably in terms of both level and slope. Since the diagram only takes into account differences of productivity *between* various large regions and not *within* them, it tends to underestimate the influence of the agricultural sector's size on profitability.[4] On the other hand, price policy may have resulted in greater differences than would exist if prices were adjusted to world market price ratios. This is mostly due to the particularly heavy support given to sugar and wheat, which are cultivated on the best soils in the country, the effect of which is constructed by special price support to milk farms in the Northern Sweden. A correction of this bias would not charge the general conclusion to be drawn from the diagram, that the size of the sector is an important factor behind its low productivity.

STRUCTURE

Mean size is often used to describe farm structure. The 1969 acreage inventory showed an average area in Sweden of 19 hectares. But this criterion is a rather inadequate characteristic. Land allocation in different-sized farms is also highly important. In order to show the extent to which arable land is worked in units susceptible to the use of rational techniques, it is generally more appropriate to specify what proportion of the total area is farmed in reasonably large units. Whereas in countries such as Great Britain, Italy and France, 55, 40 and 30 per cent of the land respectively is worked by units of at least 50 hectares, the corresponding figure for Sweden is 20 per cent. The ratio between these countries is practically the same as that obtained when studying farms of 20 hectares and upwards (Diagram 5).[5] In certain other countries, however, such as Western Germany and the Netherlands, the structure of farm holdings is quite similar to that of Sweden.

The number of individual farms in Sweden has fallen throughout the post-war period. This can be seen from Table 10, which shows the changes that have occurred in the number of farms and acreage for farms of different sizes. Farms of less than 10 hectares arable land have declined most. Since the mid-1950's

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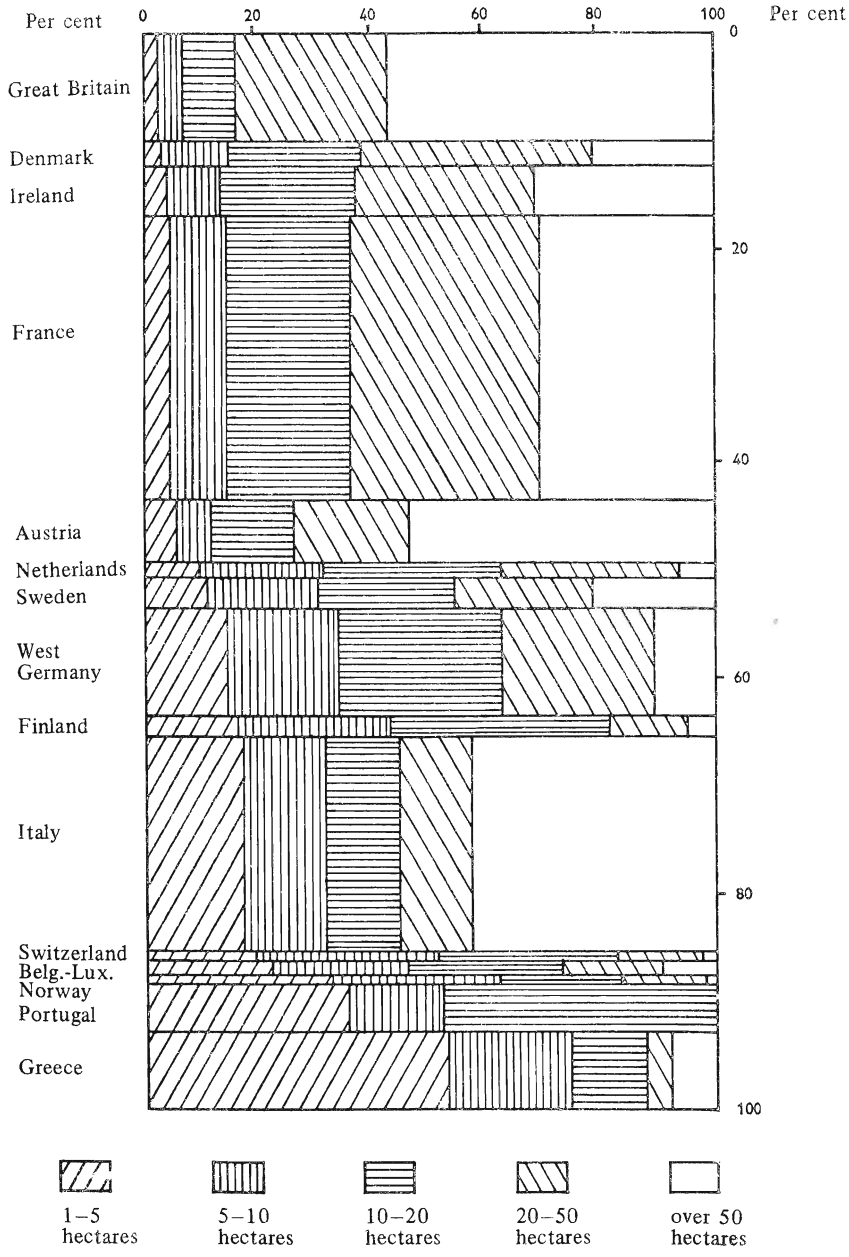
[3] See L. Hjelm, Det svenska lantbrukets effektiviseringsvägar (Agricultural Rationalization in Sweden), *Statens Offentliga Utredningar* 1963:66, Stockholm 1963

[4] Judging however by the comparison using crop statistics in Appendix G, the underestimate should not be too serious.

[5] However, in certain countries, such as Italy, the opportunities of large-scale operation inherent in the structure shown in the diagram are not exploited, because the figures refer to the distribution of proprietary units and existing leasehold systems break down the large propriety units into several small holdings.

Diagram 5. *Agricultural land in Western Europe by size of farm*



Note: The horizontal axis gives the percentage distribution in each country and the vertical axis the percentage distribution in Western Europe.

Source: Hjelm, *op.cit.*, p. 55.

Table 10. *Number of farms and total acreage in Sweden, 1944–69*

Year	Size in hectares arable 2–5	5–10	10–20	20–30	30–100	over 100	Total
Number of farms (1 000's)							
1944	107.8	94.1	58.5	17.0	15.8	2.3	295.5
1951	95.9	89.8	59.8	17.7	16.7	2.3	282.2
1956	87.6	83.2	59.6	18.5	17.0	2.2	268.1
1961	66.6	75.0	53.5	18.3	17.4	2.2	232.9
1967	44.4	52.7	42.5	18.3	20.2	2.3	180.4
1969	35.5	43.9	39.9	18.5	21.9	2.5	162.2
Change 1944–69	−72.3	−50.2	−18.6	+1.5	+6.1	+0.2	−133.3
Arable land (1 000's of hectares)							
1944	399	721	850	428	772	397	3 567
1951	350	682	859	438	803	395	3 527
1956	320	635	860	458	821	394	3 488
1961	251	572	790	457	837	390	3 297
1967	173	400	633	458	988	421	3 073
1969	134	334	591	460	1 067	449	3 035
Change 1944–69	−265	−387	−259	+32	+295	+52	−532

Source: Sveriges Officiella Statistik, Jordbruksräkningen (Census of Agriculture) 1961; *Statistiska meddelanden* (Statistical Reports) J 1967:50 and 51.

there has also been a definite fall in the number of farms ranging from 10 to 20 hectares. Altogether the number of farms fell by just over 100 000 to 160 000 during the period 1944–69. Total acreage fell during the same period by 0.5 million to about 3.0 million hectares.

There are several indications that the closure rate has accelerated during the 1960's. Whereas for example the number of dairy producers fell during the second half of the 1950's by about 8 000 annually, the annual decline in the mid-1960's was 12 000. Income statistics also suggest an appreciable acceleration (see Table 11).

The closure rate in the 1960's is far too large to be attributed solely to low recruitment as one generation succeeds another. The gross decline due to retirement and death is estimated at about 9 000 per annum.[6] Even if recruitment had ceased altogether the disappearance of the older generation would still not suffice to explain the decline of the farming population, as was previously the case. Obviously younger farmers have also begun to leave agriculture at an increasing rate.

[6] O. Gulbrandsen, *Strukturomvandlingen i jordbruket* (Structural Change in Agriculture), The Industrial Institute for Economic and Social Research, Stockholm 1957, Chapter 6 (projections for the 1960's).

Table 11. *Indicators of structural change in Swedish agriculture, 1954–70*

Region	Annual reduction in number of dairy suppliers				Annual reduction in number of farms according to tax returns	
	1954–58	1958–62	1962–67	1967–70	1956–59	1959–65
	1 000's					
Southern and Central Sweden						
Plainland provinces	3.1	3.7	4.6	7.9	3.1	3.9
Forest provinces[a]	2.3	2.3	4.8		2.5	2.6
Northern Sweden (Norrland)	2.5	1.8	2.9	2.6	2.5	2.4
Total	7.9	7.8	12,3	10.5	8.1	8.9

[a] Comprises the provinces of Jönköping, Kronoberg, Göteborg & Bohus, Älvsborg, Värmland and Kopparberg.

Sources: Svenska Mejeriernas Riksförening (Swedish Dairy Association), June statistics; *Sveriges Officiella Statistik*, Skattetaxeringarna (Tax Assessments).

One might have expected an extensive transfer of land from the abandoned farms to other units, resulting in a rise in the number of large units. This has not happened. The number of farms of more than 20 hectares rose by a bare 8 000 during the period 1944–68.

Although a fairly large area has in fact been transferred from abandoned to surviving farms – according to special surveys about 250 000 hectares during the period 1956–61 – almost the same area of cultivated land has been put to other uses such as forestry.[7] Transfers of this kind have also occurred within several large farms: this also helps to explain the negligible increase in the area of farms exceeding 20 hectares. Another explanation is that even after amalgamation, many of the farms have not exceeded 20 hectares.

The decline of the small farms as reflected by production has been greater than these acreage figures suggest, above all because small holders have come to devote less work to agriculture and more to part-time employment elsewhere. This has been made possible mainly by dispensing with livestock.

These changes are reflected by census reports, income statistics and statistics concerning dairy producers.[8] The census reports show that between 1950 and 1960 the number of farmers with farms of more than 2 hectares declined by 110 000.[9] The agricultural census reports, on the other hand, indicate that the decline was only 50 000 during roughly the same period (Table 10). The main reason for this discrepancy is that a considerable

[7] Lantbrukets strukturutveckling (Structural Trends in Agriculture), *Statens Offentliga Utredningar* 1964:37, Chapter 4.

[8] Since details of occupation in the census reports are based on sources of income, these statistics give more or less the same picture as the income statistics.

[9] The number of farmers with holdings of more than 2 hectares in 1950 is given in Gulbrandsen, *op.cit.*, p. 211, while the figure for 1960 will be found in *Statens Offentliga Utredningar* 1964:37, op.cit., p. 138.

number of farmers principally employed outside agriculture have retained their farms. According to a sample study made in 1966, only 120 000 of some 185 000 farmers were both of employable age and primarily occupied on their farms.[10]

The dairy statistics show that the number of dairy producers, which in 1950 (when it was at its height) was about 250 000 in 1970 was hardly more than 80 000. The agricultural census reports lead one to conclude that most of the 170 000 producers who have gone out of business are (or were) farmers with less than 10 hectares arable (about 90 per cent of the decrease). Milk sales comprised the main agricultural income of this group. Since the possibilities of making a living out of small farming without raising livestock are very limited, dispensing with milk production must in the majority of cases entail either a partial or complete change of occupation or retirement.

The process of structural change can be summarized as follows. The transfer to part-time employment on small farms noted during the 1950's has been succeeded during the 1960's by a more complete abandonment of farming, at the same time as the transfer to part-time employment has continued. But in spite of the extent of closures, the size-structure has changed quite slowly. Using the figures quoted in Table 10 for acreage and the number of farms, mean area in 1969 can be calculated at about 19 hectares as against 12 hectares in 1944 and 14 hectares in 1961.[11] The structural change has been relatively insignificant in the sense that the number of large farms and the acreage cultivated on them have increased slowly.

At the same time as structural change has proceeded slowly, technical development in agriculture, especially as regards machinery, has made large-scale operations of considerable advantage. These potentialities have been exploited in countries such as the USA, Canada, New Zealand and Australia, and one wonders why the same methods have not been applied to Swedish agriculture. There are three possible reasons for this. One of them is the small economic gains that would result from large-scale operation under Swedish conditions. The second is that price developments as regards products and the factors of production, due among other things to current price policy, have reduced the economic incentives to large-scale operation. The third reason is that there may be various obstacles to the introduction of large-scale operation, offsetting the economic benefits that would accrue. We turn now to consider the validity of the first of these suggested causes. The other two will be discussed in later chapters (chiefly in Chapters 4 and 9).

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[10] Å. Sambergs & L. Hedqvist, Lantbrukets struktur- och befolkningsläge våren 1966 (Agricultural Structure and Population, Spring 1966). *Medd. från Jordbrukets Utredningsinstitut* (Reports from the Swedish Agricultural Research Institute) 4–66. The figure of 120 000 is derived from the Table on p. 23.

[11] The trend towards larger farms seems to have been about the same in Sweden as in other Western European countries. In most of these countries mean acreage increased by one or two hectares, i.e. 10 per cent, during the 1950's. Things have moved far more rapidly in the USA and Canada during the same period, mean acreage having risen by more than 30 hectares or 41 and 28 per cent respectively. Source: OECD: *Agricultural and Economic Growth.* Paris 1965.

Developments in the USA and Canada appear to have proceeded at more or less the same rate during the 1960's as during the 1950's; thus mean acreage in both countries is estimated to have increased by about 20 hectares during the period 1961–66. (Estimates based on information from the Dominion Bureau of Statistics (Canada) and the US Department of Agriculture.)

ECONOMIES OF SCALE IN AGRICULTURE

Acreage and livestock are the two principal determinants of a farm size. We shall begin by dealing with the relation between profitability and acreage. Two kinds of analysis will be presented in this context. The first is concerned with actual economic results, the second with the economic result attainable by an optimally adapted farm at current market prices. To illustrate the actual economic results of farms of different sizes we have used data from JEU, which, however, only cover farms of up to 50 hectares and from statistics on income tax returns. These two sets of data, referring to 1966, are collated in Table 12, which shows the total incomes of farming families and the proportion of their incomes attributed to farm properties.

As the table shows, there is a definite correlation between acreage and income. This correlation is more pronounced in the figures for income derived solely from agricultural property, since a large proportion of incomes on the smallest farms (especially under 10 hectares) are earned outside the farm itself, the farmer being employed part-time elsewhere. Consequently the series relating to incomes derived solely from farming exaggerate the connection between income and acreage, since full-time work on the small farms would give larger incomes than those indicated in the table. It should also be borne in mind that a farmer's input of his own capital rises in proportion to acreage, so that the figures do not reflect the direct relationship between income and acreage. The problem of allowing for differences of capital output when comparing profitability is a complex on to which we shall be returning in Chapter 4.

Another body of material illustrating the relationship between profitability and acreage, with allowance made for labour input and capital expenditure, is

Table 12. *Relation between farm income and acreage for the plains of southern and central Sweden, 1966*

Acreage, hectares arable	Farm account statistics (JEU)		Tax returns, owner-occupied farms	
	Family's total income	Of which from the farm	Total income on joint return	Of which from the farm
	1 000's of Sw.kr.			
2– 5			12.3	3.4
5– 10	17.3	11.1	12.4	7.1
10– 20	23.8	18.6	16.9	13.5
20– 30	27.0	22.4	20.0	17.6
30– 50	34.4	29.4	24.1	20.8
50–100			32.5	27.0
over 100			53.7	39.2
Average	24.4	18.6	18.8	13.9

Sources: Statistiska meddelanden (Statistical Reports) J 1968:10 and Appendix E.

L. Hjelm's study of agricultural rationalization in Sweden,[12] which presents both the profitability of existing farms, based on material from JEU, and the profitability of what we have previously referred to as optimally adapted farms. Some of the results, relating to two typical plain regions with different natural conditions, are summarized in Table 13.

The upper half of the table is based on the same material as the left-hand part of Table 12. In Table 13, however, interest charges have been deducted thus allowing for the input of own capital. Also profitability is expressed in terms of labour return per working hour instead of annual income. As can be seen from the table, and as shown by Table 12, labour return in existing farms definitely rises in proportion to the acreage in the interval studied.[13]

The figures in the lower part of the table, for the optimally adapted farm, also show a definite connection between acreage and labour return. Whereas the figures for actual labour return refer to an interval of 5–50 hectares, those for the optimally adapted farm refer to the interval of 60–150 hectares. But

Table 13. *Relation between profitability and acreage, 1960*

	Southern Sweden Southern plains of Götaland		Central Sweden Plains of Svealand	
	Labour input hours per year	Labour return Sw.kr. per hour	Labour input hours per year	Labour return Sw.kr. per hour
Existing farms (techniques actually employed, 1960 prices)				
Size, hectares				
5–10	3 200	2.60	3 700	1.70
10–20	4 700	3.50	4 000	2.00
20–30	5 600	3.40	4 500	2.10
30–50	7 200	3.90	5 400	2.30
	Optimal size hectares	Labour return Sw.kr. per hour	Optimal size hectares	Labour return Sw.kr. per hour
Optimal farms (1960 techniques and prices)				
Labour input hours per year				
3 000	60	11.80	55	6.20
5 000	120	14.90	110	8.30
7 000	150	14.40	140	8.50

Source: Hjelm, *op.cit.*, Chapter 4.

[12] Hjelm, *op.cit.*

[13] This presupposes constant land prices. In practice, however, land prices would rise owing to the capitalization of improved profitability of the farm, causing the latter to be divided between land and labour. This problem is dealt with in greater detail in Chapter 4.

the most interesting observations with respect to economies of scale are obtained by comparing the two halves of the table. This shows that structural change, primarily in the form of increased acreage, could make it possible to manifold the return on a given total labour input. Whereas the empirical data show that the labour return at 5 000 working hours is of the order of Sw.kr. 2–4 per hour, the same work input for the optimally adapted farm gives a return of Sw.kr. 8–15 per hour. Hjelm has also shown that there are practically no topographical impediments in Sweden to a transition to farms of 100 hectares or more. According to the study, only about 1/4th of the national acreage is situated in such a way as to preclude the establishment of continuous units of at least 100 hectares.[14]

According to Hjelm's study it would not be remunerative, given the techniques available at the time (1960), to use more than 120 or 150 hectares at an annual labour input of 5 000 and 7 000 hours respectively. Since the additional labour return resulting from an increase from 5 000 to 7 000 working hours is negligible, the survey implies that larger units would not be remunerative in Sweden.

There are, however, several reasons for doubting this maximum profitability level. The optimum entrepreneurial forms have been studied within such limited intervals of labour input that it has been impossible to take into account the advantages that might accrue from specialization, e.g. on the managerial side. In order for family farms to attain the perfect management presupposed by estimates regarding the optimum farm, extremely high managerial qualities would be required of at least one member of each family, unless the necessary information were to be supplied to the farm in some other way, e.g. by consultants. In other words, the figures in the table exaggerate the ability of the family farm to improve its profitability by increasing its acreage, at the same time as they underrate the advantages of still larger farms with more advanced division of work.

Another reason for questioning the profitability maximum is the assumption made in the study, for lack of data, that techniques do not change beyond a given size of farm.[15] This does not seem to accord with the facts. Thus some of the largest – and most profitable – machinery cannot be used efficiently even on the largest farms covered by the study.

It should also be noted, as emphasized in the survey, that the optimum size of farm increases with technical progress. Thus, given a labour input of 7 000 hours and the techniques assumed by Hjelm to have come into being by 1975, an optimally adapted farm would require 250 and 320 hectares respectively in the central and southern Swedish plainlands.

The figures quoted so far refer to the profitability of the farm as a whole. The profitability of expanding the acreage of an existing farm is often far greater.

[14] Hjelm, *op.cit.*, p. 183.

[15] Cf. the connection between labour consumption and size of farm in Diagram 1 , Hjelm, *op.cit.*, p. 214. It is assumed that the reduction of labour input in cash-crop farming practically ceases at 100 hectares.

According to a study by E. Sandqvist, an increase in acreage entailing a land purchase cost of Sw.kr. 1 per annum on a basic farm (with 10–20 hectares arable) yields approximately Sw.kr. 3 in increased marginal profit, corresponding to 12 per cent rate of return.[16] It should however be noted that this refers to profits accruing from small increases of acreage. Nevertheless, more extensive increases can also pay well, although the profit increment declines successively with each additional expansion.[17]

The other primary means of enlarging a farm is by increasing the amount of livestock, above all though specialized livestock production. The greatest advantages of large-scale operation to date have been registered by broiler and pig production. An estimate (in 1960 prices) of the labour return which, allowing for capital costs, can be achieved with pig farms of different sizes is shown in Table 14, taken from Hjelm's study.[18] Specialization can also give considerable profits in other branches of livestock farming, albeit less spectacular than in pig farming. Table 14 also includes examples from dairy farming. Pigs and poultry are now being farmed in herds comprising tens of thousands of animals and there is at least one broiler farm with an annual production exceeding 1 million birds.[19]

Table 14. *Relation between profitability and number of animals*

Average no. of animals per annum	Total labour input hours per year	Labour return Sw.kr. per hour
Pigs for slaughter		
20	270	3.00
50	600	4.00
200	1 800	8.00
1 000	2 250	33.00
Dairy cows		
50	3 300	6.00
200	10 000	8.00
400	18 000	9.00

Source: Hjelm, *op.cit.*, p. 154, synthetic calculations based on data from accounts.

[16] E. Sandqvist, Analys av produktivitetsförhållande i svenskt lantbruk (Analysis of agricultural productivity in Sweden). *Meddelanden från ekonomiska institutionen* (Reports from the Institute of Economics), The Agricultural College, Uppsala, August 1961. Cf. Hjelm, *op.cit.*, p. 71.

[17] Thus according to Sandqvist a 20 per cent increase in acreage will cause the marginal product to fall by 13 per cent.

[18] Hjelm, *op.cit.*, p. 154.

[19] Concerning the profits of such large units, the view has recently been expressed that the advantages to society may be negated to some extent by the problems of pollution involved.

Techniques have developed rapidly during the 1960's, not least in some branches of animal production, such as dairy farming, which were formerly difficult to mechanize. Increases in herds can thus be expected to yield considerable profits in future even in these branches. Methods for preserving roughage in briquette and pellet form should eventually make this feed commercially available and so reduce the present bounds between acreage and herd size of dairy and beef farms.

The studies quoted here show that the profitability of the farms which at present predominate in Swedish agriculture is far lower than can be achieved at current prices in optimally organized units. Considerable profits can also be derived by increasing the size of farms as regards either acreage or herd. The small units of today include far too little land and livestock in relation to the supply of labour, plant and machinery. The existing structure, with its small acreages (mean acreage 19 hectares) and small herds (average 8 cows and 30 pigs), does not admit of anything like the optimum factor proportions in agriculture. Clearly then the present structure of farm holdings and the factor proportions associated with it are a major cause – if not the main cause – of the poor productivity and profitability of Swedish agriculture. A radical increase in the size of farms, coupled with a reduction of the agricultural sector as a whole, could therefore be expected to pave the way to higher productivity.

PART TWO

INCOMES AND PROFITABILITY IN AGRICULTURE

CHAPTER FOUR

PROFITABILITY AND FARM LAND VALUES

Opinion is sharply divided concerning profitability and incomes in Swedish agriculture. One common assumption, especially in price negotiations, is that agriculture is less profitable than other sectors. This is often expressed in terms of a considerable income gap vis-à-vis other sectors. On the other hand the negligible number of farms over 20 hectares that have been closed so far suggests that profitability is high enough in this category at least to keep farmers on the land and to recruit new members.

It is sometimes said regarding the comparative profitability of different sized farms that large farms (e.g. over 100 hectares) are by no means more profitable than small ones, indeed that they are less profitable. But we have already had occation to refer to a series of managerial-economic estimates showing that profitability in fact rises steeply in relation to the scale of production.

The question thus arises which of these many assertions regarding profitability and incomes in agriculture are correct. Alternatively, are all the various assertions in fact correct once one allows for the fact that they refer to completely different concepts of profitability and income? We shall endeavour to resolve these questions in this and the next chapter.

It is appropriate here to distinguish between three criteria of profitability: private-economic, business-economic and welfare-economic. *Private-economic costs and benefits* refer to the total incomes of the farmer or the farming family - irrespective of whether they result from labour or capital input. *Business-economic costs and benefits*, on the other hand, concern the return on the various factors of production; thus in industry, business-economic profitability is usually measured by capital yield at a given wage rate, in agriculture it is generally expressed in terms of labour return at given rates of interest on capital. A *welfare-economic criterion* is based on a calculation of social costs and benefits and measures the contribution made by a certain activity to aggregate production in the economy. In this context factor input is estimated in terms of the value these factors would have contributed if they had been put to other uses (opportunity cost) and output is valued in terms of the price of purchasing the corresponding products abroad.

Differences can arise between private-economic and business-economic costs and benefits, e.g. as a result of one person contributing more than one factor of production in an enterprise, for instance a part of both capital and labour input.

Profitability based on a welfare-economic criterion can diverge from that based on private-economic and business-economic criteria for several reasons. The state often changes prices and other determinants of profitability by means of economic policy, e.g. by tariffs, subsidies, discriminatory taxation, credit facilities or legislation. Restrictive practices are another. A third reason for the incongruency of business-economic and welfare-economic costs and benefits is that the imperfect mobility of the factors of production can in the short run produce a different price structure and income distribution from that to be expected over a longer period, when factors of production are generally more mobile. A fourth reason is that estimates of business-economic costs and benefits do not take into account the external effects of the firm's activities on the environment and on conditions of production in other sectors. These effects may enhance the welfare-economic value of the activity concerned – e.g. agriculture can stimulate open air activities – or they may have the opposite effect, as in the case of water pollution.

These different measures of costs and benefits have to be distinguished whenever a sector is characterized by considerable state intervention in adequate mobility of factors of production or external effects, or where it is difficult to separate capital return from labour return. As will be seen in due course, this is very much the case in agriculture, which in turn somewhat explains why there are so many different and vague interpretations of the economics of this sector.

In this chapter we shall begin by dealing with the relationship between profitability and factor price formation. Next we shall consider the problems of quantitative assessment involved in a statistical computation of the welfare-economic costs and benefits of the factors of agricultural production. The private economic aspects of agricultural profitability will be dealt with in the next chapter (Chapter 5), in which an analysis will be made of incomes and wealth in agriculture. We shall not, however, be concerned with the implications of external effects on the problem of agricultural profitability.

THE INFLUENCE OF PROFITABILITY ON FACTOR PRICES IN AGRICULTURE

As we saw in Chapter 1, state support – in the form of tariffs, subsidies and other controls – amounts to more than half the contribution made by agriculture to the national product, expressed in domestic prices. Obviously, then state support is bound to have far-reaching effects on agricultural profitability and consequently on the prices of the factors of production. Which factors gain most by price support is largely determined by price formation on the various factor markets.

The supply of factor inputs is of cardinal importance here. Assume that there is a change in the demand for an agricultural commodity and that this change affects both the demand for production factors and factor return in

the production of this commodity. The more elastic the supply for any of the factors, the less the change in total factor return is allocated to the factor in question. The degree of supply elasticity will depend on the alternative use of the factor and on how rapidly the factor can be transferred from one use to another. Thus the supply of purchased inputs such as fertilizer, fuel and machinery is generally so elastic that no significant price changes will result from a change in agricultural profitability.

Labour must be divided into two categories: employees and farmers. Employees, such as agricultural labourers and younger members of the farmer's family, are fairly mobile. Consequently their earnings are influenced more by wage trends in other sectors than by variations in agricultural profitability. Much the same applies to a large group of young and middle-aged farmers partially employed in other sectors (or working part-time on their own farms). Other farmers, especially in the upper age groups, are considerably less mobile, not least because most of them have invested a considerable amount of capital which they regard as firmly tied to their farms. Thus, on an average, about 75 per cent of the total amount of capital invested in farms is owned by the farmers themselves.

Land supply also has low elasticity, and soil implements and buildings still more so. Land is in a class of its own since, unlike most other capital, it cannot be reproduced by industrial manufacture or a biological growth process. From this follows, in theory, that changes in agricultural profitability, e.g. resulting from changes in the support given to agriculture, will above all be reflected in the price of agricultural real estate, at least in the long run. There is, however, no simple numerical relation between agricultural prices and land prices. The relation between them is affected among other things by the form of the production function and by trends in the prices of the more elastic factors of production parallel to a given change in the prices of agricultural commodities.

THE DEVELOPMENT OF FARM LAND VALUES

According to an analysis with the aid of a simplified model set out in Appendix G, the increase in farm land values can be taken to be a multiple of the increase in agricultural commodity prices at constant productivity and constant factor prices. This multiple is determined by the ratio of gross earnings to land costs, both quoted per year and hectare and, with reasonable assumptions concerning these values, will amount to about 5. In this case a rise of some 3 per cent per year in product prices (corresponding to the price rise that occurred during the period 1952/53 – 1965/66) would, other things being equal, result in land prices rising by 15 per cent per annum.

When trying to explain actual land price trends during a period one must, however, bear in mind that land prices are affected by other factors besides commodity prices. According to the model put forward in Appendix C there

is a negative correlation between changes in land prices and other factor prices and a positive correlation between changes in land prices and net productivity. The multiples of the factor prices are determined by the ratio of factor cost to land price, while the multiple of net productivity is determined by the ratio of value added to land price.

One can make an estimate of land price trends according to this model. In this context it must be decided whether it is farmers' total income or entrepreneurial profit that is capitalized. If it is the total farmers' income that is capitalized, so that labour costs are restricted to wages, the model gives a rise in land prices of 9 per cent per annum.[1] If on the other hand the entrepreneurial profit is capitalized, so that labour costs include the farmer's labour input as well, the model registers a fall in land prices.

In these calculations we have assumed that land price trends in Sweden can be explained by a study of conditions on average farms. In fact, as we shall see in due course, they are probably determined by the demand for additional land from large farms. Chapter 9 shows that net productivity has risen faster on large farms than on small ones – by 4.5 per cent on farms of over 100 hectares as against the average rate of 3 per cent. Since the profit capitalized on large farms can reasonably be assumed to be entrepreneurial profit, an application of the model would indicate an annual rise of about 7 per cent in the price of additional land for large farms.[2] [3]

It is interesting to compare the rise in land prices as calculated from the model with the actual rise. During the period under consideration, farm property prices rose on average by just over 5 per cent per annum,[4] while the consumer price came closest to the prices indicated by the model for additional land for large farms. Owing to the element of uncertainty in the calculations, we are not entitled to conclude that land prices are determined by the demand for additional land on large farms. Probably they are determined by a combination of this demand and the capitalization of entrepreneurial incomes on small farms. If so, the theoretical rise in land prices agrees fairly well with the actual increase.

It is also conceivable that land prices have been influenced by factors outside agriculture, e.g. urban expansion. We have attempted an empirical approach given an answer to this problem by studying real estate price trends county by county during the period 1952–66. In view of the limited amount of material

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[1] Cf. Appendix C for calculations.

[2] Cf. Appendix C for calculations.

[3] We have assumed here that marginal productivity rose by the same amount as average productivity.

[4] This figure refers to farms where not more than 50 per cent of the taxable value refers to forest and wood-land.

available in certain cases, the counties have been arranged in groups with regard to population trends as well as agricultural conditions, since the demand for land created by a steep rise in population can be expected to accelerate increases in land prices.

As can be seen from Table 15, land prices have risen far more rapidly in and around the big cities than in other counties. The steepest rise, about 7 per cent per annum, occurred in Malmöhus county. But this can hardly be put down to the rise in population, which was appreciably less rapid there than in other urban areas. A likelier explanation is to be found in the capitalization attendant on the rise in prices of agricultural commodities. The greater the yield per hectare in an area, the greater the extent to which land prices are affected by a rise in the prices of agricultural commodities (expressed as the multiple of those prices, as in the model discussed earlier). The high yield per hectare in Malmöhus county ought therefore, coupled with a given rise in commodity prices, result in a greater rise in land prices than in areas with low yield per hectare (provided that production costs excluding land do not rise as fast as hectare yield; cf. Appendix C).

A comparison of those plain counties that are uninfluenced by big cities with the forest counties also suggests that agricultural conditions are more important than population growth in determining land price trends. Thus the price rise for agricultural real estate (with little or no wood-land) in the forest counties is between a half and one per cent slower per year than in plainland counties with

Table 15. *Rise of farm land prices, 1952–66*

No.	Group of counties	Price rise for farm property 1952–66	Growth of population 1950–65
		per cent per annum	
1	Stockholm region	4.9	1.4
2	Malmöhus county	6.8	0.9
3	Göteborgs & Bohus county	6.5	1.3
4	Plainland counties with a stable share of the national population	5.4	0.5
5	Plainland counties with a declining share of the national population	5.1	0.0
6	Southern forest counties	5.0	0.5
7	Northern Sweden	4.3	0.0
	Whole of Sweden	5.4	0.7

Sources and methods of calculation: See Appendix D. The price rises shown refer to farm properties where not more than 25 per cent of the taxable value comprises forest and forest land. The composition of the groups is as follows: 1. Counties of Stockholm, Uppsala, Västmanland, 4. Södermanland, Östergötland, Halland, Örebro, 5. Kalmar, Gotland, Blekinge, Kristianstad, Skaraborg, 6. Jönköping, Kronoberg, Älvsborg, 7. Värmland, Kopparberg and Norrland.

much the same rate of population growth, Further, it is hard to discern any connection between land prices and population change within either plainland or forest counties.

This somewhat superficial analysis seems to confirm the theoretically anticipated relationship between agricultural commodity price movements and the capitalization of agricultural support. However, as already pointed out, the empirical basis of this argument is too tentative and fragmentary to permit any categorical conclusions.

NATURAL CONDITIONS AND LAND VALUES

Just as changes in productivity are capitalized in the market value of real estate, regional variations in profitability can be expected to be capitalized, resulting in property values differing between areas, i.e. differential rents. Thus a comparison of farming families' incomes or entrepreneurial profits with real estate values in different regions reveals an unmistakable correlation. This applies to farms of all sizes (cf. Appendix D).

In practice, however, it is difficult to establish statistically a capitalization factor for small farms, owing to the difficulty of distinguishing between labour and capital returns; the result of any calculation here will depend on the opportunity cost attributed to the family's own labour input. It is only in the case of the largest farms that the family's input is small enough in relation to capital input for the problem to be disregarded.

There is, however, yet another theoretical obstacle to the calculation of capitalization factors for small farms, in that their real estate value is often bolstered by the demand for them as additional land for the expansion of other units. The economic return on a farm purchased to expand the acreage of another farm is often far higher than when it was worked as an independent unit; in other words, marginal return is greater than average return. It follows that the real estate values of small farms cannot be explained in terms of the profitability of the farms themselves.

Thus one's main interest when analyzing the determinants of land prices is bound to focus on conditions applying on large farms. A calculation of the relation between the market value of agricultural real estate and the net income from this estate resulted in a capitalization factor of about 30, according to tax returns on farms of more than 100 hectares (cf. Appendix D, for 1963 and 1965). This means that the additional revenue derived from farms in areas with superior natural conditions is capitalized at an interest rate of about 3 per cent. This rate is to be regarded shortly as a »real» rate of return.[5]

[5] Within wide limits this result is fairly unaffected by variations in the estimated labour return.

CAPITALIZATION AND ECONOMIES OF SCALE

This section attempts to define the effect of the capitalization of land prices on the profitability of farms of various sizes. Three sources are consulted, JEU, tax returns and L. Hjelm's study of optimum enterprises.

In analyzing profitability, the definition must be adapted to the problem at hand. In the introduction to this chapter we distinguished between three kinds of profitability – private-economic, business-economic and welfare-economic. In all three cases particular attention must be paid to the principles for valuing the capital invested in the enterprise. Three separate valuation principles are identified here; capital can be valued in terms of (1) the market value of the enterprise, (2) the production costs of the assets of the enterprise or (3) the opportunity cost of its real capital. In Chapter 5 we shall go on to consider the effect of profitability on the incomes and living standards of farming families.

The ratio of profit to the value of the capital invested in the enterprise is often used as a criterion of agricultural profitability, the object being to express the yield on all the capital invested when the enterprise is purchased at market price. (It should be noted that in this case interest on the capital invested, be it own capital or borrowed, is not deducted in calculating profits.) If this profitability measure be R_1, we can say, schematically, that

$$R_1 = \frac{\text{profit}^6}{\text{market value of the enterprise}}$$

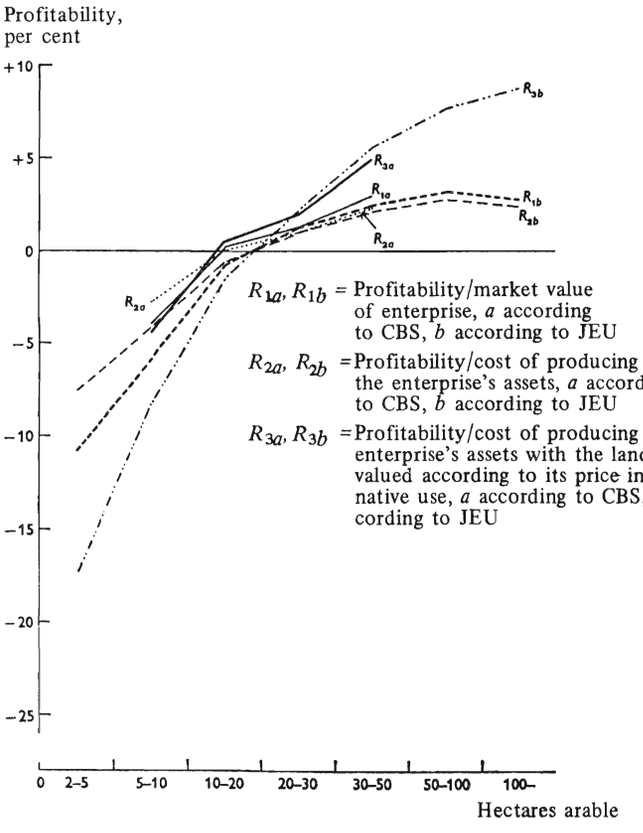
Applying definition to the JEU material for 1966 gives the curve R_{1a} in Diagram 6. According to this curve profitability is negative for small farms, rising thereafter throughout the interval for which information is available, i.e. up to 50 hectares. A study was also made of tax returns to obtain information on the relationship between acreage and profitability in regard to larger farms. Using the same definition of profitability as before, we obtain curve R_{1b} in Diagram 6, which follows much the same course in the interval covered by both surveys. The curve ceases to rise, however, on passing the 70 hectare mark.[7]

The question now arises how these relations are to be interpreted. One serious problem in a profitability measure of this kind is that numerator and denominator are partly interdependent. If profits rise, e.g. due to increased tariff protection, the market value of the farm rises too. In a perfect market the market value of farms is simply equal to the capital value at current interest rates of future profits. This is because the net yield is capitalized in the

[6] Profit = receipts less the cost of supplies, labour (including that of the farmer and his family), depreciation and maintenance.

[7] Another body of material, based on detailed accounting data from a small number of farms of about 200 hectares shows a somewhat greater profitability than the taxation returns. According to *Lantmannen* 1969:2 the yield of fourteen farms in central Sweden averaging 280 hectares between 1963 and 1967 corresponded to 8 per cent on the capital invested. It should be noted that profits from other activities such as forestry have not been included. Owing, however, to the limited scope of the material, these results are not susceptible of general application.

Diagram 6. *Profitability and farm size, existing farms on the plains of southern Götaland, 1966*



Sources: R_{1a}, R_{2a} and R_{3a} – Appendix D, Table 4.
R_{1b}, R_{2b} and R_{3b} – Appendix D, Table 3.

value of the fixed assets that cannot be reproduced in the short run. Consequently a profitability measure of this kind says nothing concerning economies of scale; the fraction can be described as an expression of the percentage yield required by the marginal farmer on farms of various sizes in order to enter (or remain in) agriculture. If the requisite return on capital invested were the same in all farm sizes, one would theoretically expect the same profitability, measured in terms of R_1, in all classes; this would have produced a horizontal line in the diagram. One explanation of the actual shape of the curve is that small farmers are probably content with a smaller return on their capital than are farmers with larger acreages. Another explanation may lie in the incompleteness of the statistical material. Thus the capital values used may possibly underrate the differences in land value between large and small farms, since purchasing price coefficients are based on mean values and schematically assessed, taxation values may conceal differences in market value.

Textbooks in business economics often employ another profitability measure so as to avoid the problem of the interdependence of numerator and denominator in the profitability measure; the denominator is made to express, not the market value of the enterprise but the cost at which a firm can be reconstructed with the same standard of capital equipment as the current. The values of the various items of real capital including land, are quoted at current market prices, i.e. the prices which an individual has to pay for the factors of production. This provides a measure of the rate of return obtained in establishing an enterprise at current capital goods prices, land included. Schematically this measure is defined as

$$R_2 = \frac{\text{profit}}{\text{cost of production of the firm's assets}}.$$

Profit according to R_2 is denoted by curves R_{2a} and R_{2b} in Diagram 6.[8]

The low yield indicated by R_2 in the diagram does not, however, imply that agricultural real estate is an unattractive investment. Nor can the course taken by the profit curves be taken to imply that the advantages of large-scale operation are minimal on acreages exceeding 50 hectares. For R_2 to serve as a satisfactory criterion of economies of scale, the denominator must represent the real production costs of the farm's assets. This requirement is undoubtedly met in all sectors, such as industry, where all capital goods can be reproduced in the long run. In agriculture, however, there is one factor of production, land, which under present Swedish conditions, cannot readily be reproduced. The yield of farms is therefore reflected, as already observed, by real estate prices. When estimating profitability in agriculture, it is impossible to circumvent this problem by using profitability definitions of the R_2 variety.[9]

In order to solve the problem of capitalization involved in estimates of profitability, the denominator of the profitability measure must include a land price that is not affected by yield when the land is used for agricultural purposes. One possibility here is to replace current land prices with the price of land used in alternative production, e.g. forestry.[10] This profitability measure is defined as

$$R_2 = \frac{\text{profit}}{\text{cost of production of the farm's assets, land values being calculated according to their price in an alternative use}}.$$

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[8] In estimating R_2, land values has been taken as the selling price of agricultural real estate, no distinction being made between developed and undeveloped land. The available statistics do not indicate any significant difference between these two categories. Since the denominator in R_2 is greater than that in R_1, the R_2 curves will be flatter than the R_1 curves.

[9] See n. 8.

[10] If one is exclusively interested in differences in profitability between farms of different sizes, it is sufficient to apply a uniform land value regardless of whether it reflects alternative use or not. When alternative use values are employed, a bias will occur in the results insofar as size of farm is correlated to alternative values, Since, however, alternative values, measured in terms of forest land prices, comprise a very small proportion of the total value of assets, this bias is negligible.

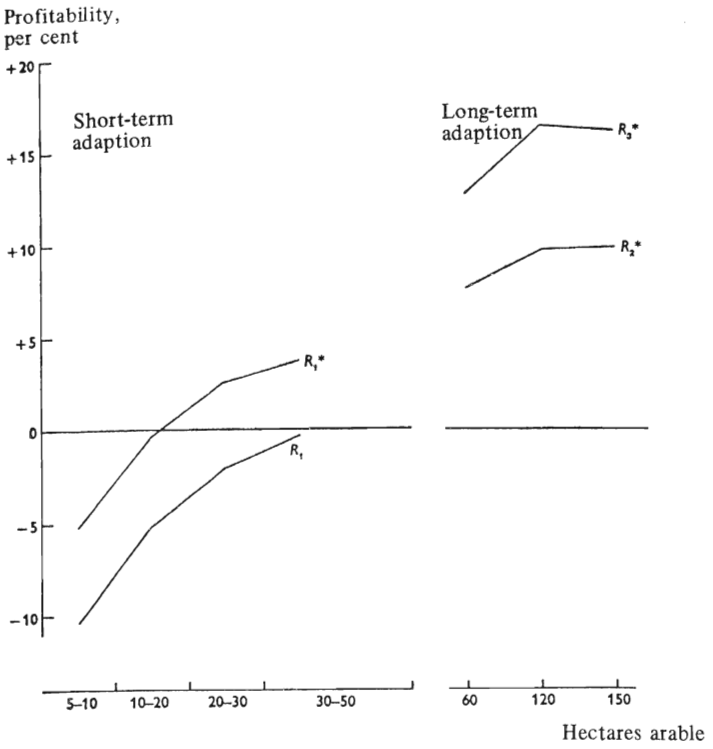
Profitability thus estimated is denoted by curves R_{3a} and R_{3b} in Diagram 6, based on JEU data and taxation returns. Profitability measures of this kind are of interest in both socio-economic studies of profitability and profitability studies regarding established farmers (as opposed to persons about to establish farms). According to this measure, profitability definitely rises with acreage *throughout* the acreage scale investigated. The difference between curves R_3 and R_2 in the diagram, known as the differential return, reflects in principle the higher price of land used for agriculture instead of forestry. The difference in land price can be regarded as the capital value of this differential return.

If the demand for agricultural land should fall, curves R_1 and R_2 would rise in the intervals where they are above zero on the profitability axis (and conversely in the sectors below zero). Thus profit curves R_1 and R_2 become progressively steeper. The maximum shift of the R_2 curves occurs when they coincide with the R_3 curves (a greater shift is hardly likely, since this would mean that agricultural land prices fell below forestry land prices). Agricultural land would then tend to be transferred to forestry. The R_3 curves can be said to denote the socio-economic profitability of agriculture with its present structure and at present price support and with forestry as the alternative, agricultural profitability being measured in terms of the profit that would obtain in agriculture if land prices were to fall to the same level as forest land prices. The fact that the R_2 curves incline less steeply than the R_3 curves shows that high land prices (other things being equal) are unfavourable to acreage-intensive methods of production compared to methods requiring less acreage.

So far our comparisons of profitability have been concerned with existing farms in Sweden. Since we know that most of these farms are anything but efficiently organized, it is interesting to estimate the profitability of optimally organized farms. An analysis of this kind is particularly important in assessing the prospects for agriculture and future agricultural policy. Material for such an analysis is obtainable from L. Hjelm's studies of optimally organized farms. Hjelm estimated profitability in the most efficient line of production using existing acreage, buildings and capital resources (short-term optimization) and for optimally adapted farms (long-term optimization). Profit according to the R_1 measure described earlier is denoted for short-run optimization by curve R_1^* in Diagram 7. This curve is of course higher than the R_1 curve for existing farms, which are inserted in Diagram 7 for purposes of comparison.

We have also estimated the profitability of optimally adapted units both at current agricultural land values and at wood-land price. These profitability values, for long-term optimization, are denoted by curves R_2^* and R_3^* in Diagram 7. The difference between curves R_1^* and R_2^* illustrates the profits deriving from increased acreage. The difference between curves R_2^* and R_3^* illustrates the part played by land prices in determining the profitability of the farms studied by Hjelm. As can be seen from the diagram, not only does the profit-

Diagram 7. *Profitability and farm size, optimally organized farms on the plains of Svealand, 1966*



R_1 = Profitability/market value of enterprise as currently organized
R_1^* = Profitability/market value of enterprise with short-term optimization
R_2^* = Profitability/cost of producing enterprise at current prices with long-term optimization
R_3^* = Profitability/cost of producing enterprise when the land is valued at prices for forest land at current prices with long-term optimization.

Source: Appendix D, Tables 4 and 5.

ability level rise with falling land prices, but the difference in profitability between farms of small and large sizes also becomes more pronounced.[11]

ALTERNATIVE PROFITABILITY CONCEPTS IN AGRICULTURE

As noted in the introduction to this chapter, it is often alleged in discussions of agricultural policy that capital yield in agriculture is lower than in other sectors. However, as we have shown, this cannot be taken automatically to imply that agriculture is an unattractive investment. If anything the causal connection

[11] Another and, in terms of principle, better way of calculating the effect of land prices on optimal farms would be to revise Hjelm's optimization analysis using lower land prices, e.g. wood-land prices. This would probably cause an upward shift in the profitability curve for optimal size farms.

is the reverse; because agriculture for various reasons is such an attractive investment for a large group of people, land prices are so high that net yield is low. This is a widespread phenomenon wherever capital gains are derived from property or non-pecuniary advantages are involved.

A similar example is provided by the stock market, where during the 1950's and the early 1960's the »net yield» was generally as low as 2 to 5 per cent owing to high and rising stock share prices. But the total annual yield of shares, including capital gains, was nonetheless considerable (in the region of 12–20 per cent), since capital gains on shares seem to have averaged about 10–15 per cent.[12] As we saw earlier, agricultural land values have risen less, about 5 per cent, Due to successive appreciation, owners of agricultural land, in common with other holders of property that yields capital profits, have been willing to content themselves with a lower yield on their own capital than that received by owners of property without capital profit, such as bank deposits.

Capitalization is thus relevant not only to studies of the comparative profitability of farming enterprises but also as an explanation of the profitability of agriculture in general. The capitalization of price support in land prices makes land as a factor of production more expensive in relation to other inputs than would otherwise be the case. Thus capitalization impedes acreage-intensive methods of production, making the difference in measured profitability (using conventional criteria) between large and small farms less pronounced than would otherwise be the case.

[12] »Net yield» is taken to mean share dividends divided by market value. »Total annual yield» is taken to mean the sum of dividends, capital profit and the value of subscription rights divided by market value. For yield figures cf. Indexlån del II (Index-loans), *Statens Offentliga Utredningar* 1964:2, pp. 96–107.

CHAPTER FIVE

INCOME, WEALTH AND LIVING STANDARDS IN AGRICULTURE

Agricultural policy in post-war Sweden has aimed above all at equalizing the earnings of the agricultural population and those of the rest of society. This objective has been defined as equality of *labour income* as between a particular category of farmers and the industrial employees in the lowest cost-of-living regions. This equality is commonly supposed to have been attained during the early 1950's and then lost. According to official estimates, an income gap appeared between the two groups in the mid-1950's, in spite of increasing price support. Since then the gap has gradually widened, so that during the 1960's it has been put at Sw.kr. 8 000 in annual income.[1]

Is this income gap a »reasonable» expression of the difference in incomes and living standards between the two groups concerned? In order to answer this question we must first examine the living conditions and earnings of different groups of farmers in relation to industrial workers. In this connection we shall analyze incomes, not only in terms of earnings, as has been customary hitherto in discussions of agricultural policy, but also in terms of expenditures.

ALTERNATIVE FARM INCOME CONCEPTS

Income can be defined in many ways. The choice of definition will invariably depend on the purpose of the income analysis. In this chapter we are primarily concerned with income as a basis of living standards, though income will also be analyzed in terms of profitability.

The simplest means of explaining different income concepts is by exemplification. To this end we have selected an estimate of the average income of basic farmers in the central and southern Swedish plainlands and managing farms with 10–20 arable hectares, i.e. a category used in official comparisons of income until 1959. (During the 1960's official agricultural incomes policy has focused on larger units, an average of basic and »norm» farms.) Our main reason for choosing basic farms is that they still constitute an average farm size in Sweden.

Table 16 is designed to illustrate certain relevant income concepts. The material is taken from statistics on book accounts (Jordbruksekonomiska undersökningen, abbreviated to JEU) for 1966. The cost of supplies, depreciation and maintenance is deducted from the total receipts (row 1) derived from agri-

[1] *Jordbruksekonomiska meddelanden* (The Journal of Agricultural Economics), 1967:4.

Table 16. *Alternative income concepts, staple farmers (10–20 hectares arable), 1966*

		Sw.kr.	
	Receipts from farming	53 400	
	Receipts from forestry	1 900	
	Other receipts	5 000	
(1)	Total receipts		60 300
	Less: Agricultural raw materials	12 700	
	Other supplies and general overheads	7 500	
	Depreciation and maintenance	13 000	
(2)	Leaving: Return on labour and capital		27 100
	Less: Wages for hired labour	1 300	
	Net interest charges on loans, leases etc.	2 000	
(3)	Leaving: Total income of »large family»[a]		23 800
	Less: Wage requirement of adult relatives (excl. wife and children)	2 300	
(4)	Leaving: Total income of »primary family»[a]		21 500
	Less: Wage requirement for wife and children	5 300	
(5)	Leaving: Total income of farmer		16 200
Alternative 1.	*Calculation of labour income*		
	Less: Capital income requirement, own capital of Sw.kr. 166 200 at 6.6 per cent interest[b]	11 000	
(6)	Balance: Labour income of farmer		5 200
(7)	Labour income gap (industrial worker's income of Sw.kr. 20 600 minus the farmer's labour income of Sw.kr. 5 200)		15 400
Alternative 2.	*Calculation of capital income*		
	Less: Income requirement for farmer in accordance with industrial worker's income	20 600	
(8)	Balance: Capital income (farmer's total income minus industrial worker's income)		–4 400
(9)	Capital income gap (Sw.kr. 11 000 + 4 400)		15 400
(10)	Percentage yield (Sw.kr. –4 400 on own capital of Sw.kr. 166 200)		–2.6 %

[a] See text for definitions of »large family» and »primary family».

[b] Interest factor derived by dividing capital income requirement by net wealth at the start of the year, both according to JEU.

Sources and notes: The figures refer to farms with 10–20 hectares arable in the plains of southern and central Sweden in 1966. The methods of calculation are presented in Appendix E together with figures for other years. Children's allowances and pensions are not included. The family's labour input of 3 488 hours breaks down into 272 580 and 2 636 hours for adult relatives, wife and children, and the farmer respectively. Wage requirement calculated from agricultural workers' wage rate: Sw.kr. 8.46 per hour.

culture, forestry and other activities, giving the return on factor input, i.e. labour and capital input (2). This return constitutes in principle the contribution made by agriculture to the national product. The result of the calculation is very much dependent on conventions regarding valuation, since receipts include payments in kind and costs include standard deductions for depreciation.[2]

If from this total labour and capital return (2) we subtract wages and expenditures for hired labour, net interest charges on borrowed capital and leases, we are left with what is known as the total income of the »large family» (3). The large family includes not only husband, wife and children – known as the »primary family» – but often adult relatives as well.

There are many ways of dividing the income of the large family into labour income and capital income and of dividing labour income between the various members of the family. In official comparisons of income the convention is for the labour input of members of the family and other relatives (but excluding the farmer) to be deducted at agricultural workers' wage rates. In this way we obtain the total income of the »primary family» (4) and the total income of the farmer.

The farmer's total income is then divided into labour and capital income by subtracting a capital income requirement from total income. This requirement consists in principle of an interest charge on the farmer's own capital according to the rate of interest on borrowed funds (alternative 1 in Table 16). The balance comprises the farmer's labour income (6) and it is this sum which generally provides the basis for income comparisons in the context of agricultural agreements. The difference between the industrial worker's labour income and the farmer's thus calculated has been referred to as the »labour income gap» (7).[3]

Thus the official convention has been to calculate the farmer's labour income in the form of a residual after deducting a certain capital income requirement from total income. An alternative method of dividing the farmer's total income into labour and capital income is to deduct his required labour income according to the objectives of agricultural policy, i.e. the income of the industrial worker

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[2] Payments in kind and depreciation have been calculated here on the same lines as in JEU. This means that the food item in payments in kind are valued at producer prices in the case of vegetable products but at consumer prices in the case of animal products. (The reason for this convention is that vegetable products are generally used as raw materials while anima products are used more as final consumer products.) Housing has been valued according to uniform national norm, due regard being paid to individual standards. Depreciation is calculated in terms of individual replacement value and a standard durability or age structure.

[3] It should be noted that, in the official comparisons of income, one-third of farmers' capital income (incorrectly termed inflation profit) is added to labour income, while industrial workers' incomes are augmented by certain invisible payments in kind e.g. supplementary pension contributions paid by industry). Moreover, interest charges are mostly based on assessed capital, whereas we have gone by the market value of paid-up capital, thus reducing the income gap by several hundred Sw.kr.

(alternative 2 in Table 16). In this way capital income is obtained as a (negative) residual of about Sw.kr. –4 400 (8). Just as the previous alternative indicates a labour income gap of Sw.kr. 15 400, this alternative indicates a capital income gap of the same size.[4] The capital income gap, then, comprises the difference between required and actual capital income. Obviously these two gaps will be of the same order of magnitude, since they both indicate the additional income needed by the farmer in order to receive the same return on his capital and labour input as would be obtained in »other sectors». Given an estimated capital of Sw.kr. 166 200 on basic farms, the yield on this capital is –2.6 per cent (10).

Thus an alternative expression of the official goal of equality is that the profit rate in agriculture should be raised from –2.6 to +6.6 per cent in order to attain what current conventions regard as a level of profitability resembling that of industry.

As already observed, the estimates quoted here concerning the income gap between agriculture and industry are based on the convention of rating the labour input of the family (excluding the farmer) at agricultural wage rates. One could of course apply other conventions. Thus one may well ask why income parity should be confined to the farmer receiving the same earnings as an industrial worker. If this objective were enlarged to include other family members employed in agriculture, the income gap would of course be greater than the official estimates suggest.

On the other hand one may also ask why the *farmer's* labour income should be computed as a residual item after incomes of the rest of the family have been established on the basis of a fixed rate (agricultural wages). An alternative procedure would be to allocate the labour income of the entire family between its various members in proportion to their known labour input. This would reduce the family's share of the total labour income and increase the farmer's, so that the labour income gap between farmers and industrial workers would be smaller than the official estimates indicate, since agricultural wages are in fact higher than average labour income in farming families (according to the example about Sw.kr. 8:50 as against some 3:70 per hour).

Another way of illustrating relative incomes would be to compare actual labour and capital return in agriculture with that required in order for labour *and* capital in agriculture to yield the same return as in industry. An estimate of this kind can be made by valuing labour input in agriculture on the basis of industrial wages and capital input in terms of the »normal» capital return in industry. Assume that this yield is 8 per cent. The estimate would then indicate that actual labour and capital return on basic farms is approximately half that required to

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[4] The income gap for the year used here, 1966, is unusually large. According to the principles applied by JEU, the average for the previous five-year period, 1961–65, was Sw.kr. 8 500.

give the same return as in industry.[5] This gap in factor return illustrates the productivity gap between agriculture and industry, since basic farms are more or less representative of average farm size in Sweden. The corresponding profitability ratio in international prices is about 1:5.[6]

Whereas the comparisons in Chapter 1 were based on labour productivity, the estimate shown here reflects the productivity of labour and capital. It will be recalled that the estimate in Chapter 1 indicated that agricultural productivity was about half that of industry in domestic prices and less than 1/4th in international prices; thus the results of the two calculations are very similar. There is, however, one principal difference between this estimate and that in Chapter 1. If we assume that factor prices in both sectors are determined by the value of marginal productivity, the estimate in this chapter can be interpreted as a comparison of industrial and agricultural marginal productivity, while the estimate in Chapter 1 refers to average productivity. However, bearing in mind the difficulties involved in estimates of this kind, one should not overemphasize the similarities between the two sets of figures. The result might possibly be taken to imply that the mean productivity ratio in Chapter 1 is an acceptable approximation of the relative marginal productivities of the two sectors.

The estimates presented here, like the official estimates of agricultural incomes, do not include the profits or losses made by the proprietor in connection with changes in the prices of farm assets or in prices generally. Price movements of this kind may entail capital gains or losses by the proprietor. Real capital gains occur when the value of farm assets rises faster than prices in general, or when the real value of liabilities falls owing to inflation. When capital gains of this kind are included in the income concept we can speak of »total income including capital gains». This concept can be defined as the income that can be taken out of the enterprise without affecting the real wealth of the proprietor. But capital gains, unlike labour and capital income, are not received in cash, unless the property is sold or used for an additional mortgage loan.

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[5] Our estimate has been made as follows. Actual factor return – row (2) in Table 16 – is divided by a hypothetical factor return at industrial wage rates and capital yield. The number of reported hours of work in agriculture (3 640 hours at 10:40 per hour) is taken as the volume of labour. Capital costs are assessed in terms of the sum of interest charges on loans and an imputed return on capital in industry (8 per cent). The estimate is unreliable as regards both the number of working hours and the amount of capital. The main problem as regards working hours is that the estimated number may be too large. (Cf. the discussion in Chapter 1, p. 29.) The main problem in estimating capital input is deciding at what prices to value capital. Our estimates are based on the reproduction cost of assets, land being valued according to its opportunity cost – i.e. capital input is evaluated in welfare-economic terms. (In this particular case much the same result would have been obtained by valuing all assets at current market prices instead.)

[6] The estimate is based on the simplified assumption that support to agriculture is reduced to the same level as support to industry; this corresponds to a fall of about 35 per cent and 15 per cent in the prices of agricultural commodities and agricultural raw materials respectively.

We have made an estimate of this capital gain, based on the assumption that capital gain is predominantly due to price rises in agricultural real estate, apart from the falls in the real value of liabilities (at given nominal interest rates). Capital gain in 1966 as estimated by this method was approximately Sw.kr. 2 500. Since capital gains may vary considerably from one year to another, the best procedure is to quote it as an average for a longer period. Our estimates according to this method indicated an average capital gain of about Sw.kr. 2 800 per annum by basic farmers during the period 1954–66, rising, however, to about 5 000 per annum towards the end of the period.[7] About half this gain was due to the declining real value of liabilities.

THE GROWTH OF FARM INCOME

One problem when comparing incomes in agriculture with those of other sectors is that harvests, price fluctuations and other circumstances cause profits in agriculture to vary considerably from one year to another. Consequently income comparisons for individual years with other groups, e.g. wage earners, whose income generally rises fairly evenly, can be misleading. Instead we shall therefore compare income growth during a period of years, using trend estimates in addition.[8] A comparison of deviations from the trend during individual years will indicate the effect of special circumstances on incomes.

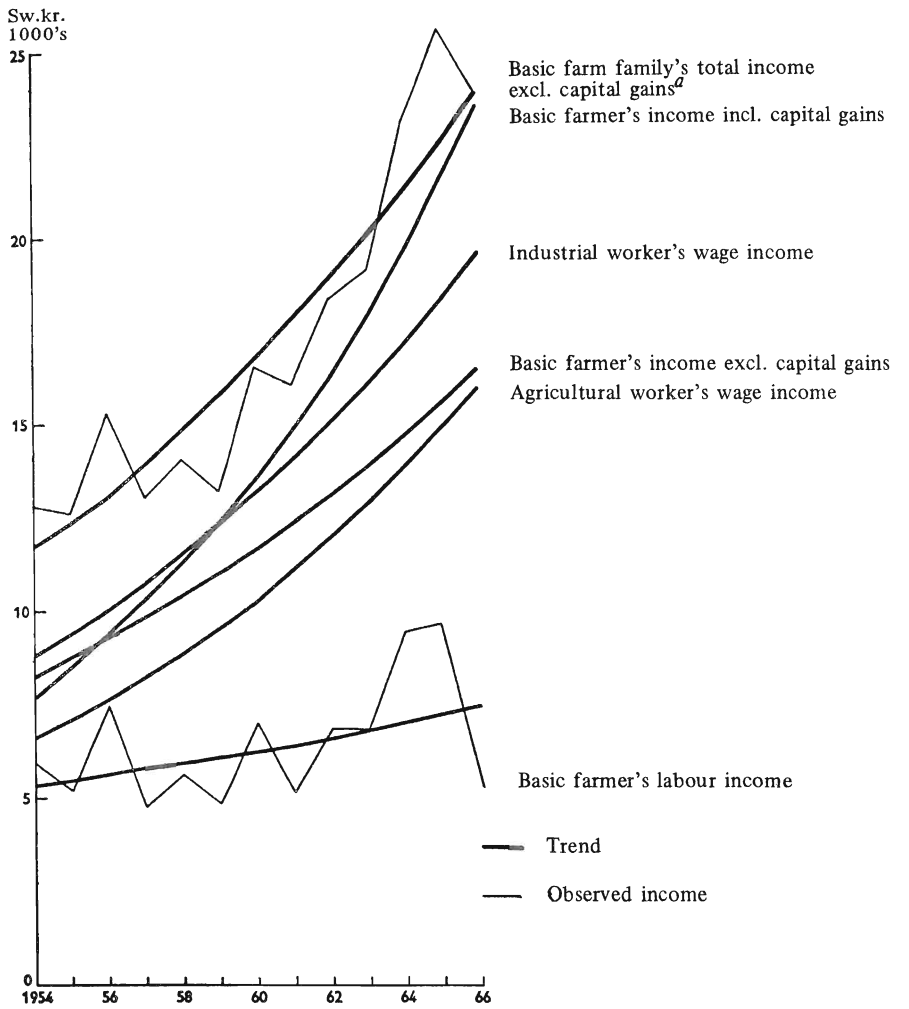
Income growth in basic farms is illustrated in Diagram 8 and Table 17. For purposes of comparison, Diagram 8 also includes agricultural wages and industrial wages in the lower cost-of-living regions. The trend indicates a rise in the farmer's labour income from about Sw.kr. 5 000 to 7 000 during the period 1954–66. His total income, excluding capital gains, rose during the same period from about Sw.kr. 8 000 to about Sw.kr. 16 000, so that by the end of the period it was approximately Sw.kr. 9 000 higher than his labour income.

As will be seen from Diagram 8, the farmer's total income excluding capital gain was only slightly less than the industrial worker's wages at the beginning of the period. Since the trend was for industrial workers' annual wage to rise faster than farmers' total income – 6.8 as against 5.8 per cent per annum – the gap had increased to about Sw.kr. 3 000 by the end of the period. This increase is due to the fact that family labour return, estimated at agricultural wage

[7] See Appendix E, Table 1.

[8] Of course, trend calculations are not immune from criticism. Thus extreme observations at the beginning or end of a period can greatly influence the inclination of a regression curve. Another way of evening out annual variations in the material is to »normalize» agricultural profits, i.e. convert them into »normal year» figures. A technique of this kind is used in the so-called »typical farm» estimates used to compare incomes in connection with negotiations on farm prices. But normalization is a hazardous method, partly because a farmer will try to mitigate the effect on his income of, say, harvest fluctuations, by altering his factor input.

Diagram 8. *Growth of farm income, 1954–66*



[a] Includes husband, wife and children under 16 as well as other relatives.

Sources: Räkenskapsresultat från svenska lantbruk (Accounting results from Swedish farms), *Lantbruksstyrelsens meddelanden* ser. B (Reports from the National Board of Agriculture) (i.e. JEU). Industrial and agricultural wages according to *Sveriges Officiella Statistik*, Löner (Wages). The data on farmers refer to the plains of southern and central Sweden. Trends and capital gains calculated by the authors.

rates, rose faster than total income (excluding capital gain) of the entire family – by 7.6 per cent per annum as against 6.1 for the large family and 6.8 per cent for the primary family. This means that the proportion of the primary family's income attributed to the farmer in the statistics fell, while the proportion attributed to the rest of the family rose accordingly.

Table 17. *Income trends for basic farmers and their families (10–20 hectares arable) compared with wage trends for industrial workers and farm workers, 1954–66*

	Income in 1966 (trend)	Annual rise, trend for 1954–66	
		Nominal	Real
	Sw.kr.	Per cent	
»Large family's» total income			
excl. capital gains	23 900	6.1	2.5
incl. capital gains[a] method 1	31 100	8.9	5.1
method 2	30 500	8.5	4.7
»Primary family's» total income			
excl. capital gains	21 700	6.8	3.2
incl. capital gains[a] method 1	29 100	9.9	6.1
method 2	28 400	9.4	5.6
Farmer's total income			
excl. capital gains	16 400	5.8	2.2
incl. capital gains[a] method 1	23 500	9.6	5.9
method 2	22 900	9.0	5.2
Farmer's labour income	7 300	2.7	−0.8
Annual wage for			
industrial worker in lowest cost-of-living regions	19 600	6.8	3.2
farm worker	15 900	7.6	3.9

[a] In method 1, capital gains are calculated as the sum of the annual increment to the real value of the farmer's property and the annual reduction in the real value of his liabilities, at a given nominal rate of interest (see p. 80). In method 2, capital gains are calculated instead as the difference between the change in real wealth and the change in wealth resulting solely from changes in the volume of assets and liabilities (see p. 84).

Source: Appendix E.

We found that the total income, excluding capital gain, of the basic farmer was Sw.kr. 3 000 below the industrial worker's annual wage by the end of the period. Including capital gain, however, the farmer's income is Sw.kr. 3 000 or 4 000 higher than the industrial worker's. The farmer's total income including capital gain has risen considerably faster each year than the industrial worker's wages.

The inclusion of capital income and capital gain in the farmer's income introduces, however, a certain element of uncertainty into comparisons with the income of the industrial worker. One should really take into account the industrial worker's capital income and capital gain as well. But the necessary statistics are lacking. This shortcoming is negligible in the case of capital income, due to the limited wealth of industrial workers.[9] Since the comparison group

[9] According to *Meddelanden från Konjunkturinstitutet* (Reports from the National Institute of Economic Research) B 25, the average wealth of industrial workers in 1955, was approximately Sw.kr. 10 000, while that of farmers was Sw.kr. 66 000. No data are available for subsequent periods. See also Appendix E. – Apart from the errors referred to previously, income additional to that from regular employment has not been included as regards industrial workers, further, their payments in kinds are not fully reported.

consists of rural industrial workers, the principal source of capital gain is presumably an increase in the value of owner-occupied homes. The actual size of this capital gain is not known.

In view of the difficulty of making a reliable distinction between the farmer's income and the total income of the family, one might well feel moved to compare the total family incomes of farmers and industrial workers. But income data regarding families of industrial workers are only available for certain years. According to one analysis of the 1960 census figures, the total income of the industrial worker's family that year was Sw.kr. 15 060.[10] Since the industrial worker's family is generally a primary family, the comparison should be applied to this category. The primary family's income in basic farms the same year, according to the trend curve, was Sw.kr. 14 600 excluding capital gain and Sw.kr. 16 500 including capital gain. Thus, according to these data, the incomes of primary families in agriculture and industry were practically at the same level, Sw.kr. 15 000, at the beginning of the 1960's. The income data quoted in Konjunkturinstitutets (the National Institute of Economic Research's) survey of saving in the late 1950's also indicate that the incomes of farmers' and industrial workers' families were more or less equal.[11]

CONSUMPTION AND SAVING IN AGRICULTURE

So far we have calculated farmers' incomes on the basis of receipts, as is also the practice in the estimates made in connection with agricultural agreements. But living standards and incomes of farmers can be further illustrated by studying *how they use their income.* An estimate of this kind for the same farmer category and year as in Table 16 is given in Table 18. Whereas income in terms of receipts is defined as the sum of labour income and capital income, it is defined in terms of income use as the sum of consumption, saving and taxes.

Table 18. *Use of income on basic farms (10–20 hectares arable), 1966*

	Sw.kr.	
»Large family's» use of income		
Cash expenditure	11 400	
Housing, benefits in kind	4 100	
Other payments in kind	3 600	
Total consumption		19 100
Saving		1 700
Taxes		6 000
Total income incl. capital gains		26 800

Source: Appendix E.

[10] Den framtida jordbrukspolitiken (The Agricultural Policy of the Future), *Statens Offentliga Utredningar* 1966:30, p. 296.

[11] Cf. Appendix E, Table 7.

The estimate is confined to the large family, since consumption and saving cannot be unequivocally distributed between the individual members of the family. Of course the result of this calculation is also dependent on conventions, e.g. regarding the valuation of payments in kind.

Consumption is calculated as the sum of cash expenditure on consumption together with payments in kind. Saving is defined as the increase of real wealth between the beginning and end of a period.[12] Income calculated in terms of use and with regard to changes in real wealth, is thus made to include capital gains. Income calculated in this way corresponds to the maximum consumption possible after tax has been paid without reducing real wealth. As can be seen from the table, this income was in the region of Sw.kr. 26 800 in 1966.

Income calculated in terms of use is thus greater than that calculated on the basis of receipts – Sw.kr. 23 800 for the large family (income concept (3), Table 16) – shown earlier. Allowance must be made, however, for the fact that income calculated in terms of use includes certain items that are excluded from income calculated on the basis of receipts. During the year in question the value of these items amounted to approximately Sw.kr. 1 000, most of it family allowances. The difference between the sum of Sw.kr. 26 800 calculated on the basis of income use and Sw.kr. 24 800 calculated on the basis of receipts (after adding the Sw.kr. 1 000 mentioned previously) is Sw.kr. 2 000, which in principle is an expression of the capital gain that year. As stated in our account of a rough estimate of the size of capital gain (p. 80), this »profit» was about Sw.kr. 2 500 during the year in question. Adding this sum to the income based on receipts gives a figure of Sw.kr. 27 300. Thus there is a discrepancy of Sw.kr. 500 between the two calculations, most of which, however, is due to the failure of the rough estimate of capital gains to take into account price movements for other assets than agricultural real estate. The difference between these two methods of calculating total income including capital gains is less on the average over longer periods, e.g. approximately Sw.kr. 200 for 1954–66.

Further information on consumption and saving among farmers is provided in the 1958 consumption survey by the National Social Welfare Board and the savings surveys of 1955, 1957 and 1958 by the National Institute of Economic Research. This material also provides information concerning the consumption and savings of other groups. Table 19 contains information on consumption and taxation taken from JEU and the National Social Welfare Board's consumption survey

[12] Changes in real wealth have been obtained by subtracting wealth at the beginning of the year from wealth at the end of the year, the latter being deflated by the price rise during the year according to the consumer price index. For technical reasons it has not been possible to allow for rises in livestock prices, with the result that savings have been underestimated somewhat.

Table 19. *Levels of consumption for farmers and other income earners, 1958*

	JEU	Consumption study by National Social Welfare Board				
	Basic farms[a]	Basic farmers[a]	Other entre-preneurs	White-collar employees	Workers	Rural workers[b]
Food, benefits in kind	2 125	1 985	..	..	..	..
Housing, lighting, fuel[c]	2 203	2 236	2 168	2 202	1 815	1 944
Other consumption	7 589	8 043[d]	..	..	..	..
Total consumption	11 917	12 264[d]	13 011	14 317	12 046	11 036
Taxes	2 559	2 866	2 322	3 937	3 006	2 544
Consumption per						
person		3 504	4 066	5 507	4 015	3 449
consumption unit		3 833	4 647	6 818	4 818	4 087

[a] Basic farmers on plains of southern and central Sweden.

[b] Workers in all non-urban districts.

[c] Evaluated from the reported standard of housing.

[d] Owing to an underestimation of expenditure on vehicle purchases, these consumption figures are probably about Sw.kr. 360 too low.

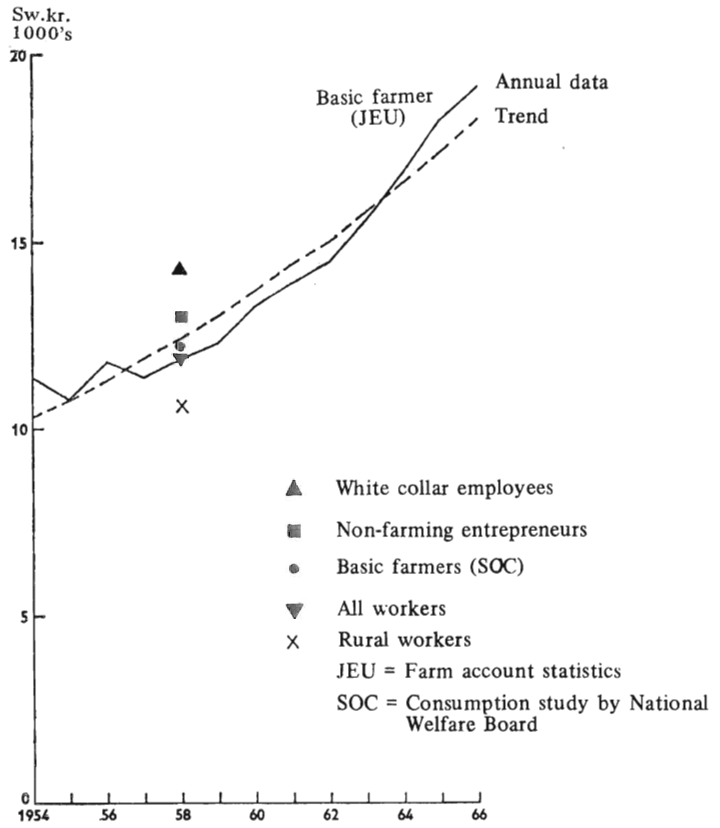
Sources: Data from JEU according to Appendix E. Other data from *Sveriges Officiella Statistik,* Hushållens konsumtion 1958 (The Consumption of Households in 1958).

(SOC).[13] In this table farmers are compared with certain categories in other sectors such as white-collar employees and workers. Rural workers correspond best to the comparison group employed previously, industrial workers in low cost-of-living regions. According to the National Social Welfare Board's 1958 survey, these workers' consumption was somewhat lower than that of basic farmers both individually and for the family as a whole.[14] It should also be noted that 1958 was a relatively poor year for farmers' incomes, and this may have inhibited their consumption. Relative consumption data are shown in diagram 9, which also gives the growth of basic farmers' consumption between 1954 and 1966 (according to JEU). This diagram shows that farming households' consumption in 1958 was somewhat lower than the trend level.

[13] Since the JEU data in principle refer to nationally managed farms, one would expect higher incomes and perhaps higher consumption standards than the average with which SOC is concerned. But the consumption data are much the same in both cases. Total consumption according to the National Welfare Board's estimate is somewhat higher – the opposite of what one might have expected. This is probably because SOC gives a more comprehensive account of all the members of the family, while JEU concentrates on family members occupied in agriculture.

[14] If on the other hand one calculates consumption per unit, i.e. makes allowance for the lower consumption requirements of children as opposed to adults, the consumption of workers' families is somewhat higher. Since the measure of unit consumption was primarily designed with regard to the smaller calory requirements involved in children's food consumption, it is uncertain which measure is the more adequate in assessing the living standards of the two groups.

Diagram 9. *Consumption of farmers and other income earners, 1954–66*



Sources: Trend and annual data for basic farmers according to Appendix E. Other data according to Table 19.

Thus, provided the margins of error in the material are not too large, one might conclude that the aggregate household standard of consumption at the end of the 1950's was approximately Sw.kr. 1 000 higher among basic farmers than among rural workers, while consumption per person was roughly equal.

Saving studies by the National Institute of Economic Research suggest that farmers' savings during the later 1950's were between Sw.kr. 1 000 and 2 000 higher than industrial workers'.[15]

The National Social Welfare Board's survey also permits a comparison of taxes. As can be seen from Table 19, basic farmers and rural industrial workers were taxed more or less equally.[16]

[15] See Appendix E, Table 7.

[16] The use of taxation statistics to compare incomes and taxes is problematic among other things because of special methods applied for valuing payments in kind. Thus, whereas basic farmers' payments in kind in 1966 were valued at Sw.kr. 7 700 in JEU (Table 18), the corresponding tax assessment figure for the same year was only Sw.kr. 3 200. At a marginal tax rate of 40 per cent, this difference corresponds to almost Sw.kr. 2 000 less in tax. This means that the basic farmer's income can be almost Sw.kr. 2 000 less than the industrial worker's without entailing a lower living standard, at least compared to industrial workers living in a rented apartment.

Summing up the results of these comparisons, whether one considers farmers or the primary family as a whole, basic farmers appear to have enjoyed practically the same standard of consumption as industrial workers in recent years, while their savings have been larger. The material presented here suggests that farmers' total income tends to be two or three thousand Sw.kr. less than industrial workers' if capital gains are excluded, and two or three thousand more than industrial workers' if one includes capital gains.[17]

On the other hand, as we have already remarked, the estimated labour income of basic farmers is appreciably lower than industrial workers' annual wages. The gap has steadily widened during the sixties. As we have seen, it is not matched by any significant difference in total income and consumption standard. The reason why farmers' labour income is so much smaller than their total income and, consequently, than industrial workers' income, is that the basic farming household disposes several factors of production simultaneously – the farmer's labour, that of the rest of the family, and capital.

The farmer's labour income has steadily diminished in proportion to the total income of the family, while capital income has risen in proportion. This has been due to a steep rise in the value of the capital invested in agriculture, partly because price increases for agricultural products have been capitalized in real estate values. This has considerably increased the farmer's wealth, since liabilities have not risen at the same rate.

In order to obtain a complete picture of farmers' economic situation, one should therefore make allowance for wealth differences. Average assessed wealth in agriculture in 1966 was just under Sw.kr. 100 000. This figure increases if agricultural real estate is valued at its market price instead of the taxable value. With the aid of so-called overprice percentages on real estate taxable values, the market value of farmers' wealth can be put at more than Sw.kr. 150 000. The JEU study, which is more comprehensive than taxation figures in its valuation of personal property on farms, quotes an additional Sw.kr. 10 000 of wealth for basic farmers.

The amount of wealth in excess of Sw.kr. 100 000 in agriculture and other sectors can be studied with the aid of tax returns. These show that 1/3rd of all active persons in 1966 whose taxable wealth exceeded Sw.kr. 100 000 were farmers. The number of farmers assessed at more than Sw.kr. 100 000 was just under 60 000, i.e. about 30 per cent of the total number of farmers in Sweden (and almost half the full-time farmers).

The incidence of wealth in agriculture compared to other sectors is also illustrated by the savings studies of the National Institute of Economic Research, according to which mean wealth in agriculture at the end of the 1950's was roughly equal to that of other entrepreneurial groups, i.e. approximately Sw.kr.

[17] The error resulting from the impossibility of including industrial workers' capital income and capital gains is probably not sufficient to vitiate these conclusions.

70 000, while for wage earners it was in the region of 15 000.[18]

Summing up we can say that, while the total incomes of farmers with average-sized farms are probably about equal to those of industrial workers', their wealth is far greater, more or less on a level with that of other entrepreneurs.

THE DISTRIBUTION OF INCOME AND WEALTH IN AGRICULTURE

Our analysis so far has been confined to the incomes of basic farmers. This has been partly due to the nature of the income objective of agricultural policy, which as we saw earlier, has been attached to basic farms throughout the post-war period although the frame of reference has grown somewhat more flexible in recent years. But the main reason for analyzing the incomes of basic farms in particular is that they are fairly close to the mean incomes in agriculture as a whole.

One objection to this approach is of course that mean income is a highly inadequate characteristic of income conditions in a sector with wide income disparities, and as we shall see shortly, there is a considerable dispersion within as well as between different sizes of farm. In this section we shall therefore endeavour to delineate income conditions among different categories of farmers, taking wealth into account.

The relation of income and wealth to acreage is shown in Table 20, which is based on tax returns. This table shows that both income and wealth rise steeply

Table 20. *Average taxable income and wealth of farmers in different acreage classes, according to tax returns, 1966*

	Size in hectares							
	2–5	5–10	10–20	20–30	30–50	50–100	over 100	Total
	Sw.kr. 1000's							
Income	14.0	13.9	17.1	20.1	23.6	32.2	53.5	16.4
Wealth	52.0	70.0	99.0	121.9	152.9	263.1	664.5	89.6
	1000's							
No. of farm units	47.3	55.0	43.8	18.4	13.2	6.3	2.3	186.3

Sources: Income refers to »combined income» on tax return, wealth to net wealth according to taxation statistics, *Statistiska meddelanden* (Statistical Reports) J 1968:10. No. of farm units according to J 1968:25.

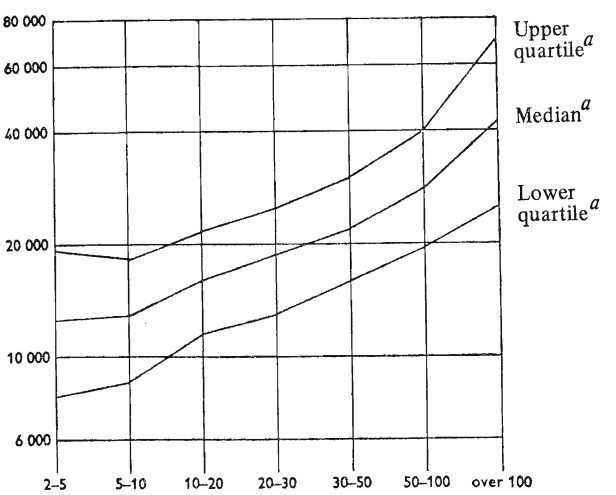
[18] For wealth see Appendix E, Tables 7–9, which include material from tax returns as well as savings studies.

in proportion to acreage.[19] Thus income for the highest acreage class is four times that of the lowest, while wealth is fourteen times as great.

Over half the farmers in the country come in acreage classes below the basic farm size. The table shows that average income for these groups is about Sw.kr. 3 000 less than for basic farmers.

The distribution of income within the various acreage groups is illustrated in Diagram 10. Income distribution *between* acreage groups is indicated in this diagram by their mean incomes (the middle curve in the diagram). The upper and lower quartile incomes, i.e. the income exceeded by the quartile with the highest incomes and the income level above the quartile with the lowest incomes, have been used as a measure of income distribution within the acreage groups.

Diagram 10. *Range of taxable income in agriculture, 1966. Logarithmic scale.*



[a] Median = the income below which half the farmers lie. Lower (upper) quartile = the income below (above) which the quarter of the farmers with the lowest (highest) incomes lie.

Source: Own processing of data on farmers' taxable incomes, expenditure, net receipts, assets and liabilities in 1966. *Statistiska meddelanden* (Statistical Reports), series J. The data on income refer to the combined income from all activities for husband and wife, income losses included.

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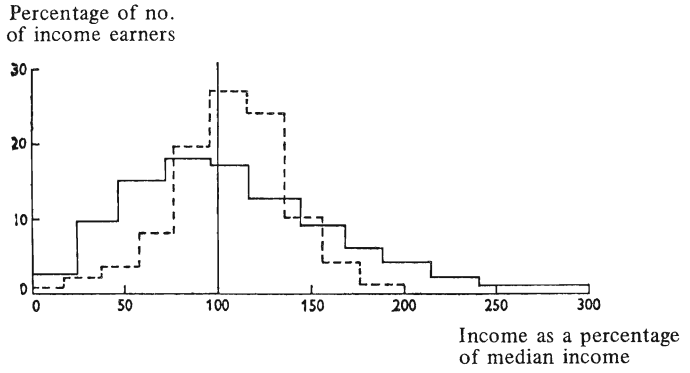
[19] The income concept in JEU that most closely resembles taxable income according to Table 20 is that previously referred to as the total income of the primary family excluding capital gains. According to the latest figures for 1966, this income was Sw.kr. 21 500 as opposed to a taxable income of Sw.kr. 16 900 for the same year. The difference of Sw.kr. 4 600 is mainly due to payments in kind having been valued higher in JEU than in tax assessments. Nor does JEU contain a representative sample of farmers. As we saw earlier, the JEU figures for wealth are also higher than the taxation figures.

As will be seen from the diagram, there is a wide dispersion in all acreage groups, the dispersion within the acreage groups being about as large as that between them. Thus the upper quartile income for basic farms is about twice that of the lower quartile. This difference is roughly the same as the difference in mean income between farmers with 10 and 50 hectares respectively.[20]

The dispersion of income in agriculture is also large compared to other social groups. To illustrate this a comparison has been made in Diagram 11 of income distribution among farmers and industrial workers. The diagram shows how heavily each group is concentrated around its mean income. The vertical axis denotes the percentage in each group whose income deviates from the median figure by a certain percentage.[21]

Diagram 11. *Comparative distribution of income among farmers and industrial workers in rural districts, 1960*



—— Entrepreneurs in agriculture and allied occupations, 30–66 years

– – – Workers in manufacturing industries, 25–66 years.

Note: Percentage distribution of income earners by income classes, the middle of each class being expressed as a percentage of the median income of farmers and industrial workers respectively.

Source: Sveriges Officiella Statistik, Folkräkningen (Population Census) 1960, raw-data Table I 3.

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[20] The wide dispersion of incomes in a single year might be attributed to temporary harvest fluctuations. To reduce this hazard we also studied farmers' average income during several consecutive years. These estimates covered basic and »norm» farm groups during the periods 1957–62 and 1960–62. The resultant dispersion was practically the same as that previously described for a single year (cf. Appendix E). One is bound to conclude that the wide dispersion of income is not principally determined by harvesting conditions.

[21] Owing to the varying scope of payments in kind, which are rated low, the absolute income *levels* are not directly comparable, which is why the income range is related to the median income of each income group.

Since the income range is wide even within each acreage class, classification in terms of acreage is hardly a suitable basis for an analysis of variations of income in agriculture. Therefore we have also investigated the distribution of income and wealth in agriculture irrespective of acreage. The results of this investigation are summarized in Table 21. Each group in the table denotes the number of farmers in a particular income and wealth category.

As can be seen from the table, the group representing the averaged taxable income and wealth of both basic farmers and farmers in general (Sw.kr. 15 000–20 000 income and Sw.kr. 80 000–100 000 assessed wealth) comprised 4 900 farmers in 1966. There were about 28 000 farmers with taxable incomes of less than Sw.kr. 10 000 and an assessed wealth of less than Sw.kr. 60 000. At the same time there were 26 000 farmers with taxable incomes exceeding Sw.kr. 20 000 and assessed wealth exceeding Sw.kr. 100 000.

LOW STANDARDS OF LIVING IN AGRICULTURE

If the problem of agricultural incomes is analyzed in terms of social policy, the interest is bound to focus on farmers with low incomes and little wealth. Thus one would concentrate primarily on the 28 000 farmers mentioned earlier whose income was less than Sw.kr. 10 000 and wealth less than Sw.kr. 60 000 in 1966.

Is there any distinctive feature by which this group of farmers can be characterized? Are they for instance concentrated to a certain acreage and age group? This question is answered in Table 22, where farmers with incomes of up to Sw.kr. 10 000 and wealth not exceeding Sw.kr. 60 000 are classified according

Table 21. *Distribution of income and wealth among farmers, 1966*

Income[a] Sw.kr.	Wealth, taxed value, Sw.kr. under 40 000	40 000–60 000	60 000–80 000	80 000–100 000	over 100 000	Total
	1 000's of persons					
under 5 000	7.0	2.4	1.5	1.0	1.1	13.0
5 000–10 000	11.8	7.2	4.6	3.1	3.8	30.5
10 000–15 000	12.5	8.9	6.2	4.6	8.4	40.6
15 000–20 000	8.7	5.8	4.9	4.9	9.3	33.6
over 20 000	9.6	6.1	5.5	5.6	26.3	53.1
Total	49.6	30.4	22.7	19.2	48.9	170.8

[a] Combined income from all activities for husband and wife, reduced by the deduction for losses.

Source: Appendix E.

Table 22. *Farmers with low income and wealth, classified by age and farm size, 1966*

Size of farm	Category of farmer[a]	Age, years: under 50		50–59		60–66		over 66		All age groups	
		1000's	%	1000's	%	1000's	%	1000's	%	1000's	%
2–10 hectares	»less well-off»	4.2	15.7	5.8	20.6	5.9	33.5	7.0	36.3	22.9	24.9
	Others	22.5	84.3	22.4	79.4	11.7	66.5	12.3	63.7	68.9	75.1
	Total	26.7	100.0	28.2	100.0	17.6	100.0	19.3	100.0	91.8	100.0
over 10 hectares	»less well-off»	2.9	7.5	1.2	5.1	0.8	7.3	0.5	8.8	5.4	6.8
	Others	35.7	92.5	22.4	94.9	10.2	92.7	5.2	91.2	73.5	93.2
	Total	38.6	100.0	23.6	100.0	11.0	100.0	5.7	100.0	78.9	100.0
All farms	»Less well-off»	7.1	10.9	7.1	13.7	6.7	23.5	7.6	30.3	28.5	16.7
	Others	58.2	89.1	44.8	86.3	21.8	76.5	17.5	69.7	142.3	83.3
	Total	65.3	100.0	51.9	100.0	28.5	100.0	25.1	100.0	170.8	100.0

[a] »Less well-off» = farmers with a taxable income of not more than Sw.kr. 10 000 and taxable wealth of not more than Sw.kr. 60 000. This definition is of course arbitrary and is simply used as an example.

Source: Appendix E.

to acreage and age and compared with other farmers. Relatively more farmers with low incomes and little wealth are shown to be over 60 years of age and to farm less than 10 hectares, though not more than every third farmer have these characteristics. Nor do even half the total number of all farmers with low incomes and little wealth (under Sw.kr. 10 000 and 60 000 respectively) belong to this group of farmers.

Since farmers over 66 receive income support in the form of pensions, it might be argued that their incomes are somewhat irrelevant from the point of view of agricultural policy. Perhaps it would be more appropriate to concentrate on those aged between 50 and 66. Of the farmers in this group with low incomes and wealth, 85 per cent farm less than 10 hectares. But they comprise no more than 1/4th of the total number of farmers with mentioned characteristics. Thus an acreage subsidy to farmers aged 50–66 years and farming less than 10 hectares could not be expected to benefit persons with low incomes and little wealth (defined above) in more than one case out of every four, unless some kind of income and wealth test were applied.

Nor is geographical location a reliable criterion of farmers in poor economic circumstances. Geographical variations in profitability (cf. Chapter 3) are substantially offset by variations in forestry incomes and incomes derived from work outside agriculture. Thus there is no large geographical area where, say, 75 per cent of farmers with less than 10 hectares have annual incomes of less

than Sw.kr. 10 000. In most areas in 1966 less than half the farmers with farms of this size had taxable incomes of less than Sw.kr. 10 000.[22] This remains true even when the special support to agriculture in northern Sweden, amounting to Sw.kr. 1 000 or 2 000 for farms of this size, is deducted from the income figures in the available statistics.

Thus the only reliable way we could find of identifying farmers with slender economic means was to consult data on incomes and wealth. Since agricultural policy hitherto has been framed in terms of acreage, age and location, the criteria and methods of income support through this policy have obviously been very inefficient.

Another factor that tends to confuse incomes policy, as we have already hinted is that part of the support is given to people principally employed elsewhere or to pensioners. These groups are in fact considerable – 35 to 40 per cent of the total number of persons formally registered as farmers.[23] One is led to ask wheth er it is such groups as these that income support to agriculture is intended to bene fit. Thus farmers who remain in agriculture after retiring age receive state income support over and above their pension.

If income support to agriculture is to be more effectively attuned to social policy, it will probably have to be related more specifically to the income and wealth of the individual farmer, in which case social and labour market policy will provide a more efficient solution for these categories than price policy.

SUMMARY

We began our analysis of agricultural profitability by asking why there were so many different schools of thought on the subject. We suggested that the reason might lie in the variety of profitability concepts employed and that accordingly the differences of opinion thus arising were logically compatible. Following the analysis in Chapters 4 and 5, we concluded that a certain confusion of terms goes a long way towards explaining the conflict of opinions concerning profitability.

We found that the welfare-economic profitability of agriculture, measured in international prices, is very low, about 1/4th that of industry. In view of the heavy support given to agriculture, one suspects that business-economic profitability is considerably greater. This, however, is very hard to determine in the case of agriculture, since both yield and anticipated increases in value are capitalized in the market value of agricultural real estate. Here as with, say, shares, capitalization causes profitability, measured as current yield in relation to the

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[22] This is apparent from the income figures for the upper quartiles in different sectors of production in *Statistiska meddelanden* (Statistical Reports) J 1968:10, Table 10.

[23] This figure can be found in two sources. The first of these is the 1960 census, in which data concerning the number of pensioners and farmers principally employed in other sectors are summarized in Appendix A, Table 3. This table specifies a figure of 40 per cent, assuming that one-third of active farmers over 65 are aged 65 and 66 years. The second source is Sambergs, *op.cit.* Tables III:8 and 9 in this work lead one to conclude that the proportion is about 35 per cent.

market value of the capital invested, to appear low even for the most efficient farms.

On the other hand private-economic profitability, especially at the current rate of support to agriculture, is often high enough to permit a living standard equal to that of other population groups and in addition allow a considerable accumulation of wealth in the course of time. This is because farming families provide the predominant part of both labour and capital input (85 and 75 per cent respectively). In spite of the low welfare- and business-economic profitability of each factor input, the total return is adequate to enable farming families to attain a sufficiently satisfactory private-economic balance to make them stay on their farms. This is at least true of families with farms comprising more than 10 to 20 hectares.

Another important reason for the conflict of opinion is the wide dispersion of incomes and wealth in agriculture. There are both millionaires and paupers in this sector. The groups for whose benefit the parity goal of agricultural policy has been created are in fact small in number compared to those whose members have either higher or lower incomes. This is bound to create problems when general devices such as price policy are used with a view to influencing income trends in agriculture. Thus an agricultural policy that aims at guaranteeing the profitability and incomes of a certain group of farmers through prices is not a very efficient means of solving the income problems of other farmer groups, least of all those with low incomes.

PART THREE

THE COSTS OF MAINTAINING AN AGRICULTURAL SECTOR

CHAPTER SIX

THE COSTS OF AGRICULTURAL SUPPORTS

Since agricultural productivity is lower than that of other sectors, the total size of the national product (national income) can be increased by transferring factors of production from agriculture to those other sectors. The resultant increase in the national product is generally referred to as reallocation gains. In the first part of this chapter we shall try to assess these gains.

The lower productivity of agriculture also means that factor returns are less than in other sectors, and this causes some factors to leave agriculture. If, however, the state applies controls or subsidies to make factor return greater than it would be in a free market, factor transfer is inhibited and the national product is less than it would otherwise have been. The loss of national income resulting from the retention of more factors than would have remained without support will be regarded here as the cost to society on the »welfare-economic cost» of agricultural support. Estimates will be made of both the welfare-economic cost and the fiscal cost of agricultural support. These two costs are not necessarily of the same magnitude.

It is also important to know whether the welfare-economic costs can be reduced. The minimum cost of maintaining an agricultural sector fulfilling certain given requirements will be considered in the following chapter (Chapter 7).

REALLOCATION GAINS

Historically the transfer of factors of production from agriculture to other sectors has been one of the most characteristic features of the economic growth. It need hardly be pointed out here that the greatest transfer has involved labour, agriculture has provided considerable reserves of labour for the rest of the economy. Whereas 70 per cent of the working population was occupied in agriculture in about 1880, and 35 per cent in about 1935, the present (1968) figure, as we saw earlier, is about 6 per cent.[1] As the agricultural sector contracts in relation to other sectors, this labour reserve also declines. The transfer of labour can none the less be maintained by drawing heavily on the reserve that is left, and may account for a great deal of the increased employment in other sectors,

[1] *Sveriges Officiella Statistik*, Historisk Statistik för Sverige I (Historical Statistics of Sweden I).

especially in periods when the total gainfully employed population is expanding slowly.

The importance of agriculture as a supplier of labour to other sectors is reflected, among other things, by the fact that, while employment outside agriculture rose by 325 000 persons between 1950 and 1960, the number employed in agriculture fell by 185 000. Thus the decrease in the agricultural labour force corresponded to 57 per cent of the rise in employment in other sectors.[2] The fact that only a small proportion of the total labour force is now employed in agriculture does not necessarily detract from the importance of agriculture as a labour reserve for other sectors, since there are forecasts indicating that the total supply of labour will increase less rapidly than during the 1950's, while the exodus of labour from the land may prove more constant.[3] The total number of man-years in Sweden is expected, according to these forecasts, to rise by 23 000 between 1965 and 1975. If the present (percentage) decline of the agricultural working population continues unabated, this would give a further 100 000 man-years, so that the labour force in other sectors would rise by 123 000 altogether. Agriculture would thus continue to provide most of the labour increment in other sectors.

Efforts have been made in Sweden and elsewhere to assess the quantitative contribution to the growth of GNP resulting from the transfer of factors of production from agriculture – the reallocation gain.[4] For several reasons, an exact estimate is difficult to arrive at, but the magnitude of reallocation gains can be illustrated by simply multiplying the difference in labour productivity in agriculture and other sectors by the number of persons who have moved from agriculture to other sectors during a given period. More specifically, we are here concerned with the difference between actual GNP in 1960 and GNP that would have resulted if agriculture had still occupied the same proportion of the working population as in 1950. The reallocation gain can then be calculated with the aid of the formula.

$$(\imath_{a50} \cdot L_{t60} - L_{a60})\,(p_{b60} - p_{a60})/(G_{t60} - G_{t50})$$

in which $\imath$ = sector proportion of total employment
L = number of persons employed
p = gross value added per person (average labour productivity)
G = GNP (in constant prices)

Index a denotes agriculture, b other sectors, t all sectors
Indices 50 and 60 denote 1950 and 1960 respectively.

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[2] *Sveriges Officiella Statistik*, Folkräkningar (census figures) 1950, Part IV, Table B and 1960, Part IX, Table 4.

[3] Kungl. Maj:t prop. (Government Bill) no. 125, 1968. Appendix 2. Avstämning av 1965 års långtidsutredning (Revision of the 1965 Long-term Survey), p. 10.

[4] The concept of reallocation gain is discussed in E. Lundberg, *Produktivitet och räntabilitet* (Productivity and Profitability), Stockholm 1961, pp. 39 ff.

One problem in calculating reallocation gain is that reallocation can affect productivity both in the sector releasing labour and in the sector receiving it. We shall assume that average labour productivity outside agriculture is not affected by the reallocation, i.e. that the productivity of the additional labour is equal to the average for these other sectors.

The tendency for this assumption to underrate or overestimate the actual reallocation gain will depend on whether the transfer of labour from agriculture has facilitated an expansion of sectors or firms whose marginal productivity is greater or smaller than that of the economy as a whole. An exodus of labour from agriculture can contribute to the expansion of the most productive sectors either through the new workers moving into these sectors themselves or through their replacing labour which (thanks to the reduction of the agricultural labour force) then goes to highly productive sectors. During periods of severe labour shortage the transfer of labour can sometimes help to eliminate bottlenecks in production, which in turn may give a high marginal product. On the other hand, agricultural workers are often unfamiliar with industrial work, with the result that their productivity in the new sector may be below average initially.

Two separate assumptions, each representing an alternative extreme, will be made concerning the productivity of migratory labour in agriculture. The first alternative is to assume that the labour transferring from agriculture is as productive as the agricultural sector on average, productivity here being measured in domestic prices. This means that agricultural production is assumed to decline in proportion to employment, which in turn, according to a study by G. Österberg, would mean that some 15 per cent of the increase in GNP registered between 1950 and 1960 can be attributed to the transfer of labour from agriculture to other sectors.[5]

It should be noted that this estimate has been made in domestic prices. If it is made in international prices instead, the reallocation gain becomes somewhat higher, about 20 per cent of the increase in GNP between 1950 and 1960.[6] This is because price support is higher for agriculture than for other sectors.

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[5] G.R. Österberg, *An Empirical Study of Labour Reallocation Gains in Sweden between 1950 and 1966.* The Industrial Institute for Economic and Social Research, Stockholm 1966. In a more recent study Y. Åberg has obtained a lower percentage for the contribution of reallocation gains to the increase in GNP, namely 3–11 per cent during the period 1946–65. This is partly because Åberg has applied older (1913) productivity relations between different sectors with a view to long-term comparisons. Y. Åberg, *Produktion och produktivitet i Sverige 1861–1965.* The Industrial Institute for Economic and Social Research, Stockholm 1969.

[6] Since value added in agriculture is probably about 50 per cent lower in international prices than in domestic prices, as was observed in Chapter 1, p_{a60} in our formula (p 98) must be replaced by $0.5\,p_{a60}$. Since tariff protection in other sectors is put at about 5 per cent and the share of value added in the product price at about 50 per cent, p_{b60} is reduced to about $0.90\,p_{b60}$. It is also assumed, following what was said in Chapter 1, that $p_{b60} = 2p_{a60}$.

One can safely assume that estimates of this kind underrate the reallocation gain, for an exodus of labour can hardly be said to result in a proportional fall in agricultural production. As our second alternative we have assumed that production within the interval in question is not affected by the number of persons occupied. One justification for this assumption is the low marginal product of the agricultural labour force according to available studies.[7] On this assumption, the reallocation gain between 1950 and 1960 can be put at almost 30 per cent of the total rise in GNP.[8]

The figures for the contribution of agriculture to meeting labour demand and for reallocation gains both suggest that the reduction of labour input in agriculture has been a major growth factor in Sweden. The implications of a continuing reduction are discussed in Chapter 7.

It should be emphasized that our analysis has been concerned with long-term reallocation gains. In the short run, allowance should also be made for the possibility of labour transferring from agriculture at such a rate as to preclude the release of agricultural real capital for use in industry. If this were to happen, the costs of the new investments required in industry (depreciation and interest charges) would have to be deducted from the reallocation gain, unless there was spare production capacity available in industry. If the figures for increased value added outside agriculture are reduced by 20 per cent to allow for these circumstances, the figures previously mentioned as the contribution of reallocation gains to increased GNP are reduced by 6 percentage points.

In a short-term analysis allowance must also be made for the fact that a large proportion of the agricultural labour force is so old that its contribution to the output of other sectors would be very slight. As far as this category is concerned, reallocation gain arises in practice through retirement or death, provided that no replacements are recruited. As shown in Chapter 1 (especially Table 3), however, there is still a great deal of young labour in agriculture that in principle could increase the supply of labour to other sectors even in the short run.

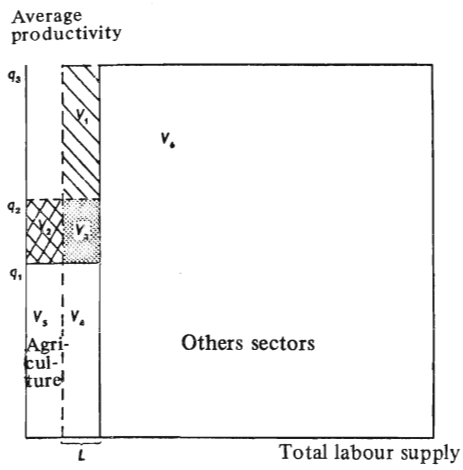
The principal significance of these estimates can be illustrated by means of a simple diagram (12).[9] The horizontal axis represents the total supply of labour in society, which is divided into two sectors, agriculture and other. The vertical axis denotes average productivity. In the diagram q_1 stands for productivity in agriculture, q_3 for productivity in

[7] In other words, marginal labour productivity is far below the average. Cf. E. Sandqvist, Analys av produktivitetsförhållanden i svenskt lantbruk (Analysis of Agricultural Productivity in Sweden), *Medd. från ekonomiska institutionen* (Reports from the Institute of Economics), The Agricultural College, Uppsala, August 1961. According to this study, the value of the marginal product per Sw.kr. of input is as little as 0.42 in arable farming and 0.05 in livestock farming.

[8] In this case p_{e60} in our formula is put at zero. If productivity outside the agricultural sector is measured in domestic prices, the reallocation gain is 30 per cent; 27 per cent if measured in international prices. This method probably over-estimates the reallocation gain, since it is doubtful whether the volume of agricultural production can be kept constant with such a large decline in the labour force, failing an increase in capital input. If capital input has to be increased, the costs involved must be deducted from the estimated reallocation gain.

[9] The technique used in constructing this diagram is based on Österberg, *op.cit.*

Diagram 12. *Reallocation gains in terms of labour productivity*



L = Transferred labour
q_1 = Labour productivity in agriculture before the transfer
q_2 = Labour productivity in agriculture after the transfer
q_3 = Labour productivity in other sectors
V_i = Contribution to GNP

other sectors. The contribution made by each sector to GNP is equal to the volume of labour multiplied by average productivity. These contributions are represented by the rectangular areas in the diagram.

Assume that a certain quantity of labour, represented in the diagram by the interval L, is transferred from agriculture to other sectors. According to our first method of calculation, the resultant reallocation gain will be equal to a bar consisting of the diagonally marked area V_1 plus the shaded square V_3. This bar represents the difference between the average productivity of the two sectors (in domestic prices) multiplied by the volume of labour transferred.

But no allowance is made in this estimate for the rise in the average productivity of agriculture resulting from the transfer of labour. Assume that agricultural productivity rises after the transfer from q_1 to q_2. In this case our first calculation underrates the gain by the equivalent of the chequered area V_2. The total reallocation gain will then be equal to the diagonally marked square, the chequered square and the shaded square, i.e. $V_1 + V_2 + V_3$.

In the special case where the volume of agricultural production is unaffected by the transfer of labour, the sum of these three areas is equal to the rectangle formed by L and q_3, i.e. $V_1 + V_3 + V_4$, since V_2 and V_4 are equal, the unchanged total agricultural product before the transfer being denoted by $V_5 + V_4$ and after the transfer by $V_5 + V_2$, so that $V_2 = V_4$. The reallocation gain in this case agrees with the result of our empirical estimate, in which the marginal productivity of agriculture was assumed to be nil.

Whereas the first empirical calculation gives a reallocation gain corresponding to the area $V_1 + V_3$, the second method gives a gain corresponding to $V_1 + V_3 + V_4$. The eventuality of the average agricultural product rising from q_1 to q_2 following a reduction of the labour force, which was not included in the estimates, represents an »intermediate case», provided that V_2 is smaller than V_4.

THE PRESENT COST OF SUPPORT TO AGRICULTURE

In general discussions of support to agriculture, attention is usually drawn in the first instance to the increased consumer cost of foodstuffs as a result of tariffs. This extra expenditure can be roughly measured by showing how much more cheaply foodstuffs could be purchased abroad if they were subject to the same tariffs as other commodities. An estimate of this kind shows an extra expenditure in the region of Sw.kr. 2.4 billion for 1967.[10] To this, however, must be added the contribution made by taxpayers through the state budget, i.e. about Sw.kr. 200 million. Most of this goes to the farmers through price controls, especially via milk prices and other forms of support to small farms. Finally there are the subsidies, totalling around Sw.kr. 30 million, disbursed in connection with state-sponsored rationalization.

The total amount of support, well about Sw.kr. 2 1/2 billion, is not identical with the cost to society of support to agriculture. As we have seen, this cost arises because factors of production are kept in agriculture by means of price support instead of being transferred to other sectors with higher yields. The long-term production cost to society can be measured as the difference between the costs of production in the protected portion of agriculture and the cost of purchasing the corresponding quantity abroad. The protected portion of agriculture is here taken to mean that portion which would disappear if protection were reduced to the same level as in other sectors.

In order to estimate the cost to society we must begin to ascertaining how many factors of production would be released by the elimination of protected production. An estimate of this kind is hypothetical, since, as already observed, protection in agriculture is very large compared with other sectors, so that its removal would inevitably lead to a very extensive and, consequently, almost unpredictable fall in production. Since it would also take many years to adapt the new situation, our estimate will be concerned with the long-term price reaction in production.

On the basis of the studies described in Chapter 8, we have estimated that the price fall of just over 35 per cent entailed by an elimination of price support would cause production to drop by 50 to 70 per cent. The fall in the number of man-years is put at 70 to 80 per cent or between 130 000 and 150 000. We saw in Chapter 1 that the difference in average productivity (measured in international prices) between agriculture and other sectors was in the region of Sw.kr. 25 000. If we accept average productivity as an approximation of marginal productivity and assume that productivity in agriculture and elsewhere does not change as a result of the transfer, a possible long-term reallocation gain can be estimated by multiplying the fall in the number of man-years by the difference in productivity. This gives a reallocation gain of about Sw.kr. 3.5 billion. For

[10] According to Appendix B the value of consumption of agricultural products in 1967 was Sw.kr. 5.4 billion in domestic retail prices and Sw.kr. 3.0 billion in international prices. The difference, Sw.kr. 2.4 billion, constitutes the added expenditure.

reasons stated previously (p.100) this is probably an underestimate of the long-term reallocation gain. Moreover our estimate is based on the assumption that capital intensity is the same in both sectors. Using the profitability ratios in Chapter 5, however, we can estimate the reallocation gain without having to make this special assumption. In this case the reallocation gain amounts to roughly Sw.kr. 4.5 billion.[11] If we assume that the structure of the agricultural sector would improve considerably in connection with the transfer, so that factors of production in agriculture yield the same as in other sectors, our estimate indicates a reallocation gain of about Sw.kr. 3.7 billion.[11] It must be stressed that these are only rough estimates, owing to the schematic methods and the uncertain assumptions involved.

Reallocation gain is one criterion of the long-term cost to society of agricultural protection. Alternatively the sum indicated can be described as the price paid by Sweden for not availing itself of the purchasing opportunities that exist on the international market, especially in certain developing countries and in affluent transoceanic countries, as the USA, Canada, New Zealand and Australia. As already explained, these estimates are highly schematic. They assume, for instance, that prices on the world market are not significantly affected by the fall invisaged in Swedish production. As shown in the analysis in Chapter 2, this is an acceptable approximation provided Sweden is the only country to abolish agricultural protection.

Thus, according to our rough calculations, the absence of reallocation gain makes the national income about Sw.kr. 4 billion less than it might have been if agriculture had received only the same degree of support as other sectors. It is hazardous to say how this loss of income is divided between different income earners without first making a more detailed analysis of the economic policy that would have been applied if the transfer had materialized. One decisive question is whether the »loss» would primarily reduce consumption or investment.

Apart from these losses of income due to reduced national income, non-farming consumers also suffer a loss of income through the redistribution of income in favour of the agricultural population. This redistribution is equal to the additional expenditure incurred by consumers, which we specified earlier as Sw.kr. 2.4 billion less the cost – in current prices – to farmers of producing the protected part of their output. Since this latter cost can be put at about Sw.kr. 600 million (using a method described on p. 105), the redistributed income can be put at Sw.kr. 1.8 billion. The redistribution of income should also include state subsidies, which as we have seen amount to about Sw.kr. 200 million. This gives a total redistribution of income of about Sw.kr. 2 billion from non-

[11] For the method of calculation, see pp. 105 ff.

farmers to farmers.[12]

Apart from the fall in income incurred by society as a result of lower national income, one can also speak in terms of another »welfare loss», due to agricultural support raising the prices of foodstuffs in relation to those of other commodities, thus forcing on consumers what from their point of view is an inferior pattern of consumption, in that they cut their consumption of agricultural commodities in relation to other goods and also shift to simpler agricultural commodities. An estimate of this welfare loss is difficult in principle, but we have made the attempt (using a method described on pp. 105 ff).r Our estimate gives the additional income required by consumers to compensate for the deterioration in their pattern of consumption that would result from the increased relative price of agricultural commodities due to protection. According to this estimate the welfare loss suffered by consumers as a result of changed patterns of consumption – loss of »consumer's surplus» – can be equated with a loss of income of about Sw.kr. 250 million (1967).[13]

It should be noted that the costs referred to here are not solely the result of state support. They are also due to the fact that, in the short run, too many factors of production remain in agriculture owing to lack of mobility.

WELFARE BENEFITS ACCRUING FROM AGRICULTURE

The cost of agricultural policy to society should be weighed against the welfare benefits accruing from it. Two conceivable welfare benefits that have featured in general discussions of agricultural policy are the preservation, by means of support to agriculture, of a fairly well-populated countryside together with part of the traditional cultivated scenery. No attempt will be made here to assess these benefits in figures but it should be pointed out that they have to be weighed against the increased costs of transport and distribution in rural areas as opposed to urban areas.

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[12] Part of the extra expenditure incurred by consumers, some Sw.kr. 300 million, consists of import revenues, which in principle go to the government. Most of it, however, goes to farmers, since it is used to compensate export losses and maintain a producer price (e.g. for sugar) that is greater than the consumer price. It should be noted that part of the redistributed income reverts to the state in the form of increased taxes from farmers, and this may well reduce the amount of income redistributed. If, however, the reallocation gains we have mentioned were to be realized, total tax revenue would increase even more, given the present tax regulations. Since the need for taxation revenues is presumably not affected to any great extent by the distribution of population between agriculture and other occupations, the burden of taxation could be alleviated in such a situation. Thus agricultural support still further reduces, through taxation, the proportion of the non-farming consumers' incomes available for private consumption.

[13] The calculation refers to the difference between the amount consumers would be prepared to pay for the consumption that the higher prices force them to abstain from, and the amount this consumption would cost them on the world market (reduction of consumer's surplus).

The costs enumerated above should also be seen in the light of the welfare benefit derived by society through the improved living standards of farmers with low incomes. This benefit applies for instance to those, particularly persons of advanced age, who would have difficulty in obtaining employment elsewhere if the support were removed. Thus from the 1966 income distribution survey presented in Chapter 5, the average taxable income of farmers aged between 50 and 66 and earning less than Sw.kr. 10 000 per annum can be put at about Sw.kr. 6 500. Assuming this income to be derived exclusively from agricultural production, the production value can be estimated at about Sw.kr. 11 000. Abolition of price support would in this case, given the same pattern of production, have entailed a reduction of the individual farmer's income by Sw.kr. 4 000, undoubtedly a serious loss.

But a large proportion of the earnings of those with low incomes is often derived from activities outside agriculture, so that the average loss of income would be less than that specified above. But even if it did amount to as much as Sw.kr. 4 000 per farmer, the support required to compensate for the loss would be a very small sum in macroeconomic terms. The number of farmers in the age and income group in question being about 20 000, the total loss of income resulting from the abolition of support would not exceed Sw.kr. 80 million. If compensation were also to be paid to the 20 000 or so farmers aged between 50 and 66 and earning between Sw.kr. 10 000 and 15 000, whose incomes would fall below Sw.kr. 10 000 if support were abolished, the total sum would still not exceed Sw.kr. 160 million. Thus the additional income that present agricultural policy provides for older farmers with low incomes is small in relation to the total redistribution of income from consumers to farmers. Consequently there is good reason to investigate whether there are other possible forms of agricultural support that will make the redistribution of income more efficient from a welfare point of view.[14]

Of course farmers with good incomes would also lose a large proportion of their earnings if state price support were abolished. We shall return to this problem in Chapter 9.

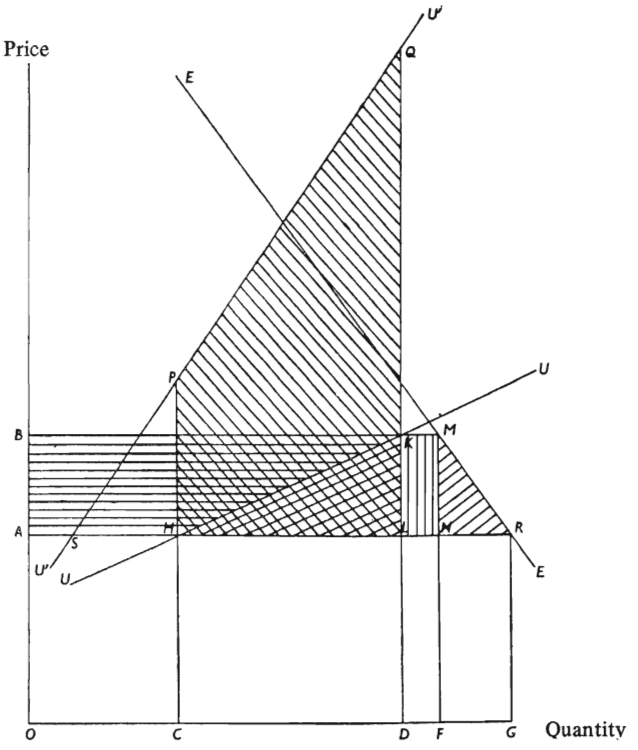
PRINCIPLES UNDERLYING THE CALCULATION OF COSTS

The theory and methods of calculation in our analysis of the costs of protection can be described as follows.

In Diagram 13, line *EE* denotes the domestic demand for agricultural commodities, while *UU* denotes domestic output, corresponding to the marginal cost curve for the agricultural sector. The area below the output curve denotes the total costs of agricultural production. Both are assumed to be functions of

[14] See Gulbrandsen & Lindbeck, *op.cit.*, Chapters 9, 10.

Diagram 13. *Costs of protection*



	ABMN	Consumers' additional expenditure
	ABKH	Income distribution to the advantage of farmers
	HKL	Additional cost of greater agricultural production (at current domestic prices)
	LKMN	Sum of import duties
	NMR	Consumers' welfare loss due to reduced consumption of agricultural products
	HPQL	Additional cost to society in the long run (at factor prices corresponding to the yield value of the factors on alternative use)

the price in the usual way.[15] Given the same protection as in other sectors, the domestic-market price is assumed to equal *OA* (the foreign price + 8 per cent duty). Domestic production would then be *OC*, consumption *OG* and imports the difference between the two *CG*. If a higher tariff, *AB*, is introduced, the

[15] The production function on which the line *UU* is based assumes that there are diminishing returns to scale. In Chapter 1 and Appendix A it was assumed when calculating net productivity that the production function exhibited returns to scale, since these estimates were concerned with a limited production interval. The present analysis, on the other hand, refers to changes throughout almost the entire scale of production.

domestic-market price becomes *OB*, production *OD*, consumption *OF* and imports *DF*. The measure, mentioned previously, of extra expenditure incurred by consumers through heavier protection at the consumption volume *OF* is then represented by the area *ABMN* (Sw.kr. 2.4 billion in 1967).[16]

The additional expense incurred by consumers through higher protection for the volume of consumption *OF* consists of import duties (*LKMN* – approximately Sw.kr. 300 million) and increased sales receipts in agriculture (*ABKL* – approximately Sw.kr. 2.1 billion). But, as already noted, Swedish agricultural controls are organized in such a way that most of the tariff revenues are used to finance agricultural price support.

Earlier we defined the welfare-economic production cost of agricultural support as the difference between the costs of production of the protected production and the sum for which this volume can be purchased on the world market. If the costs of agricultural production are assessed at current factor prices in agriculture, they are represented by the area *CHKD* in the diagram. Since protected production can be purchased for a sum corresponding to the area *CHLD*, the additional cost to society is given by the triangle *HKL* (Sw.kr. 600 million).[17] If on the other hand the factors of production in agriculture are valued at factor prices in other sectors, the marginal cost curve will be higher than *UU* (represented in the diagram by the line *U'U'*). According to this method the additional cost of protected production is *HPQL* (Sw.kr. 4.5 billion).[18]

The difference between farmers' increased sales receipts (*ABKL*) and the increased domestic costs of production at current factor prices in agriculture (*HKL*) can be regarded as a transfer from consumer to producer. This transfer is shown by the area *ABKH* and represents an increase in producers' surplus (about Sw.kr. 1.5 billion).[17]

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[16] Calculated as total support (Sw.kr. 2.6 billion according to p. 101) less tariffs.

[17] In order to calculate the cost to society of agricultural support at current factor prices in agriculture (the area *HKL*), one must first estimate the proportion of the volume of agricultural production that would disappear if protection were abolished. As we saw earlier, this fall in production can be estimated at 50 to 70 per cent. Assuming a fall of 60 per cent, the welfare cost of agricultural support at current agricultural factor prices, the area *HKL*, can be estimated at ($0.6 \cdot ABKL \cdot 1/2 = 0.6 \cdot 2\,100 \cdot 1/2 =$) Sw.kr. 1 470 million.

[18] This area can be calculated according to the trapezium formula $(HP + LQ) / 2 \cdot HL$. Since the profitability ratio of industry to agriculture in international prices is approximately 1:0.25 and the value added 45 per cent of the product value (according to Table 1, last column) the height of the output curve *U'U'* will be $(1/0.25 \cdot 0.45 + 0.55) = 2.35$ times the height of the *UU* curve. This gives us $HP = 1.25 \cdot CH$ and $LQ = LK + 1.35 \cdot DK$. With a relative agricultural support of 51 per cent according to Table 7, $CH(1/1.51) = 0.66\ OB$, $DK = OB$, $LK = 0.34 \cdot OB$ and $HL = 0.6 \cdot OD$. Thus the area of the trapezium is

$$\frac{1.35 \cdot 0.66 \cdot OB + (1.35 \cdot OB + 0.34 \cdot OB)}{2} \cdot 0.6 \cdot OD = 0.77 \cdot OB \cdot OD.$$

$OB \cdot OD$ being the value of total production in domestic prices, the area of the trapezium is ($5.9 \cdot 0.77 =$) Sw.kr. 4.5 billion.

As a measure of the loss incurred by consumers through what they regard as an inferior consumption pattern, we can take the difference between what consumers are prepared to pay for consumption *FG* (given by the area *FMRG*) and the amount this consumption would cost them at world market prices (represented by the area *FNRG*). This difference corresponds to the area *NMR* and constitutes the fall in consumers' surplus (about Sw.kr. 240 million).[19]

In these estimates no allowance has been made for any loss of productivity that might occur in other sectors following the transfer of labour from agriculture. Our estimates are also based on the assumption that the relations between factor prices in agriculture and other sectors would not be affected by adaption to world prices. Another possible situation in the event of a change to world market prices is that only the factors of production that can attain the same return as in other sectors remain in agriculture. This situation is depicted in the diagram by point *S*, the intersection of the curve *U'U'* and the line *AR*, corresponding to price level *OA*. At this point domestic production is *AS*. In this particular case the curve *UU* will also pass through point *S*, since factor prices in agriculture rise when production diminishes, thus raising the left-hand side of the curve *UU*. The reallocation gain is represented by the triangle *SLQ* and can be put roughly at Sw.kr. 3.7 billion.[20]

As mentioned previously, we have not made any allowance in these estimates for rises in world market prices that might result from the abolition of protection. As we saw in Chapter 2, world market prices would rise most if support to agriculture were abolished simultaneously throughout Western Europe. The reallocation gain in relation to these higher world market prices could then be expected to be Sw.kr. 500–700 million less than indicated in the above estimates.[21]

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[19] The calculation of the area *NMR* is based on the assumption that the price elasticity of demand for agricultural commodities (values in constant prices) amounts to 0.4 (according to Bentzel et al., *Den privata konsumtionen i Sverige 1931–65* (The Private Consumption in Sweden 1931–65). The Industrial Institute for Economic and Social Research, Stockholm 1957). Given a 35 per cent fall in prices the distance *FG* will thus be about 20 per cent of the distance *OF*, the actual volume of consumption. The area *NMR* will then be (0.20 · 2 400 · 0.5 =) Sw.kr. 240 million.

There are many well known problems connected with the use of producers' and consumers' surplus as a measure of welfare. Thus our analysis assumes that the marginal substitution ratio of food consumption to income is constant.

[20] In the course of studies concerning the optimum location of agriculture, L. Folkesson has found, according to certain unpublished estimates, that agriculture on an acreage of 0.7 to 1 million hectares in optimum conditions would be capable of the same factor return as other sectors at world market prices. If we therefore put the distance *SL* at 0.75 · *OD* and *LQ* (cf. p. 107, n. 18) at 0.34 · *OB* + 1.35 · *OB*, we obtain a reallocation gain of (0.75 · (0.34 + 1.35) · 0.5 =) 0.63 · *OB* · *OD*, which, since *OB* · *OD* is the volume of production (Sw.kr. 5.9 billion) corresponds to the sum of Sw.kr. 3.7 billion.

[21] Assuming, as in Chapter 2, that world market prices would in this case rise by 20–30 per cent, *AR* and, consequently, *HL*, would be raised to the corresponding degree. Since (according to p. 107, n. 18) *CH* is 0.66 · *OB*, *CD* is 0.6 · *OD* and *OB* · *OD* is Sw.kr. 5.9 billion, the area *CDLH* represents a value of (0.66 · 0.6 · 5.9 =) Sw.kr. 2.3 billion. Given the above-mentioned rise in world market prices, the value of this area rises by 20–30 per cent, i.e. by Sw.kr. 460–490 million and the reallocation gain is reduced by the same amount.

CHAPTER SEVEN

THE COSTS OF EMERGENCY FOOD RESERVES

As observed in the introductory chapter, one of the prime motives of Swedish agricultural policy has been to guarantee an emergency supply of foodstuffs in the event of a blockade. In this chapter we shall consider the implications of this requirement and endeavour to assess the costs it entails for society.

FOOD NEEDS IN EMERGENCY SITUATIONS

To evaluate the cost of emergency food reserves one must first specify food needs in the event of a blockade. The next step is to determine the way in which these needs are to be provided for; by *emergency production,* by *stock-piling* or by a combination of the two. Allowance should here be made for the possibility of switching production to deal with an emergency. This done, one can proceed to estimate the quantity of factors of production that must be retained in agriculture in peacetime to make it possible to produce the desired output in an emergency. The most economical peacetime application of these factors will be considered in Chapter 10.

A crucial question in choosing between production and storage concerns the type of emergency envisaged. The debate on agricultural policy seems to have centred largely in the maintenance of food supplies in the event of a blockade lasting several years, i.e. more or less the same situation as arose during the last war. Of course one can also conceive of other emergencies, for instance a short (e.g. one-year) blockade, after which agricultural commodities soon become available again on the international market. Another possibility is that of a war resulting in the destruction of a large proportion of food production outside Sweden, e.g. as a result of nuclear, biological or chemical warfare, making the purchase of foodstuffs abroad more or less impossible for one or more years. A fourth possibility is for Sweden too to be exposed to warfare of this kind.

The nature of emergency planning will of course depend on which of these eventualities it is decided to plan for. The briefer the blockade, the more advantageous is storage compared to domestic production. On the other hand, the longer the blockade, the greater the extent to which production can be reorganized during the emergency. If Swedish food production is destroyed, e.g. by radioactive fallout, protected storage would seem to be the only effective means of guaranteeing food supplies.

A comprehensive analysis should include estimates for every conceivable emergency situation. We have, however, selected a less exhaustive method of illustrating the implications of preparedness, confining ourselves to an estimate of the costs of a blockade that makes heavy demands on the peacetime volume of domestic agricultural production. This presupposes a blockade lasting too long to be met by storage alone but not long enough for a reallocation of resources for agriculture from other sectors to be worthwhile. We have therefore chosen to base our estimates on a three-year blockade. Although this may not be the most probable alternative in the event of a conflict abroad, we shall assume it to be the situation with which emergency arrangements have to cope, since an estimate for such a situation can be said to set a maximum limit to the domestic production capacity required to meet an emergency.

When calculating the quantity of factors of production that must be retained in agriculture during peacetime in order to meet an emergency, four principal circumstances must be taken into account: (1) the extent to which consumption of calories and nutritive substances can be reduced in an emergency; (2) the extent to which production resources can be saved by a re-structuring of consumption and production in the event of a blockade; (3) the extent to which emergency requirements can be catered for by storage; (4) the extent to which land can be kept in reserve for use in an emergency. Thus we shall investigate the productive resources and storages required, in combination with a re-structuring of production and consumption, to meet an emergency.

(1) During the last war the maximum reduction of calory consumption (in 1942) was 10 per cent of the pre-war consumption rate. Although calory consumption today is lower per capita than in the 1930's, nutrition experts are agreed that a further reduction would still be possible without impairing health or work capacity. Moreover agricultural commodities can be consumed more completely during a shortage.[1] For these reasons we have assumed that the quantity of agricultural commodities used for consumption during an emergency can be kept 10 per cent lower than in peacetime.[2] The consumption of specific nutritive substances can also be cut to a certain extent. Thus we have reckoned with a minimum protein supply of 65 g per day and person (as against 74 g at present). Deficiencies of other nutritive substances such as minerales and vitamins in our consumption alternative can be supplied by cheap industrial manufacture. Thus agricultural production and storage requirements are not affected by the need to supplement products of this kind.

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[1] This will be made possible by reducing waste and by utilizing low-value parts of products, used in peacetime as fodder (e.g. skim milk) and for industrial purposes (e.g. fats for technical applications).

[2] The 1960 Survey of Agriculture provides in its estimates (*Statens Offentliga Utredningar* 1966:30, op.cit., Chapter 8) for a reduction on this scale.

(2) Since vegetable production can supply a given quantity of calories with far less factor input than livestock production, considerable calory savings can be effected by increasing the proportion of vegetable products consumed. Somewhat schematically speaking, 80 per cent of the calory content of vegetable products is »lost« when they are converted into livestock products. Thus the greater the extent to which vegetable consumption can be made to supplant animal consumption during an emergency, the lower the degree of self-sufficiency required in peacetime to guard against an emergency. The question then arises as to the degree of dietary change that can be accepted in an emergency. This will depend to a certain extent on how comprehensive the vegetable substitute for animal protein can be made. In our estimates, however, consumption of animal protein is not expected to fall below 40 g per day and person (as against 46 at present).

The feasibility of dietary change is also subject to psychological considerations. There may be a limit to the amount of change that can be accepted without a breakdown in rationing morale during an emergency. In this case not all dietary combinations that provide the requisite 90 per cent of peacetime calory content and 65 g protein per person and day, including 40 g animal protein, will be admissible. In our estimates we have therefore kept dietary change within certain limits which, in the light of experiences from the last war, appear to be feasible. The conceivable structure of consumption according to these estimates is shown in Table 23, column 3 and the accompanying text (pp. 115 ff.).

We assume that production will also be re-structured in connection with the change in the pattern of consumption, since peacetime production need not coincide with emergency production. By planning to re-structure production in the event of a blockade, peacetime production can be made more profitable from a social point of view. The optimum peacetime deployment of production resources will be considered in Chapter 10.

The amount of calories yielded by optimum peacetime production will depend entirely on what proves to be the optimum peacetime application of resources. However, the quantity of calories produced in peacetime, or the ratio of this production to calory consumption (known as the degree of self-sufficiency), is no criterion of potential emergency food supplies. Peacetime self-sufficiency figures expressed in calories are no measure of the degree of preparedness. More relevant are the quantity of factors of production and the stocks maintained in peacetime not the amount of calories one chooses to produce with these resources in peacetime.

(3) The third circumstance concerns the balance to be struck between storage and domestic production. The optimum balance between these alternatives is attained when marginal costs of both are equal. The interval for which the balancing is most relevant is that of the additional production (over and above that

attained at world market prices), which is required to meet consumption needs during a blockade. Storage costs, on the other hand, comprise the cost of importation (at minimum purchase prices) together with interest charges, depreciation and storage handling costs.[3]

Storage costs are largely governed by the kind of foodstuffs to be stored and by turnover. In spite of progress in storage techniques, animal products are still so expensive to store that they are not a paying proposition in the context of large-scale blockade.[4] The storage costs of certain vegetable products such as grain, sugar and edible oils, on the other hand, are far lower, especially if continuous turnover can be avoided, the point here being that it is expensive to sell and replace part of the stock to avoid deterioration. There are many products which it is far cheaper simply to leave in store until they reach a point where they would probably be unfit for human consumption even during a blockade; they can then be used, say, as fodder or for industrial purposes and new stocks put in their place.[5] This procedure calls for successive storage to build up stocks of several different vintages.

The principles behind the problem of balancing storage and domestic production are illustrated in Diagram 14. The vertical axis gives the costs of storage and production respectively. The base line in the diagram shows the volume of consumption (in calories) desired for reasons of preparedness in the event of a blockade. The relation between storage volume and marginal storage costs (continuous stepwise line) and the relation between volume of production and marginal production costs (broken and dotted stepwise lines) can be read off from left to right.

As observed in Chapter 3, the marginal costs of agricultural production are rising, but the marginal cost for storage is somewhat uncertain. We do know, however, that storage costs per calory are far lower for vegetable than for animal products. We can also assume that sugar can be stored more cheaply than grain, which in turn can be stored more cheaply than edible oils. Storage costs also vary as between different animal products. Thus butter is cheaper to store than meat. These relations are shown in the diagram. The diagram also assumes certain economies of scale in the storage of individual products.

The marginal costs of domestic production are also lower for vegetable than for animal products, and the order of individual products in this respect is much the same as with regard to importation and storage, though the marginal cost curve rises less steeply for production. This is partly because the competitiveness of domestic production vis-à-vis imports is weakest in the case of vegetable products, especially sugar, and partly again because handling and storage costs

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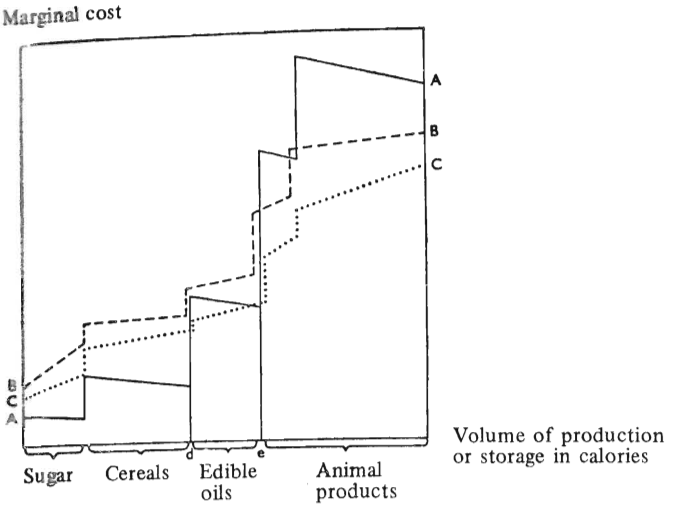
[3] Depreciation covers the value decrease of storage premises and – as quality deteriorates during storage – of food stocks.

[4] *Statens Offentliga Utredningar* 1966:30, op.cit., Chapter 8 together with the so-called Emergency Group's manuscript, on which this chapter is based.

[5] Sugar stocks need only be re-refined after a number (10–15) of years.

Diagram 14. *The principles for an optimal combination of storage and production to cope with an emergency*



A —— Stores (in calories)

B - - - Production (in calories) with present structure

C ····· Production (in calories) with optimal structure

are particularly high for animal products (compared to vegetable products). Given the present structure of Swedish agriculture, the diagram indicates the optimum combination of storage and production at point *e* on the horizontal axis, where marginal storage costs exceed marginal production costs.

We have also noted that production becomes more advantageous with a more optimal entrepreneurial structure in agriculture (broken line in the diagram); the most advantageous combination of production and importation/storage is shown by point *d*, which indicates that storage is limited to sugar and grain requirements.[6]

In practice there are serious difficulties attached to determining the optimum combination of production and importation/storage, owing to shortcomings in the empirical material. In extreme cases such as sugar and animal products, the difference between the alternatives of production and storage are so large that the conclusions are more or less incontrovertible. Thus the cost of importing and storing sugar to provide for a three-year blockade is about 60 öre per kg (just over 50 öre per kg for importing and somewhat less than 10 öre per kg for storage), while the domestic product costs about 120 öre per kg. The corresponding figures

[6] In our discussion of principles regarding the production and storage costs of animal products, we have assumed that these include fodder costs. But fodder that is particularly expensive to produce in the event of a blockade (e.g. oil cake and other protein products) may also have to be stored.

for grain are approximately 40 and 55 öre per kg respectively. Most animal products, on the other hand, are at present far cheaper to produce than to import and store. The differences are less striking for other products, especially edible oils, so that it is harder to say how best to guarantee supplies of these products in an emergency.[7]

Eventually, however, production may become more expensive than storage for certain animal products, partly because of probable technical advance in the production of »imitation» animal products (based on vegetable products). Thus vegetable cream has already (1968) become an established consumer product, and similar developments are afoot, especially in the USA, regarding milk and certain meat products, such as bacon.

Another problem in balancing production and storage is that an emergency estimate has to take into account the need for specific nutritive substances, above all protein. This means that the estimate has more dimensions than our simplified diagram suggests. To solve this problem one must in principle estimate a large number of alternatives, all of which must fulfil certain predetermined requirements regarding calories and specific nutritive substances. For practical reasons we have confined our estimates to a limited number of alternatives and selected from these the alternative that appears economically most advantageous (see below and Appendix F). Thus our estimate is not to be regarded as a conclusive analysis of the balance between production and storage.[8]

(4) Some of the acreage expected to go out of cultivation during the next few years can, if so desired, be kept cleared of trees by means of extensive livestock farming or chemical spraying. During a blockade, this acreage could then be used for more intensive cattle and hay production. This would free some of the acreage, in peacetime used for fodder cultivation, for the production of vegetable foodstuffs. This method is somewhat analogous to the hay harvesting and grazing practised in many parts of the country on poor or remote meadow and marshland during dry years. The difference consists in the far greater dimensions of the feed reserves, and a special administrative organization would be required to maintain reserves during peacetime and to exploit them (e.g. by the transportation and grazing of livestock and the allocation of hay crops) during an emergency.[9] Food supplies can be further improved in an emergency by the cultivation of household vegetables (e.g. potatoes) in private gardens, parks and other green areas. The reserves of land retained for use in an emergency can also provide nature conservancy and open-air facilities.

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[7] One alternative to storage of end products is to store certain means of production. Thus fodder, especially fodder grain, can be stored with a view to increasing pork production in the event of a blockade. The production alternative presupposes the storage of means of production that are normally imported, e.g. motor fuel, commercial manures and oil cakes. The costs thus incurred have in principle been included in our estimates.

[8] More detailed studies in this field are being conducted by L. Folkesson on behalf of the National Agricultural Marketing Board.

[9] Concerning labour requirements, etc., see Appendix F.

HOW TO MINIMIZE THE COST OF MEETING EMERGENCY FOOD NEEDS?

It would be interesting to try to establish statistically the minimum cost for providing for emergency food requirements. We have therefore made an emergency estimate for a considerably more efficient agricultural sector than that existing today. Our estimate refers to a hypothetical situation arising in about 1980.

In order to estimate the cost of foodstuffs we must first establish the factors of production required to attain the volume of production needed during a blockade. We will assume that the population numbers 8.5 millions. Our assumptions regarding diet during the blockade are shown in Table 23 (column 3), which also gives consumption in 1967 (column 1) and the peacetime consumption assumed

Table 23. *Example of food balance in Sweden for an emergency, 1980*

Commodity	Consumption 1967 (1)	Assumed peacetime consumption 1980[a] (2)	Annual average during a blockade in about 1980		
			Consumption (3)	Depletion of stores (4)	Production required (5)
	Millions of kg				
Cereals	616	540	800	400	400
Sugar	336	350	300	300	
Margarine	135	160	120	40	80[b]
Food potatoes	614	530	650		650
Milk products[c]	3 213	2 500	2 100		2 200[d]
Beef and veal	161	170	110		110
Pork and broilers	227	250	270		270
Eggs	92	100	55		55
Protein					
animal	151[e]	170[e]	126[e]		127
total	201[e]	215[e]	203[e]	26	163
Calorie volume	1 000 billions of calories				
Agricultural products	7.4	7.2	7.4	2.6	4.9
All foods[f]	8.3	8.6	7.7		

[a] Our assumption concerning consumption in peacetime is based on an extrapolation of pupulation, incomes, changes in consumption patterns and income elasticities. The extrapolations are based on trends to date.

[b] Corresponds in rapeseed, about 160 million kg.

[c] In terms of milk with a 4 per cent fat content.

[d] Including milk for feeling.

[e] Including fish but excluding skim milk for feeding.

[f] Including other foods besides agricultural products.

Source: For consumption in 1967 – *Jordbruksekonomiska meddelanden* (The Journal of Agricultural Economics). Otherwise see Appendix F.

for 1980 (column 2). The most important changes in consumption between 1967 and 1980 are assumed to be a reduction in the consumption per inhabitant of bread, potatoes and milk and a rise in the consumption of meat. We have also assumed a continuing tendency for margarine to supplant butter. Cereal and potato consumption is expected to rise during the emergency, while the consumption of meat, eggs, sugar and margarine will decline. Butter production and consumption can be increased by reducing the fat content of milk, at the same time as milk consumption (in litres) can be raised by using less skim milk in pig farming. But an extensive change in the latter respect calls for increased supply of other protein fodder such as fish meal and meat meal, if pig production is to be kept constant. These supplies can be guaranteed by storing defatted protein fodders.

The same table (column 4) also shows the proportion of annual consumption which is assumed to come from stores during the emergency. This balance between production and storage has been determined on the basis of a hypothetical agricultural structure more efficient than that at present. This is shown by the broken production cost curve in Diagram 14 with the combination of storage and production denoted by point *d*. According to the table, all the sugar, half the cereals and 1/3rd of the margarine required are provided from stores. The difference between consumption and the depletion of stores gives the volume of production required during the emergency (column 5). It is also assumed that certain factors of production will be stored, namely half the annual requirement of oil cakes, 1/3rd of the annual requirement of nitrogenous and phosphorus fertilizers and the entire annual requirement of potassium fertilizers.

To estimate the necessary cultivated acreage, we must first calculate crop requirements. This can be done with the aid of the production figures in Table 23 and with technical coefficients for the ratio of crop yield to end products. According to this estimate an emergency situation will call for a harvest 2/3rds the volume of that registered during the first half of the 1960's. If to begin with we disregard the possibilities of retaining reserves of land in peacetime, the acreage required for this crop yield during the blockade is estimated at about 2 million hectares. This estimate is based on the present acreage yield of various soils in Sweden. In practice, however, the trend is for acreage yield to rise by about 1/2 per cent annually. On the other hand we have to expect certain productivity losses in agriculture during a blockade due to military service and the shortage of supplies. For the sake of simplicity we have assumed that these two tendencies cancel. Given a more rapid rise in acreage yield than hitherto, which is technically possible, the acreage required would be less than 2 million hectares.[10]

[10] A rise in acreage yield of 1 per cent per annum would bring the required acreage down to about 1.9 million hectares. Folkesson arrived at the same requirement but with far smaller storage requirements, by assuming a higher acreage yield. L. Folkesson, *Utveckling och testning av en operationsanalytisk modell för beredskapsplanläggningen inom livsmedelsområdet* (Development and Testing of an Operation Analysis Model of Food Storage for Military Preparedness Purposes). National Agricultural Marketing Board, March 1968, mimeograph.

The peacetime cultivated acreage can be further limited by retaining land reserves. We assume that the yield of land thus kept in reserve is 40 per cent lower than that of marginal arable. In this case, given land reserves of 1/2 million hectares, the necessary peacetime cultivated acreage would be 1.7 million hectares.[11]

Now allowance has been made in these estimates for the possibility of bad harvests resulting from adverse weather conditions. If we reckon with an average fall in harvest of 10 per cent during the emergency, which would be unusually severe, the acreage figures quoted above would have to be raised by about 1/4 million hectares.[12] Thus to provide for harvest failure on this scale, the requisite acreage would be 2.25 million hectares (without land reserves) or 1.95 million hectares (with reserves of 1/2 million hectares). These acreage figures would have to be raised if population growth proves more rapid than assumed here. But not even a steep rise in net immigration, say from 10 000 to 30 000 persons per annum, would increase acreage requirements by more than about 70 000 hectares.[13]

Requirements of other factors of production during an emergency are influenced by the structure of farm-holdings in agriculture. As we saw earlier, total factor use in agriculture declines as units grow larger (at least up to a certain point). Of course it will take time for the existing structure to be recast to any great degree. But this is no reason for not trying to calculate the factors of production required in a radically transformed structure of farm-holdings to cater for emergency food requirements.[14]

By way of example, take an area of 2 1/4 million hectares divided into units averaging 150 hectares. This gives about 15 000 farms. Given the required composition of production, and a reasonable level of farming technology, the total amount of farm labour required in the event of a blockade works out at 60 000 man-years.[15] The capital stock required in the form of machinery, buildings, etc.,

[11] The methods of calculation are set out in Appendix F.

[12] The probability of a harvest failure of 10 per cent or more occurring during a single year is 1 to 4 (according to statistics of crop damages). This means that the probability of a harvest failure of 10 per cent or more during three consecutive years is 1 to 64.

[13] With a net immigration of 30 000 persons per annum, the population in 1980 would be 8.75 million, i.e. 3 per cent greater than envisaged in our estimate. Since the yield per marginal hectare is about 25 per cent lower than the average, the acreage would have to be increased by less than 4 per cent ($3 \cdot 1.25$), i.e. approximately 70 000 hectares.

[14] One might expect a more efficient structure of farm-holdings to make domestic production more profitable compared to storage. But in our example the main commodities stored were sugar and cereals, the present profitability of which is influenced by particularly high tariffs (cf. Chapter 10), while their storage costs are low. It follows that, regardless of the structure of farm-holdings, domestic production of these commodities is hardly likely to be cheaper than storage.

[15] By reasonable production technology we mean methods of production by which the use of factors of production is 30 per cent higher than on estimated optimal farms, owing to deficiencies of structure and expertise. The estimates of labour requirements and capital stock are described in greater detail in Appendix F.

is estimated at about Sw.kr. 12 billion.[16] If land reserves of 1/2 million hectares are retained, chiefly in central and southern Sweden, a cultivated peacetime acreage of rather less than 2 million hectares would suffice, reducing labour requirements accordingly. On the other hand this assumes that labour can be transferred from other sectors, or schoolchildren enlisted in the event of an emergency. The alternative of the land reserves specified above would then reduce peacetime labour requirements to just over 50 000 man-years.

What would be the welfare-economic costs of an emergency agricultural system of this kind? The estimate made here concerns the alternative without land reserves. First we must calculate the alternative value of the factors of production which, according to our estimate, are needed in agriculture in order to cater for emergency food requirements. This we estimate at Sw.kr. 3.8 billion in 1967 prices.[17] From this sum must be subtracted the cost of importing the agricultural output that would be lost if these factors of production were transferred to other sectors. These can be estimated at Sw.kr. 2.2 billion in 1967 world market prices. To this must be added storage costs, estimated at Sw.kr. 260 million per annum as against some Sw.kr. 30 million per annum at present.[18] This makes the total cost of emergency food supply (3.8 – 2.2 + 0.3 =) Sw.kr. 1.9 billion or in round figures Sw.kr. 2 billion. A comparison of this figure with the added cost of maintaining agriculture on its present scale (Sw.kr. 4 billion), as stated previously, is in itself a rough indication of the conceivable welfare-economic gain to be derived from such a reduction and structural transformation of agriculture as can be attained without renouncing the emergency policy.

HOW RAPIDLY CAN OPTIMAL AGRICULTURAL PREPAREDNESS BE ACHIEVED?

In practice it would take time for the present form of agriculture to be transformed into a form which would meet emergency requirements at the lowest welfare-economic cost. During this transformation, the cost will vary between the above-mentioned sums of Sw.kr. 4 and 2 billion per annum. The swifter the transformation, the greater the savings effected, provided the factors of production thus released can be put to profitable alternative use. The two most important means of reducing costs are structural change and the release of factors of production from agriculture. These two methods are interdependent to a certain extent; the more rapid structural change, the more rapidly factors of production can be transferred without jeopardising preparedness. The magnitude of the need

[16] The figure refers to replacement value.

[17] For the method of calculation, see Appendix F.

[18] We have assumed a purchasing cost of Sw.kr. 1.7 billion. The value of emergency stores at present can be estimated at about Sw.kr. 200 million.

for transformation can be seen from our estimates, according to which 30–40 per cent of the present acreage can be taken out of cultivation, in addition to which it will be of economic advantage for more than 9 out of every 10 farms to disappear as independent units.

Given the closure rate of the 1960's, some 10 000 units annually, it would take 15–20 years for the number of farms to decline to the 15 000 mentioned above. Given the de-cultivation of about 50 000 hectares per annum, which appears to have been the rate in the past few years, it would take about the same length of time to reach the estimated acreage requirement of 2 1/4 million hectares. Assuming current trends continue, the rise in mean acreage would tend to be slow initially as at present but tend to accelerate as the number of farms declines.[19]

As an example we can mention that, provided the current trends (in absolute figures) continue, the number of farms in 1980 should be about 50 000 and the total acreage 2.4 million hectares, giving an average acreage of 48 hectares or 30 hectares greater than 1968. If these developments continue at the same rate, mean acreage would rise within the subsequent three of four years to 150 hectares, i.e. more than five times. But this pattern is highly unlikely to materialize, one important reason being that, whereas at present transformation can proceed without extensive new investment, owing to the low utilization of most of the factors of production, a rapid rise in mean acreage such as we have indicated would call for a comprehensive replacement of existing real capital.

SUMMARY

The estimates put forward here concerning methods to provide for emergency food requirements with greater economic efficiency than at present are primarily to be regarded as numerical examples intended to illustrate a train of thought. The most important points in our analysis of the cost of emergency preparedness can be summarized as follows.

(1) We have tried to calculate the resources required to cope with an adverse blockade. In this context we are not primarily concerned with the peacetime volume of production. Instead our estimates are concerned with the quantity of factors of production and stores needed in peacetime to guarantee food supplies during an emergency. The degree of self-sufficiency during peacetime depends on the most remunerative line of production (cf. Chapter 10).

(2) One characteristic feature of our estimates is the relatively large stores of vegetable products. We have bargained for emergency stores about 10 times as large as those held at present. This is economically feasible through con-

[19] This is because the rise in mean acreage is dependent on the percentage closure rate, which, given the current trend, rises faster for the number of farms than for total acreage.

centrating storing to vegetable products and to means of production to guarantee a continuation of peacetime production efficiency during an emergency.

(3) Calory consumption is assumed to fall during the emergency by 10 per cent of the assumed peacetime consumption rate. Protein supplies are assumed to fall somewhat more, above all animal protein. This implies a change in the emphasis of consumption from animal to vegetable products.

(4) Due to the relatively large stores of vegetable products, consumption during an emergency can be switched in this direction without any significant changes in production. This means among other things that there will be no call for a drastic reduction of livestock. Our estimate also assumes that domestic livestock production in peacetime will be sufficient to cater for the need for animal products during an emergency. This is a realistic assumption, since it pays in peacetime to concentrate domestic production on animal products (cf. Chapter 10).[20]

(5) Given a more optimal structure of farm-holdings in agriculture than at present (with 15 000 farms as against 180 000 in 1967), the following fundamental factors of production would be required according to our estimates:

land: 2 to 2 1/4 million hectares (3.1 in 1967)
labour: 60 000 man-years (190 000 in 1967)
real capital (excluding land): Sw.kr. 12 billion (30 billion in 1967)[21]

With a peacetime land reserve of 1/2 million hectares, the cultivated area can be limited to 1.7 or 2 million and labour to just over 50 000 man-years. Thus agricultural production capacity is at present far greater than is warranted by considerations of emergency needs.

(6) Considerable social savings, about Sw.kr. 2 billion, can be effected through the reduction and structural transformation of the agricultural sector. Given the current trends this would take between 15 and 20 years.

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[20] Greater storage of vegetable products makes it possible to reduce stocks of motor fuel, lubricants, spare parts, etc. These savings have not been taken into account in our estimates. Nor do these methods of catering for emergency food supplies require any radical transformation of industry for reasons of food production, though the production of agricultural machinery may have to be stepped up if reserve capacity in the form of idle machinery and implements should prove inadequate.

[21] The figure quoted for the present capital stock is questionable since a large proportion of buildings, which probably comprise the bulk of the capital stock, are probably of limited usefulness even now.

PART FOUR

PRICE POLICY IN AGRICULTURE – EFFECTS AND PROBLEMS

CHAPTER EIGHT

PRICE LEVEL AND FARM OUTPUT

The price system is the most potent instrument of agricultural policy. It is of great importance to all the central objectives of that policy – objectives regarding production, efficiency and incomes. This means that a great deal is demanded of the price system in order to fulfil the objectives of agricultural policy.

Three strategic aspects of the price system are of interest in the context of agricultural policy: (1) the general level of prices of agricultural products and means of production (in relation to prices in other sectors of the economy), (2) the relations between the prices of different products and means of production in agriculture, and (3) the choice between a relatively high and low price to consumers. The general level of agricultural prices has far-reaching effects on the volume of production, efficiency and incomes, while relations between the prices of different products and means of production in agriculture are mainly significant in terms of efficiency (allocation and factor proportions). Price relations, however, are also an important factor in the distribution of income between different categories of farmers. The choice between a relatively high and low price to consumers is mainly important to the composition of consumption, the distribution of income between consumer groups, government finance and the state of competition in the foodprocessing industry.

In this chapter we shall deal with the relationship between the price system and production objectives. In Chapter 9 we shall endeavour to analyze the effect of agricultural prices on efficiency and income trends in agriculture. One of the main questions in this connection being whether the general price level of agricultural products affects the rate and direction of structural change. In Chapter 10 we shall discuss the implications of an »optimum» price system in the context of emergency planning. Most of our attention thus will be devoted to the choice between a relatively high and low price to consumers, the relationship between the prices of different agricultural products and the need for government market controls. In addition, we shall try to estimate the effect of alternative price policies on the prices of agricultural products.

PRICE LEVEL AND PRODUCTION GOALS – SOME GENERAL ASPECTS

As we saw in the last chapter, emergency food supplies can be provided for with far less factor input than at present. If then we wish to limit factor

input to the requirements of emergency, our main problem will be to reduce the agricultural sector.

In the long run, it is profitability that decides how many factors of production are added to or taken away from an industry. The agricultural sector can only be expected to shrink if factors return there is lower than in other sectors. Since prices are the principal means by which the state can influence profitability, price policy is bound in the long run to be the most important means of controlling factor input in agriculture.

The idea of reducing the volume of agricultural production by means of price policy is usually rejected on the grounds that total agricultural output is highly inelastic, so that even drastic price cuts would do little to reduce the volume of production. But this objection is only valid in the short run, i.e. before agricultural resources of land, labour and capital manage to adjust.[1] But we are more concerned with long-term effects, e.g. over a period of 10 to 20 years, since our main interest is in the effect of price policy on production *capacity*, i.e. the quantity of factors retained by agriculture in the long run. This is primarily determined by the profitability of agriculture in relation to that of other sectors. The relationship between profitability and production capacity is especially valid if the factors of production in society are fully employed. We shall assume this to be the case, since a high level of general demand is one of the prime objects of economic policy.

The rate at which factors of production can be drawn away from a agriculture will depend on the potency of the means employed. The lower the prices of agricultural products – and with them agricultural profitability – the faster the rate at which factors of production can be expected to leave agriculture, all other things being equal, and the faster production capacity in agriculture will diminish. Similarly the reduction of production capacity should in principle be influenced by measures taken to stimulate labour mobility. This is, however, conditional on the prices of agricultural products being such that profitability of agriculture is far lower than elsewhere, since – as we saw in Chapter 5 – the total labour and capital income of a farming family can still be relatively good even if the profitability of each factor of production (labour and

[1] Since it is often the farmer and his family who answer for most of the labour input, in theory a general fall in the prices of agricultural products may *in the short run* even result in increased output on individual farms. This may happen because farmers and their families may well be prepared to reduce their leisure time in order to increase labour input and so maintain their incomes. At the same time as the fall in prices has a substitution effect which can favour reduced labour input (more leisure), income effect tends to increase labour input (less leisure). In practice, however, the net effect seems unlikely to result in even a short-term increase in labour input, for the working hours put in by farming families are already extremely long (2 600 for a basic farmer according to the JEU figures for 1966). We also know, from surveys, that the marginal productivity of labour in Swedish agriculture is very low, so that the yield from additional labour input would be very slight.

capital) taken *individually* is low. Another reason is that many farmers will go to great lengths to avoid the drastic change of working and living conditions entailed by a transfer to other occupations.

In order for production capacity to fall, it is also necessary that agricultural prices are kept below the level where other factors of production are induced to enter agriculture and replace the loss of labour to such an extent that the total factor input remains unaltered. There are of course alternative uses in other sectors for these other factors – raw-materials, land and capital – as well.[2]

There are a number of rather intractable circumstances tending to limit labour mobility. One of these consists in the limited employment opportunities for elderly workers outside agriculture. Another is the housing shortage. The latter is of course conditioned by the actions of the authorities themselves, but the latter must of course be taken as a given factor in framing agricultural policy. Moreover there are in practice limits to what can be regarded as socially and politically acceptable with regard to price policy and factor mobility. One important example of this is concern for agricultural incomes and, probably, for the pace of regional migration as well. Thus it is bound to take a long time to reduce production capacity to the level required for emergency.

EMPIRICAL ANALYSIS OF THE RELATION BETWEEN PRICES AND PRODUCTION

A price policy which aims at influencing production capacity in a certain direction does not necessarily require exact prior knowledge of the relationship between prices and production. Here as in other sectors of economic policy one can advance by a process of trial and error, experimenting with changes in price levels to see whether production capacity develops as desired in the long run.

One practical problem in this trial and error technique is that it is hard to obtain reliable measurements of actual production developments, e.g. because harvests vary according to weather conditions. A common way of coping with this problem is to adjust the actual volume of production in terms of harvest yield – i.e. to standardize the volume of production. But this is seldom satisfactory owing to the unreliability of the methods used to determine the relation of actual to normal yield and to ignorance about the effects on production of the steps taken by the farmers themselves to compensate for harvest fluctuations.[3] It is therefore desirable to supplement standardized production volume figures

[2] As regards buildings and machinery, it is mostly new acquisitions that can be put to alternative use.

[3] Similar problems arise of course when price policy, as has previously been the case, is attached to an income objective. Indeed one might go so far as to say that the problems are more serious in this connection, since one cannot standardize income figures merely by standardizing crop statistics. In principle one must also convert costs to apply to a »normal» year. Thus a standardized volume of production would appear simpler to calculate than a standardized level of incomes.

with indicators that are relatively independent of the kind of harvests. Such indicators include cultivated acreage, volume of labour, number of farmers, purchases of machinery, new building and the amount of commercial fertilizer used. These can be weighted to give an expression for total factor input.

Thus practical policy could well include a preliminary long-term plan for total factor input as well as volume of production and harvest. Detailed plans might then be drawn up for desirable changes in individual branches and factors of production. Actual developments can then be measured against this plan and appropriate action taken to counteract what are regarded as excessive deviations.

Agricultural policy would benefit considerally if it were possible to arrive at a quantitative definition of the relationship between prices and the volume of production. The better our knowledge of this relation, the greater the precision with which price policy can be used to influence the volume of producrion. Since the influence of agricultural prices on the volume of production is exercized through their effect on profitability and incomes, it is important to know how these latter are affected by price movements.

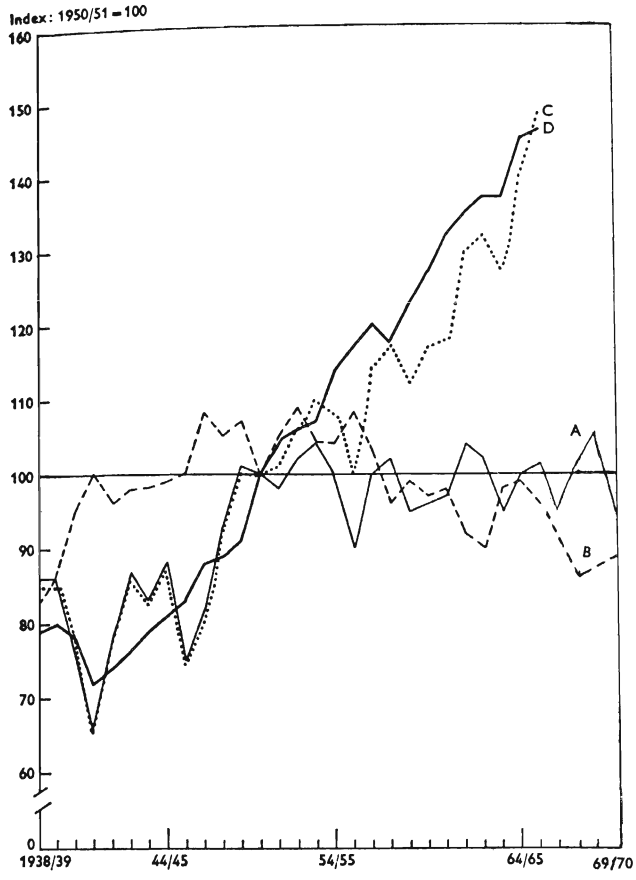
Since incomes are less than total receipts, their percentage change is greater than that of prices. Incomes (labour plus capital incomes) can be taken as being about half the sum of receipts (measured as the value of net production). This means for instance that a 10 per cent fall in real prices reduces real incomes by 20 per cent, other things being equal. Some of the farmers who, prior to a price fall of such dimensions, e.g. on the strength of their wealth, considered that their incomes were sufficient to warrant their remaining in agriculture, would suffer such a severe loss of income as to give them second thoughts. These figures suffice to indicate that moderate falls in real prices might have far-reaching effects on agricultural profitability and, consequently in the long run on the propensity of the factors of production to stay put. In the next chapter – on price level, efficiency and income – we shall consider the effect of price movements on farms of different sizes.

TIME SERIES ANALYSIS

Some idea – albeit vague and uncertain – of the relation between price level and volume of production can be obtained by studying the development of prices, production and productivity in agriculture over time. For such a study to be valid, however, the mobility of factors of production during the period in question must not diverge too radically from what can be expected in future. Since factor mobility is largely dependent on labour demand in sectors outside agriculture, our best course is to confine the analysis to a period, like the present, during which there has been a high demand for labour outside agriculture. Accordingly we shall take the end of the 1930's as our chronological starting point.

In terms of price movements, the period we have chosen can be divided into two stages, the first stretching from the end of the 1930's to the mid-1950's and characterized by a rise in the real prices of agricultural products, the second from

Diagram 15. *The development of prices and production in agriculture, 1938/39–1969/70*



A —— Volume of production
B - - - Real producer index
C —— Index of real factor prices
D ..... Net productivity

Note: A = value of production minus agricultural raw materials purchased (chain index),
B = farmer price index divided by consumer price index,
C = index of factor prices divided by consumer price index (chain index), and
D = value of production divided by factor volume.

the mid-1950's to the mid-1960's, characterized by falling real prices.[4] Between 1938 and 1955, when real prices rose by just under 2 per cent per annum, the volume of production – the value of production expressed in constant prices – rose by approximately 1 per cent annually. From 1956 to 1967 real prices fell by almost 1 per cent annually and the volume of production was more or less static. These trends are illustrated in Diagram 15.[5]

[4] Real price level is defined here as the producer price index (farm price index) divided by the consumer price index.

[5] See also Appendix G, Table 1, p. 218.

Before drawing conclusions from this historical material regarding the relationship between agricultural prices and the volume of production, there are other factors to take into account, above all the increase of net productivity and factor prices in agriculture. Productivity was inhibited during the 1940's by the war, with the result that net productivity rose by no more than about 1 1/2 per cent annually between 1938 and 1955. Since then it has risen faster, by over 3 per cent per annum. Real factor prices are estimated to have risen by slightly more than 2 per cent per annum between 1938 and 1967. These trends are also shown in Diagram 15.

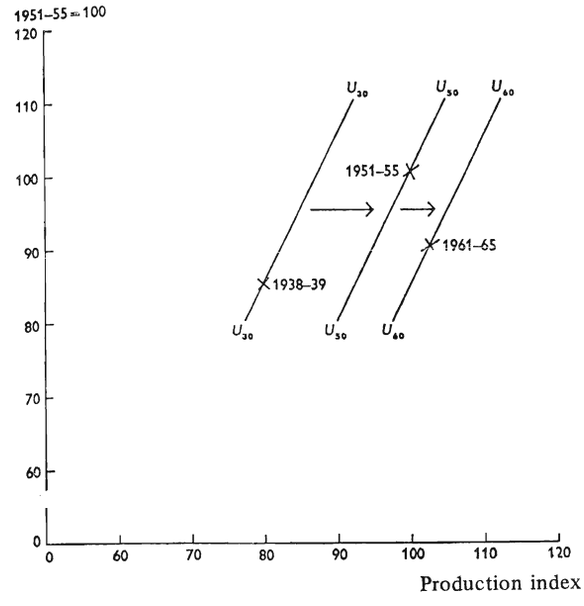
In principle, rising net productivity increases the volume of production at given product and factor prices. If on the other hand factor prices rise, production will decline if productivity and product prices remain unchanged. In principle a rise in factor prices has the same qualitative effect on the volume of production as a fall in product prices; both influence profitability in the same direction. In order to obtain quantitative criteria of the effects of prices and productivity on production, we have made a regression analysis of the relationship between the volume of production and the above-mentioned factors during the period 1938/39 – 1964/65. Since production was drastically influenced by weather conditions during certain years, the correlation has been adjusted for this effect (for methods, etc. used in the regression analysis, see Appendix G). We wish to emphasize that these studies are to be regarded as preliminary attempts at the quantitative determination of output reactions in Swedish agriculture.

Our calculations show that, given constant net productivity and constant factor prices, production will rise by 0.4 per cent if the product price rises by 1 per cent, i.e. a supply elasticity of 0.4 or approximately 1/2. Our study also shows that a 1 per cent rise in net productivity (marginally and generally) has an almost proportional effect on production, causing it to rise by 0.9 per cent. A 1 per cent rise in factor prices would reduce production by 0.4 per cent or approximately 1/2. Equal (percentage) changes in product and factor prices would cancel out.

These effects on production are schematically illustrated in Diagram 16, which shows the relation between prices and production.[6] Observation points have been inserted in this diagram regarding the average index values for product prices and volumes of production during the periods 1938–39, 1951–55 and 1961–65 (the index for 1951–55 being put at 100). The output curves for these three periods – U_{30}, U_{50}, U_{60} – have been schematically drawn through the observation points at a slope corresponding to an supply elasticity of 1/2. The relative positions of the curves illustrate the net effect of increases in productivity, which in principle causes the supply curve to move to the right, and

[6] The properties of the production function influencing the curves in Diagram 16 are discussed on p. 106, n. 15.

Diagram 16. *Illustration of shifts in supply curves, 1938–65*



U_{30} = Schematic supply curve at the end of the 1930's
U_{50} = Schematic supply curve at the beginning of the 1950's
U_{60} = Schematic supply curve at the beginning of the 1960's

Source: Appendix G.

factor prices rises, which cause it to move to the left (upwards). The diagram illustrates how the supply curve has constantly moved to the right between the periods, implying that rises in productivity have had a greater effect on production than rises in factor prices. The diagrammatic exposition illustrates the same relationship as was obtained in the econometric analysis.

As already noted, the movement of the supply curve is a net effect of the rise in productivity and factor prices. If factor prices had not risen, rising productivity would have moved the supply curve some 25 per cent to the right from the 1930's to the 1950's, as happened in the 1950's and 1960's. But a rise of about 30 per cent in real factor prices, with an assumed effect of 1/2 on production, would have tended to move the curves U_{50} and U_{60} about 15 per cent to the left. Thus the net movement of the supply curves to the right would have corresponded to a rise in production in the region of 10 per cent. These movements are illustrated in Diagram 16.

CROSS–SECTION ANALYSIS

The changes in prices and the volume of production were not large during the period in question and the supply elasticity obtained in the estimates is therefore representative only at relatively small changes in prices.[7] In order to elicit the price policy required to bring about a long-term reduction of production to the extent indicated in the previous chapter, material is needed regarding the effect of large price movements on factor input.

Some light can be shed on this problem with the aid of Swedish farming accounts. Data from the JEU study have been used for a study of cost variations between farms of different sizes and in different parts of the country. By arranging the farms in order of rising production costs (per Sw.kr. of receipts) and cumulating their volume of production, we obtain a marginal cost curve for agriculture production in the country as a whole. This curve can be said to represent the long-term output for agricultural production in its entirety. We assume that the supply curve turn upwards, since marginal costs in the agriculture sector can be expected to accelerate as more inferior land and farms are put into production.

We have constructed supply curves on the basis of data from 27 regions and acreage categories (the continuous line in Diagram 17) and, alternatively, 8 production regions (the broken line); the curves refer to conditions in 1963.[8] Our study gave a supply elasticity of about 0.6 in the upper part of the continuous curve, rising, however, to between 2 and 3 at its middle. The broken curve shows a corresponding rise in supply elasticity, from about 1 to just under 4.

This kind of supply curve shall, ideally, be based on the average costs of individual farms. The continuous curve, seen from this point of view, can thus be said to approximate more closely to actual conditions than the broken curve. On the other hand various regions can be expected to undergo structural change in the long run, so that differences between them due merely to inequalities of size need not affect the long-term shape of the supply curves. This suggests that the long-term supply curve would not be as steep as one based on individual farms.

Another deficiency in these curves is their failure to take into account adjustments of individual farm production to new prices. In practice this adjustment probably results in somewhat greater supply elasticity than our calculations suggest.

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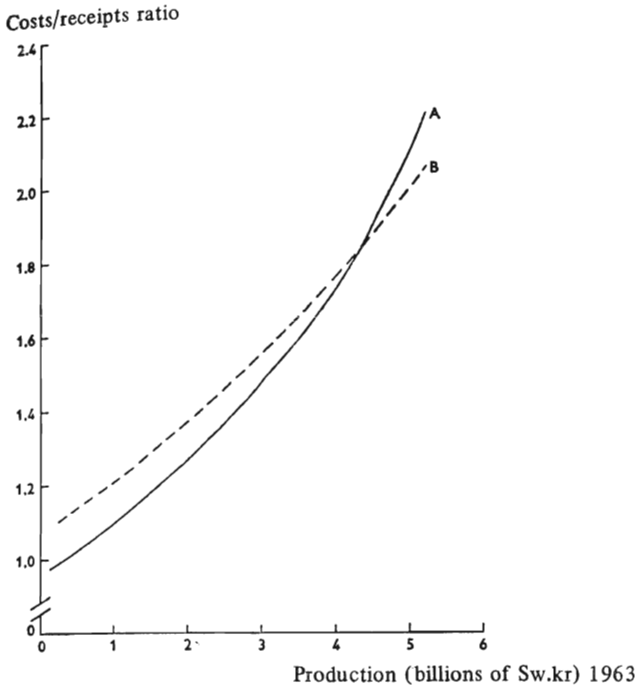
[7] It should also be added that the estimate of supply elasticity is uncertain because the volume of production varied within a limited interval during the period analyzed.

[8] Weather conditions this year were fairly normal.

Diagram 17. *Supply curves from cross-sectional data, 1963*



A ——Regression line based on 27 regions and size groups
B ----Regression line based on 8 regions

Source: Appendix G.

The supply elasticity resulting from our cross-section study in the upper part of the supply curve can be said, in view of the statistical problems involved, to agree fairly well with that obtained in the time series analysis (0.6 – 1.0 as against 0.4). The cross-section analysis suggests, however, that the more drastically production is reduced, the greater the supply elasticity one must envisage in determining the extent to which prices must be reduced.

One possible reason why the supply elasticity tends to be smaller in the time series than in the cross-section material is that the limited mobility of factors of production inhibits elasticity in time series material. This is not the case in cross-sectional material, which only reflects differences in the production costs of different farms or areas. It therefore seems reasonable to interpret the results of the time series study as giving more short-term elasticities than the results of the cross-section study.

PRICE POLICY TO CONTRACT FARM OUTPUT

What conclusions can be drawn from these studies regarding future price policy with the purpose of reducing production capacity? This depends largely on the development of factor prices and productivity. Our analysis indicates that, except in the case of a very rapid increase in factor prices in relation to productivity, the real prices of agricultural products will have to be reduced in order to contract output.

If productivity continues to increase as quickly as during the last 30 years in relation to factor prices, so that the level of production tends to rise, a reductic of real prices will be even more imperative as a means of contracting output. If on the other hand factor prices should rise far more rapidly than productivity, a reduction in real prices would be less imperative.[9] In principle one can even imagine a situation in which factor prices outstrip productivity at such a rate that the requisite fall in production can be achieved without any reduction of real prices. But this would imply a complete reversal of previous trends.

It would of course be exceedingly interesting to determine exactly the fall in real prices required to reduce production to the level required to cater for an emergency. We have tried to do this with the aid of the elasticity figures obtained above.

According to our estimates in the previous chapter the production capacity required to cope with an emergency situation in the mid-1970's is about 30 per cent less than the production capacity that existed during the earlier 1960's.[10] We have therefore to ascertain the extent to which prices must fall in order to bring about the appropriate fall in production. Given constant productivity and factor prices, average supply elasticity with the above fall in production can be estimated on the basis of the supply curves in Diagram 17 at 1 1/2. Thus price would have to be reduced by about 20 per cent in order to reduce production by 30 per cent.[11]

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[9] As regards the family farm, the costs of which mainly comprise the labour and capital return expected by the family, a price movement of this kind pre-supposes that the family's required income, based on comparisons with income trends in other sectors, rise faster than productivity.

[10] In Chapter 7, Table 23, col. 5, the production required to be able to meet an emergenc is said to correspond to a harvest volume of 6.4 billion harvest units. During the early 1960's, harvest volume varied between 9 and 9.5 billion harvest units. It is this volume. that would fall by about 30 per cent.

[11] According to the two curves in Diagram 17, a long-term fall in the volume of production from Sw.kr. 5.3 billion to 3.7 billion would call for a price fall of between 18 and 24 per cent, corresponding to supply elasticities of 1.2 and 1.6 (the estimate of price falls is based on the ratios of the cost/receipts relations at the points on the two supply curves corresponding to the specified volumes of production).

But a reduction of output by as much as 30 per cent is bound to take a long time (one or two decades), and considerable changes in productivity and factor prices can be expected before it is complete. If for example the process were to take 15 years, productivity could rise by about 55 per cent in the meantime if the current trend persisted. This means that productive resources in agriculture would have to be halved during the same period.[12] On the other hand factor prices can be expected to rise; if the present rate is maintained, they would rise by about 45 per cent during the specified period. But much of the rapid increase to date reflects the fact that agricultural workers' wages have risen more rapidly than those of industrial workers. If instead we assume that wages will rise at the same rate in both groups in future, and that industrial wages will continue to rise at the same rate as before, factor prices will rise by about 35 per cent.

This raises the question of what effect a change of this magnitude in productivity and factor prices would have on production. In view of the considerable reduction in output and factor input envisaged in the estimate, elasticity figures from the time series material do not seem to be applicable to the rises in factor prices. Instead we shall assume that the supply curve based on accounting data retains its slope and shape but shifts to the right because of increased productivity and to the left because of increased factor prices. If the curves for 1963 are moved by the distance corresponding to the specified percentage rises in productivity and factor prices (55 and 35 per cent, respectively), the desired volume of production would be attained at a real price level some 15 per cent below that in 1963.[13] In this case then, the rise in factor prices would have a greater effect on production than the rise in productivity.

We have endeavoured to check these calculations by means of a schematic estimate of their effect on profitability trends in agriculture relative to other sectors. According to this estimate (see Appendix G), product prices would probably have to be reduced by rather more than 15 per cent, given the assumed rises in productivity and factor prices, in order to achieve the envisaged fall in output. The more rapidly productivity rises in the future, the more real prices can be reduced without further impairing agricultural profitability.

Another reason why real prices may have to be reduced by more than 15 per cent in order to achieve the desired reduction in output in, say, 10 or 15 years, is that the supply elasticity according to the cross-section material does not take into account the limited mobility of the factors of production.

Summing up, our empirical studies suggest that the envisaged reduction of the volume of production requires a fall in the real prices of agricultural products, probably by 10 or 20 per cent. A reduction of the real prices of agricultural

[12] In order for production to be reduced to a level 0.7 times that of the early 1960's at the same time as productivity rises by 55 per cent, the factor use is reduced to (0.7/1.55=) 0.45.

[13] For the method of calculation, see Appendix G.

products need not entail any reduction of nominal prices. In an inflationary economy it suffices for agricultural prices to be kept constant for a few years or to rise more slowly than other prices. Given a general inflation of, say, 4 per cent per annum, a three- or five-year freezing of agricultural prices would be enough to achieve what we regard as the necessary price level, without any reduction in nominal prices.

Over a longer period – e.g. 10 years – prices would obviously be an efficient means of controlling factor input and with it the volume of agricultural production. The efficacy of this method will depend to a considerable extent on whether the reduction of prices is understood by farmers as a deliberate long-term policy. This will influence expectations concerning agricultural profitability, which in turn will probably lead to a more rapid adaptation of production than would ensue if large groups of farmers were still encouraged to expect good future profitability.

CHAPTER NINE

PRICE LEVEL, EFFICIENCY AND INCOME IN AGRICULTURE

In the previous chapter we discussed the price level required for agricultural products in order to reduce the volume of production to the level needed to guard against an emergency. The next question concerns the effects of such a price policy on efficiency and incomes in the agricultural sector. In assessing the effect on agricultural efficiency, interest is focused on two aspects, structural change and factor proportions. Firstly, we shall analyze the effects of price policy on farms of different sizes, secondly we shall analyze the effects of price policy on the profitability of alternative factor proportions in individual enterprises. Both these problems are closely related to the question of how the new agricultural prices will affect the prices of factors of production and, accordingly, the growth of incomes in agriculture.

EFFECTS OF INSTANTANEOUS PRICE REDUCTION

As already remarked, radical structural change is the primary road to greater efficiency within the agricultural sector. Such a transformation will only materialize if small and medium farmers give up their farms in large numbers so that other farmers can take over their land. Thus the pace of structural change in acreage-intensive production is determined first and foremost by the rate at which farms go out of business. It should, however, be noted that the closures which occur in forest and intermediate area are virtually irrelevant to structural change within the agricultural sector as a whole, since – as shown in Chapter 7 – these areas need not be cultivated to any great extent to provide for emergency requirements. Thus a trend towards larger farms will entail the elimination of small and medium-sized units in the plainlands as well. Consequently, if the process of structural change in agriculture is to be rapid, price policy will have to be framed so as to discourage farms of this kind from staying in business. In order to find the demands made on price policy by the desire for rapid structural change, we must begin by clarifying the relationship between price level and structural change, taking as a starting point the effect of the price level on the profitability of farms of different sizes.

Table 24 shows the profits registered by four different acreage categories – 5–10, 10–20, 50–100 and over 100 hectares. The data come from taxation statistics for 1965 concerning the average for the plainlands of central and southern Sweden. These areas are of special interest to us, since it is here that the main emphasis of future emergency agricultural planning would lie. Earlier we specified 10–20 per cent as the price reduction that would probably be required to attain the requisite production goal. In the table we have calculated by way of illustration the effects of an instantaneous reduction of prices by 15 per cent on farmers' income, *other things being equal.* Thus the table shows the effects of price reductions on incomes and wealth, disregarding the steps that in reality would be taken by farmers to adapt their production to the new price situation. The results simply describe a preliminary stage of the analysis, which means that the income and capital losses quoted are exaggerated.

According to our calculations, total factor return (value added) would fall by about the same percentage (20–27) in all acreage groups. Incomes on the other hand would fall most in the larger units, whether expressed as a percentage or in Sw.kr. This is because large farms employ a relatively high proportion of hired labour, and the wage cost thus incurred are assumed to be unaffected by agricultural prices. If instead we had assumed that agricultural workers and their employers would suffer the same percentage reduction in labour return, there would have been little difference in percentage loss of income between large and small farmers.[1]

How then do the reduced receipts shown in the table affect production, incomes, wealth, resources input and structural change? Loss of sales receipts would lead farmers to compensate by adjusting factor proportions and the volume and methods of production. Since larger farms are in a better position to change their products and factor proportions than small farms, they are also more able to counteract their loss of receipts (see below, pp. 139 ff). Since this adjustment entails savings in factors of production, factors will be transferred to other sectors.

But farms can hardly be expected to achieve full compensation for their loss of income by this adjustment, and it seems likely therefore that reduced profitability will lead to closures. Which farms are closed depend on a number of factors such as the extent by which profitability falls and the alternative yield of labour and capital input by farmers in other sectors. It is difficult to determine theoretically which farms will be closed (though an attempt to shed some light on this question is made on pp. 139 ff).

Closures will in turn increase the quantity of agricultural real estate supplied on the market, thus reducing its market value. In principle this fall will continue

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[1] As observed on p. 138, n. 3, however, such a transfer of income loss to the farmer's employees is hardly likely in the present state of the labour market.

Table 24. *Effect on income of an instantaneous price reduction (before any adjustment of production), plainland farms in southern and central Sweden, 1965*

	Size of farm, hectares arable[a]			
	5–10	10–20	50–100	over 100
	Sw.kr.			
Net value of sales[b]	12 356	25 876	96 083	240 392
Expenditure on wages for employees	633	1 470	16 753	75 005
Expenditure on interest on borrowed capital	829	1 828	9 723	25 100
Income from farm property	7 802	13 234	26 329	42 259
Total income (for husband and wife) incl. other sources of income	12 543	16 176	31 061	53 430
Factor return from agriculture[c]	9 264	16 532	52 805	142 364
Market value of farm property[d]	65 100	107 500	415 400	1 246 700
Net wealth[e]	84 500	130 100	388 600	1 109 300
Effect of a 15 per cent fall in prices	Sw.kr.			
Loss of sales receipts (loss of income)	1 853	3 881	14 412	36 059
	Per cent			
Loss of income as a percentage of factor return	20	23	27	25
Loss of income as a percentage of total income	15	24	46	67
Loss of income as a percentage of total income plus wages for employees	14	22	30	28
	Sw.kr.			
Capital value of income loss at 5 per cent interest[f]	35 100	66 500	298 100	721 200
	Per cent			
Capital value of income loss as a percentage of property value	54	62	72	58
Capital value of income loss as a percentage of wealth	41	51	77	65

[a] Calculations based on farms of average acreage for each size.
[b] Sales receipts for agricultural products minus expenditure on cropping and feed.
[c] Income from farm plus expenditure on wages and interest.
[d] Taxable value inflated by the so called overprice percentage (50 per cent).
[e] Based on the market value of the farm property.
[f] The capital loss has been calculated as follows: For the largest units the loss of income (36 059 Sw.kr.) has been capitalized at 5 per cent interest. If the same is done for the other farm sizes, capital losses are obtained of 37 100, 77 600 and 288 200 Sw.kr. but it can be objected that in these size groups the market value depends primarily on their value as additional land for other farms. We have therefore assumed that the market value of smaller units falls as much (per hectare) as for the largest size, i.e. by 4 347 Sw.kr. per hectare. Thus the largest size is assumed to determine land price formation. Much the same results would have been obtained if farms of 50–100 hectares had been chosen as price determining instead.

Sources: Data for proprietor farmers, Farmers' taxable incomes, expenditure, net receipts, assets and liabilities in 1965. *Statistiska meddelanden* (Statistical Reports) J 1967:18.

until enough buyers appear to create a new equilibrium. In this way, some land will be transferred to other sectors, insofar as this is sanctioned by the legislation restricting the right to acquire farm property, while other farms will be purchased to extend the acreage of surviving units.

Purchasers of agricultural real estate intending to use it for farming are in principle unwilling to pay more than the capital value of its anticipated yield. How far land values decline will therefore depend on the purchasers' profit expectations. But they will certainly not fall by anything like the 54–72 per cent specified in Table 24 as the capital value of the loss of receipts in agriculture in relation to land values. These figures do not take into account the measures of adjustment mentioned above. The fall in land values may in some cases have the effect of eliminating the wealth of the previous owners. This, coupled with large debts, large amortizations and interest charges, could result in bankruptcies. Large farms may suffer the same fate if they have heavy liabilities.

New farmers and enterprises bent on expansion will be faced with smaller capital requirements. Most buyers are likely to be people who can make the most efficient use of the property and can muster the necessary financial resources. Neighbouring landowners are usually best qualified to merge vacant land with their own and use it efficiently. Expansion is usually best financed by those who still retain wealth in spite of the fall in the value of their original farms, i.e. those whose debts are small in relation to the market value of their property. Since indebtedness in agriculture is low – about 25 per cent on average[2] – and in many cases insignificant, the supply of own capital in agriculture will probably survive even quite large losses of capital.

It is also conceivable that agricultural workers' wages are depressed by the loss of receipts.[3] This, together with falling real estate prices, would have the effect of reducing production costs, raising productivity and, consequently, checking closures.

In the new equilibrium, real estate prices have fallen to such an extent that profitability is the same as before, provided the farmers' expectations of factor return are unchanged.

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[2] According to the tax returns survey, and after adjusting the value of agricultural real estate by a purchase price coefficient of 75 per cent, the indebtedness of the entire farming population in 1966 was 23 per cent, *Statistiska meddelanden* (Statistical Reports) J 1963:10.

[3] There was a considerable transfer during the 1920's and 1930's when the prices of agricultural commodities fell heavily. Thus, according to estimates based on *Sveriges Officiella Statistik,* Lönestatistisk årsbok (Year Book of Wage Statistics in Sweden), the wages of agricultural workers fell by 20 per cent in relation to those of industrial workers between 1923 and 1933. During the same period the real prices of agricultural commodities fell by 30 per cent. Nowadays, however, not least in view of the intervening changes in labour policy, one would expect agricultural wages to be affected more by wage trends and labour demand in other sectors, so that in the long run the possibilities of big farmers transferring their loss of income to employees are probably limited.

The new equilibrium, compared to the old one, can be summarized as follows: There are fewer farms, the volume of production, cultivated acreage and the input of other factors of production have diminished. Land prices have fallen both absolutely and in relation to other factor prices.

It may, however, take several years for the new equilibrium to be reached. Productivity and factor prices are two examples of the changes that may occur in the meantime. The significance of such changes will be considered in the following section.

EFFECTS OF SUCCESSIVE PRICE REDUCTION

In the preceding section we considered the effects of instantaneous price reductions, i.e. the developments that would follow if prices were reduced once and for all (with wages and the prices of purchased inputs left unaffected). Such a reduction is, however, hardly a practical political proposition. It would be more realistic to envisage a price reduction carried out successively over a period of years. The ultimate effect will resemble that of several years' adjustment to an instantaneous price reduction, though in the former case one must take into account, among other things, changes in productivity and other costs occurring in the meantime, since the negative effects of price reduction will be counteracted in the long run by the growth of incomes resulting from increased productivity. If net productivity rises faster than prices fall, the net result on factor return will be positive, provided that the real prices of purchased commodities are unchanged. The extent to which this increases the farmer's income depends in the first place on the cost of employed labour and on the financing of the investments required for productivity to rise. To give some idea of the effects on agricultural incomes of a successive reduction in prices we have made a number of hypothetical calculations based on historical trends.

These estimates are based on average economic conditions in each acreage category of plainland proprietor farmers as reported in the tax returns study. Volume trends have been deduced from the value accounts in the tax returns with the aid of an index of historical price movements. Required new investments have been related to the labour transfer in the form of a marginal substitution coefficient. The method used in these estimates is described in greater detail in Appendix H.

In the examples we have schematically assumed that the volume trends in each group can be extrapolated and, accordingly, are unaffected by assumptions regarding prices.[4] The proportions between acreage categories, i.e. structure of farm-holdings, are assumed, on the other hand, to be affected on the grounds that structural change proceeds more rapidly the more prices are reduced, since

[4] Thus we have not taken into account production adjustment within each acreage category.

more farmers can be expected to give up as the pressure on profitability increases. The size of the assumed relation can be illustrated by two figures; if the fall in real prices continues at its present rate of 0.5 per cent per annum, the average annual decline in the number of farms is assumed to be about 7 000;[5] if product prices fall by 1.5 per cent per annum, the number of farms is assumed to fall by an average of some 11 000 per annum.

The results for some of the calculations are shown in Table 25. Given the assumptions, agricultural incomes in virtually all acreage classes would continue

Table 25. *Effect on productivity and incomes in agriculture of successive price reductions (illustrative calculations)*

Size, hectares arable	Increase in productivity	Decrease in labour input	Increase of family's real income per hour				Family income[a]	
				Calculated 1965–76 for a price fall of				
			Observed 1954–65	0.5 % p.a.	1.5 % p.a. alt. a	1.5 % p.a. alt. b	1965	1976 alt. b
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Per cent per annum						Sw.kr. per hour	
2–5	0.7	3.0	0.3	0.5	−0.6	−0.4	1.50	1.50
5–10	3.0	2.8	3.0	2.9	2.0	2.0	3.10	3.80
10–20	3.3	2.5	2.8	3.2	1.9	1.9	4.40	5.40
20–30	3.9	3.1	2.2	2.9	1.6	1.6	5.50	6.50
30–50	4.5	4.2	1.2	2.8	1.3	1.3	6.60	7.60
50–100	6.0	5.8	0.5	4.8	3.1	3.1	8.30	11.70
over 100	7.0	5.8	0.1	6.1	3.5	4.5	13.30	21.70
Mean family income			3.0	5.3	6.4	6.5	3.75	7.50
Average rise in productivity			4.1	6.0	9.0	9.0		

[a] At an agricultural wage of 7.60 and 11.70 Sw.kr. respectively per hour for the two years.

Note: Alternative a – historical trends for real factor prices, i.e. annual changes of +5.3, −0.5 and −0.4 per cent in wages, feed prices and other means of production respectively and a 5 per cent rate of interest.
Alternative b – as for *a* except that wages are assumed to rise by 4 per cent per annum in real terms.

Source: Appendix H.

[5] Our reason for assuming a drop-out of 7 000 per annum instead of the present annual 10 000 is that a trend of 10 000 per annum would in the long run imply an improbable rise in the percentage decrease.

to rise even if prices were to fall by 1.5 per cent per annum, owing above all to a continued rise in productivity. This rise more than counterbalances the fall in prices in most acreage groups. Labour productivity rises particularly fast on the larger farms, namely by 6 or 7 per cent per annum, due to increased net productivity and greater capital intensity. Thus, in spite of an assumed rapid rise in the real wages of agricultural workers by 4 or 5 per cent per annum, our hypothetical calculations suggest that the incomes of large farms may still rise by 3 to 5 per cent per annum. In the case of small farms, on the other hand, this rise would not exceed 1 or 2 per cent.

This faster productivity increase on the larger farms which our calculations of income growth indicate is not, however, borne out by the historical period 1954–65, from which the volume trends are taken. On the contrary, during this period big farmers' incomes rose more slowly than small farmers'. Since all trends except product price movements are the same in both periods, the reason for the big farmers' enhanced superiority must be sought in our assumptions concerning product prices.

This is confirmed by a closer analysis of historical price movements. The main reason for the less favourable historical growth of incomes on large farms is that the real prices of their main products, vegetable crops, have fallen heavily, by about 2 per cent per annum, while the real prices of livestock products, in which the small farms specialize, remained unchanged. Our calculations, however, assumed a uniform reduction in the prices of all agricultural products, the higher rate of productivity increase on large farms would then lead to a more rapid rise in incomes.

This raises the question whether the prices of agricultural products are likely to develop proportionally in future. World market price movements and available forecasts indicate, if anything, that meat and pork prices will rise in relation to food-grain and sugar prices. These tendencies would be accentuated if Sweden made price support uniform for all agricultural products (cf. Chapter 10). Meat and pork production, however, are tending more and more to be concentrated in large units that previously specialized in cereals. This makes it uncertain whether a fall in grain prices would continue to prejudice the growth of incomes on large farms more than on small ones.

Productivity trends apart, there is another factor tending to enhance the future competitiveness of large farms, namely the rapid replacement of labour by capital, which is sharply reducing labour input, especially hired labour, and not least on large farms. The reduction in hired labour will probably be so rapid as to diminish successively the ratio of wage costs to the total cost of production. This means that future wage increases will influence the economic situation of farm less and less. At the same time the prices of other means of production – those which replace labour – are tending, even expressed in real terms, to fall rather than rise. In the long run this works to the advantage of large farms combining labour with large quantities of capital.

Agriculture as a whole will be affected by price reductions through structural change. If, as seems likely, small farms with low productivity and low incomes drop out, the average development of agriculture as a whole will be more favourable than that of individual acreage categories. This is already noticeable from income trends between 1954 and 1965, when average income rose as rapidly as in the category showing the most rapid growth of income (see Table 25, col. 3). Our estimates indicate that the effect of structural change on average income growth is still more pronounced for the period 1965–76. Thus, according to the estimate based on a 1.5 per cent annual reduction of product prices, the average income for all acreage groups rises every year by 2 or 3 percentage points more than in the acreage category whose income is expected to grow fastest (farms of more than 100 hectares arable).

The same applies to the increase in productivity. The various alternative estimates indicate an average rise in productivity at least as rapid, if not more so than in the acreage categories with the greatest increase in productivity. Thus continued structural change on these lines can be expected to accelerate the growth of agricultural productivity. Even if the productivity of individual farms were to rise somewhat less rapidly than hitherto, the productivity of agriculture as a whole may rise more rapidly if the present pace of structural change is maintained. This is because structural change has now reached the stage where continuing closures at the same numerical rate as at present (about 10 000 a year) result in a heavy relative reduction of the small acreage categories that formerly predominated, so that average farm size is beginning to rise more rapidly than it has so far.

Another important point is that a swifter reduction of real prices need not *necessarily* impair the growth of incomes in agriculture as a whole compared with a more gradual reduction. This is illustrated in the hypothetical calculations summarized in Table 25 (e.g. columns 4 and 5), where incomes for the sector as a whole actually rise more rapidly in the event of accelerated price reductions owing to the supposedly more rapid progress of structural change, even though incomes rise more slowly in each individual group. This result is due to our assumption that price movements will profoundly influence structural change. If price reduction in practice had less of an accelerating effect on structural change, its favourable influence on average agricultural income would of course be correspondingly diminished.

Since our calculations indicate that incomes will rise, land values will of course rise, too. Chapter 4 showed that improvements in profitability and incomes are to a great extent capitalized in land values. Now that we have taken the growth of productivity into account, the losses of wealth referred to earlier in connection with an instantaneous price reduction need not occur. On the contrary, land values may actually rise in the case of a continuous – as opposed to a once-and for-all-price reduction.[6]

[6] This has happened e.g. in the USA, where land prices have risen steeply during the last 15 years in spite of a substantial fall in the prices of agricultural products. Thus the real values of agricultural real estate rose by about 3 per cent annually between 1950 and 1965, at the same time as the real prices of agricultural products fell by over 2 per cent annually.

The possible effects of successive price reductions naturally apply only within a certain interval of price changes. Very large reductions would have much the same effect as the instantaneous reductions discussed previously. How large the reduction could be without upsetting our conclusions will depend first and foremost on the rate at which productivity rises in connection with a given price trend.

Thus a reduction of real prices for agricultural products increases the quantity of vacant agricultural real estate in all acreage categories, accelerates the transfer of land and labour to other sectors and speeds up structural change expressed as increased average acreage. The resultant distribution of farms between acreage categories will depend partly on the degree of economies of scale and the relative price movements between agricultural products and factors of production, especially land and labour. Probably most of the farms to disappear will belong, as hitherto, to the smaller size categories. But the number of farms of the larges size may not rise immediately. It may even fall, e.g. if inferior land on these farms is taken out of production. In this case the remaining farms might be concentrated into intermediate groups (e.g. 50–100 hectares). This is the kind of concentration that has occurred in the USA since the war, parallel to a fall in the real prices of agricultural products.

The process whereby depressed profitability produces structural change can be observed in other sectors besides agriculture, as witness the disappearance of small ironworks during the 19th century, the decline in the number of sawmills at the turn of the century, structural rationalization in the textiles industry and the transformation now taking place in the retail trade. But there is an important difference between agriculture and other sectors. In other fields, such as distribution, structural change can be brought about by the emergence of large, efficient enterprises that successively eliminate their less efficient rivals. In agriculture, on the other hand, the less efficient enterprises generally have to give up *before* the large enterprises can be developed, since the latter can in most cases only materialize through the acquisition of land from the former. (Pig farming and poultry are among the exceptions to this rule, i.e. forms of production that do not require large acreage.) If structural change in agriculture is to proceed rapidly, profitability must be sufficiently depressed to induce the majority of enterprises to go out of business. This is the only way in which land can be released on a scale sufficient to provide for rapid structural change.[7]

[7] The 1942 Committee on Agriculture was perfectly aware of these relations between agricultural prices and macro-economic efficiency, judging at least by the following extract from their report: »Thus the framing of supports to agriculture on a short-term basis must always entail a compromise between the desire for such support not to exceed what is necessary for the maintenance of agricultural production of the dimensions desired and for rationalization to be effected as soon as possible and, on the other hand, the desire to help the larg sector of society comprised by the agricultural population to attain a reasonable level of income. In striking this balance care should always be taken to ensure that public support is not given in such a way as to impede the course of rationalization. This can be done by attaching only part of the support to the prices of agricultural products, a certain proportio being disbursed in the form of social benefits to the owners of irrational units and limited to their lifetime.» Riktlinjer för den framtida jordbrukspolitiken (Guidelines for Future Agricultural Policy), *Statens Offentliga Utredningar* 1946:42, p. 132.

THE IMPACT OF PRICE REDUCTIONS ON FACTOR PROPORTIONS

Our next question concerns the effect of price reductions on factor proportions in agriculture. As we saw in the previous section, falling agricultural prices increase the number of farmers who give up, thus increasing the amount of agricultural land on the market, which in turn tends to depress land prices. This seems to imply that land prices will be lower than they would have been if product prices had not been reduced (although, as we saw earlier, land prices might well rise during a period of falling prices). Consequently land prices rise more slowly relative to prices of other factors of production than would otherwise have been the case. This makes land cheaper than other factors of production, making it more profitable to use more land relative to other factors. Thus total land demand will be conditioned by two opposing factors; on the one hand price reduction reduces the demand for all factors of production, on the other hand the demand for land rises in relation to other factors owing to the relative fall in land prices.

In considering the effects of price reduction on *investment* in agriculture – land buildings, machinery and livestock – it is important to distinguish between short-run and long-run effects. The immediate effect is for the profitability of real investments to decline. This is because product prices fall while the prices of real capital are unaffected. Thus price reduction can be expected to limit real capital formation.

Real investments, then, would be inhibited during the acceleration of structural change. If, however, a high rate of structural change can be maintained, which in turn requires a quite considerable depression of profitability within the agricultural sector, the yield of real capital in large units will rise again as land becomes available for increasing the acreage of the individual farm. The point here is that real investments will be more remunerative when individual farms acquire far more land than they hold at present.[8] Thus sustained rapid structural change is essential for efficiency.

In terms of agricultural efficiency, investment in buildings, plant and machinery are best postponed until a fare more rational structure has been established, thus avoiding bad investment on a large scale in small and medium-sized units. From a macro-economic point of view, too, it is best for new investments to be curbed as long as production exceeds the level required to cater for an emergency, and capital in agriculture shows a lower yield than in other sectors.

Limited new investment will make the capital stock less modern and less technologically advanced than it would be if the volume of investment were larger. This may slow down the pace of technological advance in the sector. To correct for this, special measures may have to be taken to accelerate techno logical developments on larger farms.

Thus subsidies may be granted for technological development on individual farms, either in the form of financial assistance for new investment or as regular

[8] As a unit acreage rises the marginal product of land falls while the marginal product of real capital increases.

subsidies to cover the costs of risk-bearing development work, or again as a combination of the two. Another possibility is for grants to agricultural research and experiments to be heavily increased, subject to the express proviso that the funds be used for the development of techniques applicable to large farms.

THE IMPACT OF PRICE REDUCTION ON SMALL FARMERS

Another question concerns the type of labour that will remain in agriculture when profitability declines. As we endeavoured to show in the example in Table 24, a drastic price reduction may inflict such a heavy loss of income on large farms in relation to small ones as to cause certain small farmers to remain on the land at the same time as many big farmers switch to other occupations. Even though a more moderate and successive price reduction can be expected to affect small farmers first and foremost, it is not certain that this will induce them to give up farming. Small farmers tend to stay put, especially when the alternative yield of their own labour and land is low, as is the case with elderly farmers whose land is not wanted for amalgamation. The larger these groups are, the greater the price reduction required to bring about a compensatory rise in the numbers of more mobile categories leaving the sector.

Viewed in macro-economic terms, however, there need not be any disadvantage in elderly small farmers staying in business during a transitional period. According to the principle of comparative advantage, it is more conducive to efficiency for the factors of production with the lowest alternative yield in other sectors in relation to agriculture to stay on the land. Most of the factors of production on small farms with elderly proprietors probably belong to this category.

If, however, the land taken up by these small farms should be urgently needed for amalgamation, the loss of production resulting from the closure of a unit can be more than counterbalanced by the increased efficiency of the unit with which it is merged. In cases like these, even the payment of an early retirement pension to the elderly farmer may be advantageous from a welfare-economic point of view.

Since, as we have seen, small farms are usually characterized by slow productivity growth, and since this should be still more pronounced on farms with elderly proprietors, price reductions may not only cause the incomes of these farmers to lag behind those of other groups but may even result in an absolute decrease. According to Table 22 in Chapter 5, there were in 1966 12 000 small farmers aged between 50 and 66 with an assessed total income of less than Sw.kr. 10 000. Their position may deteriorate still further as a result of price reductions, in addition to which other groups of small farmers may be faced with the same problem. Although, as was shown in Table 24, price reduction will not mean very much in actual cash, since so little produce is sold by these farms, even slight losses of income may be hard for these farmers to sustain, in view of their present low living standards. Consequently the present scale of social

assistance, limited (1968) to grants of Sw.kr. 300–900 per annum (known as temporary grants and acreage subsidies) may prove inadequate.[9]

Price reductions may also involve younger proprietors of small farms in financial difficulties. The reason may be that the farmer has contracted heavy debts or that his training makes it difficult for him to obtain employment elsewhere. In this case, measures to stimulate mobility may be essential, e.g. farm purchase, retraining, aid in connection with moving and other labour market policy measures. Separation grants, e.g. of the kind now available, may also play an important part in helping the farmer to change his occupation.

SUMMARY

In this chapter we have studied the relation between a reduction of real prices and the growth of incomes and efficiency. As we have seen, the incomes of farmers in most acreage categories will continue to rise even if real prices are reduced by 1.5 per cent per annum, given the productivity trends to date. But we have also claimed that a successive reduction of real prices will stimulate increased efficiency in agriculture, above all through rapid structural change. Structural change would be hastened by the release of land in larger quantities, which would also serve to reduce land prices (or retard their increase). In other words, we assume that not all the land made vacant by falling agricultural prices will be removed from the agricultural sector, part of it at least being purchased by other farmers desiring to increase their own acreage. This will serve to mitigate the negative effects of price reduction on farmers' incomes (as we have seen, the reduction of real prices may even have a positive effect on average income in agriculture).

Certain groups may, however, be less fortunate owing to their lack of alternative employment opportunities and the impossibility of making their farms – mostly small ones – profitable. Social assistance may therefore be required to help elderly farmers in this category. The most efficient method of guaranteeing the incomes of the younger members, on the other hand, is probably to ease their transition to other occupations by means of labour market policy measures.

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[9] The possibilities of identifying proprietor groups with low incomes are discussed in Chapter 5, pp. 91–93. It should be added that, subject to certain conditions, farmers now are also eligible for unemployment benefit at a maximum rate of Sw.kr. 800 per month.

CHAPTER TEN

PRICE POLICY IN THEORY AND PRACTICE

An open economy, like Sweden's, can be said in principle to be making efficient use of its resources when domestic production is adapted to world market prices. As we saw in Chapters 6 and 7 if this principle were to be applied to Swedish agriculture, its volume of production will not be sufficient to provide for an emergency. Thus, apart from the objectives of social policy, also involved, some measure of price support will have to be given to domestic agriculture so long as emergency preparedness is one objective.

This chapter is concerned with how price support for this purpose can be arranged at the least possible social cost. As pointed out in Chapter 8, there are three main problems involved: (1) the level of price support, (2) the allocation of this support between different agricultural products, and (3) the way in which support is to be paid, above all the choice between a relatively high and a relatively low price to consumers.

We shall begin reviewing the economic theory on which consideration of these problems has to be based. This will also serve to sketch the theory on which much of the analysis in previous chapters was also based. The empirical consequences of the first question, namely that of the level of price support, have already been examined in Chapter 8. Accordingly this chapter is primarily concerned with the economic consequences of the two remaining questions.

PRICES AND THE ALLOCATION OF RESOURCES: THEORETICAL CONSIDERATIONS

Our analysis begins with an exercise in the traditional theory of international trade, namely the way in which a single country or group of countries can put its given resources (factors of production) to the most efficient use when foreign trade is an alternative to domestic production.

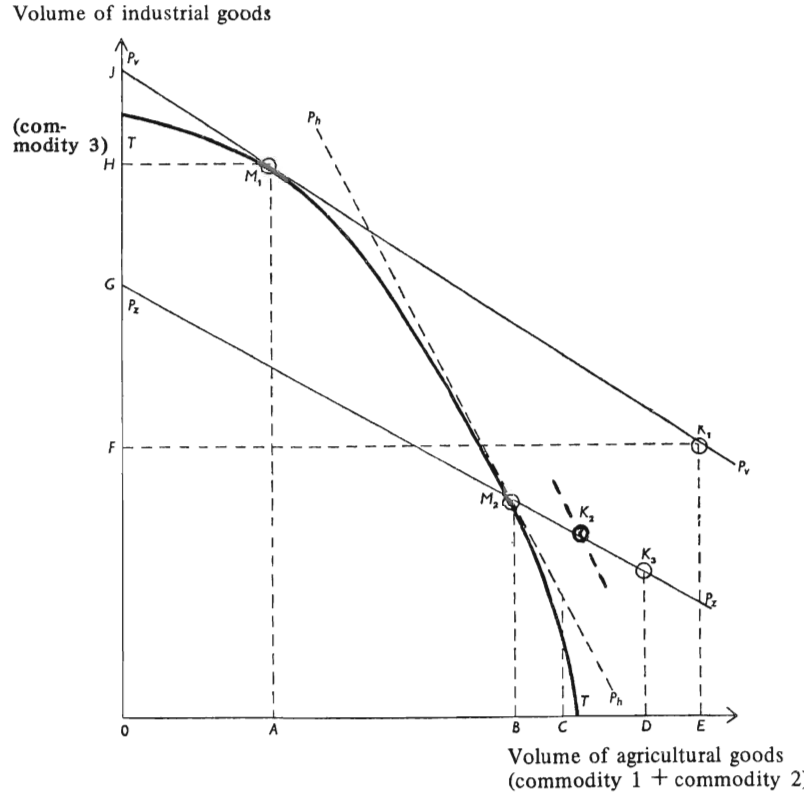
If we assume that Sweden remains outside such customs unions as the EEC, our analysis is applicable to Swedish agricultural and trade policy. If on the other hand Sweden were to become a member of, say, the EEC, our discussion of principles would instead apply to the problems concerning the agricultural and trade policy of the EEC, to which Sweden would then have to adapt. Thus the value of the theoretical analysis does not depend on whether Sweden stays outside the development of the European community or not.

The most practical course will be to base the argument on a simple model. We shall deal first with the relationship between prices of agricultural products and those of other commodities (Section I) and then with the relationship of prices between different agricultural commodities (Section II). To begin with we shall proceed on the simplified assumption that there is only one factor of production, labour, and that neither raw materials nor semi-manufactures are utilized.

I. Assume that three commocities are produced in the economy, e.g. two agricultural products (commodities 1 and 2, respectively) and an industrial product (commodity 3). Disregarding arguments concerning protective tariffs for infant industries and monopolistic price policies vis-à-vis the world market, the optimum course for our country according to the traditional theory of international trade is to adapt the composition of production and consumption to world market prices.

To illustrate this problem, the industrial commodity is shown on the vertical axis of Diagram 18 and the two agricultural commodities, aggregated to a single

Diagram 18. *Optimum price relations in the national economy*



agricultural commodity, on the horizontal axis. Curve TT, known as the transformation curve, shows the maximum possible output of one commodity in relation to alternative output quantities of the other, given a certain endowed quantity of resources. The slope of the transformation curve at a particular point – or rather, the slope of the tangent – shows how much production of one commodity can be increased through reducing output of the other by one unit; this is known as the marginal transformation ratio. The line P_vP_v denotes the world market price relation between the industrial commodity and the aggregate agricultural commodity. The slope of this line shows the quantity of one commodity that must be dispensed with in order to buy one unit of the other commodity on the world market.

Optimum economic adjustment requires that the marginal transformation ratio between any two domestic products be equal to the price relation between them on the world market. Thus optimum composition of production is attained at the point where the price line P_vP_v touches the transformation curve, i.e. at point M_1. This point represents the maximum national product in international prices (the national product measured in industrial products is OJ).

Optimum use of resources is also generally taken to require agreement with consumers' evaluations, expressed by means of households' marginal substitution ratios, which show how many units of a certain commodity consumers are prepared to abstain from in order to increase by one unit their consumption of another commodity. Seen from the consumers' point of view, optimum resource use requires that household marginal substitution ratios between the commodities coincide with the price relation P_vP_v. In the diagram, this is assumed to occur at point K_1, which is thus the point of optimum consumption.

As can be seen from the diagram, production and preferences of households are assumed to be such that free trade would cause Sweden to consume far more agricultural products (volume OE) than domestic production could then profitably supply (volume OA). The agricultural imports thus occasioned (volume AE) would be balanced by industrial exports (volume FH) of the same value.

Assume now that less factors of production remain in agriculture with free trade than would be required to cater for an emergency. Assume further that we have estimated the quantity of factors of production that should be retained in agriculture in order to meet emergency requirements as efficiently as possible. These factors of production are assumed to be capable in peacetime of producing a maximum volume OB of the aggregate agricultural product, corresponding to production point M_2.

We are then faced with the question of what producer and consumer prices should be selected for agricultural products. In order for producers to opt for production point M_2, domestic producers must be confronted with the price relation between industrial and agricultural commodities denoted by price line P_hP_h. This price relation can be attained by imposing tariffs on agricultural products; the size of this protection is shown by the difference in slope between lines

P_hP_h and P_vP_v. Instead of consumption point K_1, consumers will then choose the best possible consumption point on line P_zP_z, which in the diagram is assumed to be point K_2, at the relative price P_hP_h (drawn through point K_2).

But consumers can achieve a better position than K_2 if the state confronts them instead with price line P_zP_z, i.e. if foreign prices are permitted to apply on the domestic market at the volume of production represented by point M_2; (P_zP_z is thus parallel to P_vP_v but is on a lower level since it has to pass through the production point). But this entails confronting producers and consumers with different prices for the same agricultural products, so that price relation P_hP_h determines the composition of production and price relation P_zP_z determines the composition of consumption. A price system of this kind can be realized by support domestic production according to a system known as a relatively low price to consumers, producers being supported, not by tariffs but by production subsidies, e.g. financed by the state.

A relatively low price enables consumers to reach a point of consumption, e.g. K_3 which is preferable to K_2. Point K_3 must be located southeast of K_2, as the relative price of agriculture products is lower in point K_3 (i.e. in the case of »low-price policy») than in point K_2 (i.e. at »high price policy»); if they choose another point than K_3 or K_2 on line P_zP_z this will be because they prefer it to K_3 and, accordingly, to K_2 as well. This shows that a relatively low price is preferred to a relatively high price by consumers (provided the state does not finance the system in such a way as to change relative prices still more to consumers' disadvantage than if the prices of agricultural products had been raised). (Revealed preference proof.)

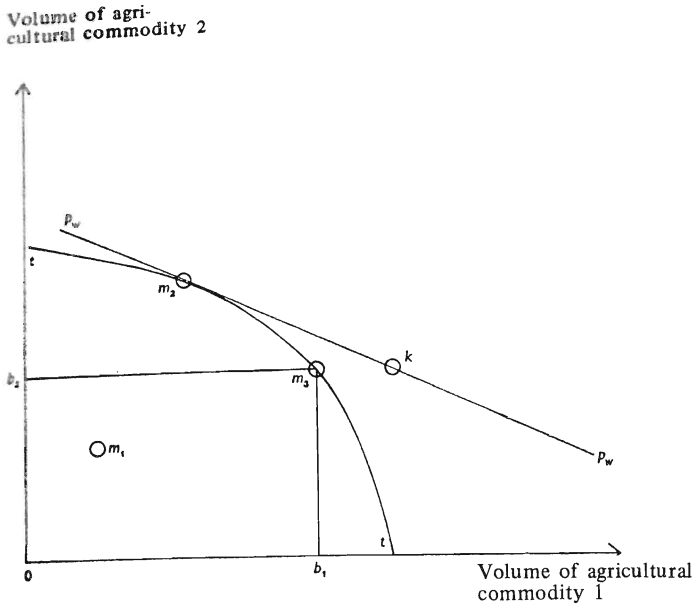
The fall in real income inflicted on society by support to the agricultural sector is shown by the distance between lines P_zP_z and P_vP_v. (Thus the national product, measured in industrial commodities, falls from *OJ* to *OG*.) A low price line limits consumers' losses to this fall in real income; this causes consumption to fall from K_1 to K_3 compared with the free-trade level. A relatively high price inflicts upon consumers the additional welfare loss entailed by the change in relative prices from P_zP_z to P_hP_h; consumption then changes still further, to K_2.[1]

The geometrical analysis made here of the difference between a relatively low and relatively high price to consumers is the same in principle as Diagram 13 in Chapter 6, where we distinguished between a production effect invariably accompanying any form of support for agricultural production and a consumption effect comprising the additional loss of welfare inflicted on the consumer by a relatively high market price.

II. So far we have taken for granted the volume of production, *OB*, produced in peacetime by the resources kept in agriculture for purposes of emergency preparedness. It remains to show how this volume can be determined and to see how it can be optimally allocated between different agricultural products.

[1] This additional welfare loss corresponds to what in the theory of public finance is referred to as the excess burden of a specific tax as against a general tax on consumption (also referred to in Chapter 6 as a reduction of consumers' surplus).

Diagram 19. *Optimum price relations in agriculture*



This problem is illustrated in Diagram 19. The axes show the quantities of the two agricultural products (products 1 and 2). The free-trade production point represented by M_1 in Diagram 18 is matched in Diagram 19 by point m_1, which denotes the free-trade allocation of production between the two products. As we saw earlier, the volume of production at point M_1 would be too small to provide for an emergency, implying that the corresponding amount of factors of production remaining in agriculture would not suffice to meet the requirements in the event of an emergency.

The requirements put on production by the policy of emergency preparedness can be described as follows, in accordance with what was said in Chapter 7.

First we have to determine what quantity of foodstuffs of various kinds would be needed in an emergency. We then compare the costs of storage and domestic production to determine optimum food production in an emergency. Assume that this makes it desirable during an emergency to be able to produce quantities ob_1 and ob_2 of the two agricultural commodities, i.e. production point m_3.

The next stage is to calculate what quantities of factors of production are required in agriculture in peacetime so that it will be possible to produce the optimum amount in an emergency. Naturally, these factors can be used to produce other combinations of commodities 1 and 2. These combinations are determined with efficient peacetime production by the transformation curve tt which goes through m_3.

A further problem is to determine how these factors of production are to be used in peacetime. There is nothing to say that the same point of production in agriculture must be chosen in peacetime as during an emergency. If the world market price ratio between the two commodities is $p_w p_w$, the optimum point of production in peacetime will be m_2 , since the marginal transformation ratio of the two agricultural commodities here is equal to the world market price ratio. The consumers can then choose the point on price line $p_w p_w$ at which their marginal substitution ratio is equal to the world market price ratio between commodities 1 and 2. This point is represented in the diagram by k, corresponding to point K_3 in Diagram 18.[2]

Thus our conclusion would be in favour of keeping the prices of both agricultural products at the same percentage level above world market prices – the principle of uniform price support. But this analysis is based on the assumption that labour is the sole factor of production and that raw materials and semi-manufactures are not employed. We will thus consider the case of more than one factor of production.

To analyze this problem we must bring in explicitly the formation of factor prices. Assume that both agriculture and industry employ two factors of production, labour and capital. If both sectors are faced with world market prices for their products, factor prices will be equal in both sectors in equilibrium. If we assume that both agriculture and industry are profit-maximizing, they will adjust their use of the two factors of production in such a way that the value of each factor's marginal product is equal to its price. This is the optimum allocation of the factors of production between the two sectors from the point of view of the whole economy.

In this case, however, as we saw earlier, factor input and the volume of production in agriculture will both be very small.[3] If for reasons of emergency preparedness agriculture is required to have a larger production capacity than would be the case in the absence of support, the input of labour and capital must be increased. But this will reduce marginal productivities of factors in agriculture (see Chapter 3) and their value, at constant prices, will be less than industrial factor prices. Consequently, in order to retain the quantity of factors of production desired in agriculture for reasons of emergency preparedness, the factors of production will have to be subsidized to such an extent as to make

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[2] Point k in Diagram 19 has been positioned in such a way that there are imports of commodity 1 while commodity 2 is exported. In principle, however, both commodities may come to be imported, as would be evident from a three-dimensional diagram of commodities 1–3. The degree of self-sufficiency measured in calories (peacetime production in calories compared to emergency production in calories) depends both on the calory content of products 1 and 2 and on the point on the transformation curve tt reached in peacetime. The latter in turn is governed by the world market price ratio $p_w p_w$. The more livestock products is decided to produce in peacetime, the lower the degree of self-sufficiency in calories required to cater for emergency requirements.

[3] This situation corresponds to point M_1 in Diagram 18, in which agricultural production is represented by the distance OA.

the value of each factor's marginal productivity plus subsidies equal to industrial factor price.

If there is only one factor of production, this amounts to giving agricultural production a price support that is as large as the subsidy. If, however, there are several factors of production, factor subsidization and price support are not equal, since the allocation of the factors of production between different branches of agricultural production need not be the same in peacetime as during an emergency. Since marginal productivities are influenced by changes in the composition of production, they will not be the same in peacetime and during an emergency either.

Thus, our problem is that a specified emergency preparedness objective is optimally fulfilled by a certain structure of product and factor prices during an emergency, while the retention in peacetime agriculture of the very factors of production required to attain this objective corresponds to another price structure. It is possible to show that, under these circumstances, the optimum subsidies to different factors of production should not be proportional to their peacetime industrial prices. The mathematical proof for this is set out in Appendix J. It is only when the composition of agricultural production is exactly the same in peacetime as during an emergency that it is optimal to subsidize agricultural factors in proportion to industrial factor prices.

Thus the general principle of optimum support to agriculture can be expressed as follows. In order to attain the optimum allocation of resources subject to the restriction of emergency preparedness, labour has to be subsidized at a certain percentage so that the wage paid by the farmer, including the subsidy, corresponds to the wage paid to the industrial worker. Furthermore, capital expenditure has to be subsidized at a different percentage to make capital yield, including subsidies, equal rate in all the branches of production which it is desired to protect.

Since capital and labour are subsidized at different rates, subsidization of the use of factors does not have the same effects as additions to the prices of agricultural products; price support entails the same percentage support of both capital and labour input.

In practice, however, it is probably impossible to differentiate support correctly between the different factors of production (this requires either complete knowledge of the production functions within every branch of agriculture or a prolonged and very unreliable process of trial and error). But if the quantities produced in peacetime do not deviate too greatly from those desired in an emergency, subsidies in proportion to industrial factor prices will be roughly optimal. Since value added comprises the return on the factors of production labour and capital, subsidization of this kind can be directly translated into uniform support of value added. If neither raw materials nor semi-manufactures are used in production, support to value added is the same as support to product prices. Thus uniform support to product prices would, subject to minor changes of production as between peacetime and emergency, be a good approximation of optimal support.[4]

[4] The practical significance of slight changes in production from the point of view of agricultural policy can be seen by comparing columns 3 and 5 in Table 28, p. 165.

Finally, we can introduce the complication of raw materials and semi-manufactures being used in production. If the earlier conclusions regarding uniform support are to remain valid, support must then be based on value added. Translating this support into price support, i.e. support based on product value, raw material and semi-manufacture prices will also have to be altered. This is because, in a system where support is based on value added, the prices of all commodities bought and sold by farmers (excluding durable real capital and labour) have to be increased in proportion to the support. This means that, at the same time as farmers receive a higher price for all the products they sell, they have to pay correspondingly higher prices for all the supplies they purchase, regardless of whether these come from agriculture or industry. In other words, all prices confronting farmers when they buy or sell commodities in connection with farming have to be raised equally. On the other hand, the prices at which industry buys and sells have to remain unaltered. A system of this kind is feasible with the aid of state price subsidies on farmers' sales and taxes on their purchases of supplies.

Using this analysis, the relation between Chapter 7 and the present chapter can be defined as follows. In Chapter 7 we defined the volume of emergency production (point m_3 in Diagram 19) and we also tried to indicate the quantity of factors of production that need to be retained by agriculture in order to produce this volume of the two agricultural commodities, thus defining the transformation curve tt. In Chapter 8 we discussed the price support required to induce this quantity of factors of production to remain in agriculture. Thus we attempted to determine the producer price relation P_hP_h in Diagram 18. Later in this chapter we shall indicate the relative prices of various agricultural products that are required in order to attain the optimal point (m_2) on the transformation curve tt; in other words, we shall endeavour to determine price line p_wp_w.

PRINCIPLES UNDERLYING PRESENT SWEDISH PRICE POLICY

We have found that, according to traditional theory and taken as an approximation, the optimum domestic policy from a welfare-economic point of view in peacetime is to apply the same price relations between different agricultural products and supplies as on the world market, even if the general level of agricultural prices, for reasons of emergency preparedness, is to be kept above that of the world market.

We also concluded that, from the consumer's point of view, a low price policy would be preferable to a high price policy (i.e. a relatively low (high) price to consumers). It now remains to compare our conclusions with the price policy that has actually been pursued.

When the principles of present price relations were determined as the median price system was introduced in 1956, the economic arguments in favour of adapt-

ing the prices of agricultural products to world market price relations were fully realized.[5] In practice, however, considerable departures have been made from this principle. Prices have been permitted to rise on commodities for which there was an excess demand on the market, i.e. commodities for which domestic consumption has been greater than domestic production. On the other hand, more restraint has been shown in raising the prices of commodities showing a domestic surplus. This policy largely reflects efforts to burden each commodity with its own export losses by means of price controls. These deviations from the principle of uniform price support have resulted in relatively high price supports for products such as sugar and beef, while price support has been relatively low in the case of typical surplus products such as butter and pork. Feed prices have been kept as low as possible with a view to minimizing costs in agriculture. All this has given the agricultural sector a price structure considerably different from the principles of uniform price support.

It should be noted that in speaking of price support we include tariffs and other forms of price support such as state milk price subsidies. As will be seen from Table 26, the differences in tariffs and total price support between agricult-

Table 26. *Price support and import tariffs, 1960/61 and 1966/67*

	Percentage of world market price				
	1960/61		1966/67		Sept. 1970
Commodity	Import tariff	Price support	Import tariff	Price support	Import tariff
Wheat	70	65	128	87	220
Food potatoes	55	20	111		99
Sugar	65		182		94
Winter rape		50		44	
Edible oils	70		75		96
Producer milk[a]		85		93	
Cheese	75		80		103
Butter	30		39		105
Beef	40	30	85	68	84
Pork	30	10	44	9	58
Eggs	40	55	95	127	188
Feed grains		25		68	
Oil-cakes	15		9		30
Average	45	50	79	63	94

[a] The price support calculated for producer milk is uncertain owing to the difficulty of determining the world market price for the quantities (about 40 per cent) used for perishable foods not traded on the world market such as consumer milk and fresh cream.

Source and method of calculation: Appendix L.

[5] Prissättningen på jordbruksprodukter (Pricing of Agricultural Products), *Statens Offentliga Utredningar* 1954:39, p. 165.

ural products are numerically considerable; thus in 1966/67 the tariff on sugar was 182 per cent as against 9 per cent on oil-cakes.

Uniform price support tends to result in domestic surpluses of certain commodities and domestic shortages of others. This, however, is a sign of the comparative advantages of the country for the surplus commodities as opposed to the commodities in short supply. Thus a policy aimed at reducing the prices of commodities in excess supply relative to the prices of commodities in excess demand results in the very autarchic tendency mentioned earlier, i.e. an evening-out of the relative self-sufficiency of different commodity sectors, thus making the economic costs to society of emergency food supplies greater than necessary.

The same conclusion applies to the prices of commodities mainly processed within the agricultural sector. Thus the policy of maintaining a lower price support for feed than for agricultural final products favours animal products at the expense of feed production. In this way the output of animal products and feed imports tend to be economically excessive.

RELATIVELY HIGH AND RELATIVELY LOW PRICES TO CONSUMERS

Agricultural price policy in Sweden has so far adhered mostly to the high price policy, the domestic market prices of agricultural products being kept above world market prices by means of import regulations. The alternative is to follow the example of Great Britain by adopting a policy of relatively low price to consumers. A policy of this kind could be drawn up in various ways. One possibility, based on the principles embodied in the British system, is for the producer to receive a higher price than is actually paid by the purchaser, the difference being supplied by the state in the form of producer subsidies. This form of low price policy may be considered, e.g., when the volume of domestic agricultural production is to be kept at a certain level for reasons of emergency preparedness. In this case price formation in the processing and distribution sectors will in principle be governed by world market prices.

Another version of the low price policy is for support to take the form of income increments (direct transfers). If these are made proportional to the sales or value added of farms they have the same effect as producer subsidies. Yet another possibility is for the income increment to be made independent of the farmer's production. In this case farmers as well as consumers will be confronted with world market prices. This procedure is mainly to be considered when, for reasons of social policy, the incomes of the farming population are to be bolstered without necessarily stimulating production. Even here, however, the volume of production will in fact be greater than otherwise, since any form of income support to a given sector will tend to stimulate its production capacity.

Irrespective of whether a high or low price policy is chosen, support to agriculture is bound to entail a reduction of the real income of society. If, however, the high price policy is chosen, the consumer, as we have already seen,

suffers an additional welfare loss through the rise in food prices in relation to those of other commodities. Another difference between high and low price policies lies in their distribution of income between different consumer groups. A rise in the consumer prices of agricultural products will be felt particularly seriously by low income groups, since their food purchases make up a larger proportion of their consumption expenditure than in the case of higher income groups. Thus a high price policy on foodstuffs, compared to a low price policy, implies a redistribution of real incomes to the disadvantage of low income groups.

As we saw in the introductory chapter, market controls have been imposed on most agricultural products, especially milk, fats and grain, to supplement tariffs and so guarantee the prices of these products with a high price policy. Import levies serve to screen off the domestic food processing industry from foreign competition. On the one hand, the competitiveness of the protected industry on the world market is impaired by increased raw material prices. (Export subsidies and import duty refunds have, however, been used to mitigate these problems.) On the other hand, tariffs on final products limit foreign competition on the Swedish market. This tendency is accentuated by the market controls which have been developed in connection with the high price policy. These controls have also had the effect of inhibiting competition between domestic food-producing and distributing enterprises.

Owing partly to increased processing of food, agricultural products are accounting for a diminishing proportion of the total value of food consumption. At present they can be said to comprise about 30 per cent of food consumption and about 50 per cent of the consumption of foodstuffs based solely on domestic agricultural products. In this way import levies and market controls on agricultural products are affecting production conditions for an increasing proportion of food production outside the agricultural sector. A low price policy, on the other hand, would confine interventions in price and income formation to agriculture, instead of affecting a large part of the food processing industry in general. In this way restrictive market controls could be avoided. The increased competition, not least with other countries, that would result from the application of a low price policy to the food processing industry and distribution would stimulate structural rationalization within these branches. But even if the high price policy should continue, greater competition could be achieved within the food processing industry if Sweden were to join a larger trade block, such as the EEC, with uniform prices on agricultural products.

As observed in the introductory chapter, the most important reasons why tariffs within the present high price policy have been supplemented by market controls are:

(1) to prevent domestic surpluses depressing prices,
(2) to create a domestic market for products which, despite import levies, are still incapable of competing with foreign products (oil seeds, sugar, grain), and

(3) to bolster farmers' incomes by means of monopolistic price differentiation (milk controls).

Only the first of these three reasons is a necessary consequence of a high price policy. The second is due to import levies being too low to detract foreign competition, while the third is purely a matter of farm incomes policy.

Since a low price policy means that world market prices apply in the country, domestic surpluses do not depress prices, nor do differences of quality between products make it difficult to find markets at home, since the price of each quality is determined by the market. Thus a low price policy does not necessitate the kind of market controls required under a high price policy. On the other hand, both high and low price policies can be accompanied by difficulties in finding foreign markets if exports of domestic surplus production are met by quantitative trade restrictions abroad or other imperfections on the world market. This may cause the price of marginal production to fall to nil. Following the principle of uniform price support, one would, in cases where a surplus showed signs of becoming permanent, reduce the support given to such a product to keep output within the limits of what can be sold at current world market prices.

An example from the dairy industry will serve to show how the adoption of a low price policy would affect market conditions. The domestic retail prices of butter, cheese and dried milk would be governed by the world market. The price of consumer milk, given competition, would be such that domestic profitability would be equal to the profitability of milk products traded on the international market. Thus, milk prices would be determined in the same way as, say, the prices of pulpwood and saw timber at present. Restrictive practices such as refusals to delivery and cartels aimed at a monopolistic price policy would be the concern of industry and the Restrictive Practices Commissioner and would not be a necessary part of agricultural policy. The milk sold by farmers would be credited according to what the dairies can afford to pay in view of its receipts for milk products. Apart from this credited price farmers would also receive a state subsidy in the form of a price or income subsidy. Together the credited price and the subsidy comprise the total return that determines the farmer's output.

What would then a consistently pursued low price policy, adapted to required emergency preparedness, involve? Such a policy would, as previously mentioned, mean that world market prices determined the level of agricultural prices in the country, and that these prices affected both consumer and producer prices. Agriculture would purchase raw materials at world market prices (which would, however, be taxed under a policy of price subsidies) and the food processing industry would purchase raw materials from agriculture at world market prices. At the same time, however, both agriculture and the food processing industry would

have to sell their products competitively at world market prices (or at prices which they can obtain in competition with products from abroad of corresponding quality).

ALTERNATIVE METHODS OF A LOW PRICE POLICY

In designing price support to agriculture, there are two main problems to consider. One has already been discussed, namely the choice between high and low price policies. The second concerns at what point in the production process support should be applied – the farm, some stage of processing. or the distribution network for final consumer products. A high price policy would have to entail support at the stage where foreign trade occurs, e.g. raw sugar, slaughtered animals, cheese and butter. A low price policy, on the other hand, leaves one free to apply support at any point. Thus it may be attached to farmers' deliveries of, say, sugar beet, livestock and milk. It need not even be attached to specific products; instead it may be related to the farmer's income or the total value of the farm's output. Thus, a low price policy can assume many different f forms. Here we shall consider two alternatives, termed the method of income subsidies and the method of price subsidies respectively.

The main principle of the method of income subsidy is that the state pays farmers a sum in cash related to the total value added of each farm but not to any particular product. To prevent this method viviating the principle of uniform price support for different agricultural products, the income subsidy must constitute a given percentage of the added value of agricultural products, i.e. a certain percentage of the difference between the proceeds of agricultural products and the cost of purchasing raw materials, semi-manufactures and services (but excluding wages to hired labour).[6]

The administrative side of this method can be managed through the ordinary machinery of taxation. The income tax returns already made by farmers contain all the information that is needed to calculate such an income subsidy.[7] One side effect would be to reduce the incentive to under-rate one's receipts.

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[6] If on the other hand support were attached to the farmer's gross output (turnover) of agricultural products, branches of production in which agricultural raw materials are processed (e.g. pork production) would receive more support than other branches.

In the theory the same result can be obtained by taxing the value added of other sectors more than that of agriculture, instead of subsidizing the value added in agriculture.

[7] Net production is then calculated as the sum of the sales receipts for agricultural produce and of produce used within the household minus the cost of seed, feed, livestock, fertilizer, fuel, power and other supplies and services purchased by the farmer.

This method involves a delay of just over a year between production and payment. This is primarily of consequence to newly established farms. But farmers wishing to avoid the delay might obtain a preliminary payment of their income subsidy based on the preliminary tax returns that can be submitted by certain categories of taxpayers.

One weakness of this method lies in the effect on producer prices of short-term price fluctuations on the world market. These upset production planning and impede the growth of specialized farms. These fluctuations can, however, be compensated by means of »price locks», e.g. in the form of import levies in the event of heavy falls in prices and import subsidies to deal with steep rises. For practical reasons, action of this kind would presumably not be taken until price fluctuations exceeded a certain limit in relation to long-term price trends (as hitherto observed).[8] This method also presupposes a reasonably reliable measurement of long-term price trends. The method most commonly used at present, that of multiannual moving averages, lags considerably in its indication of long-term tendencies when prices tend to rise or fall. We have therefore studied various alternatives for obtaining more up to date information. A more detailed description of this study is given in Appendix L. The results suggest that estimates based on linear regression of the past 6–8 years may provide an acceptable assessment of the long-term price for a given year.

The principle of *the method of price subsidies* is for the state to pay the farmer a producer's subsidy for each individual product, over and above the market price he receives. If the principle of uniform price support is to be applied, price subsidies, calculated as a percentage of world market prices, must be the same for all products. Moreover, as we saw earlier, farmers' purchases of supplies and services will have to be taxed. This method can also shield the farmer from short-term price fluctuations on the world market. This is done by varying the price subsidy in inverse proportion to price fluctuations.

Another problem concerns the financing of a low price policy. We shall assume that support to agriculture in conjunction with a low price policy is to be paid by the state out of taxes. This would mean that agricultural policy was financed along the same lines as other emergency preparedness and social policies. If, on the other hand, a high price policy is adopted, prices are raised by tariffs in a way which, from the consumer's point of view, resembles an indirect tax, although it is not included in the budget. The switch to a low price policy entails replacing this indirekt tax with some other tax, e.g. income or turnover tax, which appears in the state budget.

A change of this kind need not imply any increased burden on consumers in general, but a redistribution of income between different consumer categories will take place. If the low price policy is financed by means of turnover or income tax, income will be redistributed in favour of low-income earners, owing – as we saw earlier – to the preponderance of food expenditure in the budget. Thus, the change will bring about a more equal distribution of income. One can say that price controls which represent a regressive specific tax from the consumer's point of view are replaced by a proportional or progressive tax. Since a low price policy means including support to agriculture in the state budget, together with other expenditure items, support to agriculture is bound in the

[8] Short-term price fluctuations are dealt with in this way in the present price system, where, however, long-term fluctuations are also eliminated by the principle of not adapting median prices to long-term price movements in the world market.

normal course of budget negotiations to be balanced against other objectives. The redistribution of income resulting from a switch to a low price policy financed by turnover tax would raise the real incomes of low-income earners by one or two per cent.[9]

The adoption of a low price policy can also affect the distribution of income within the agricultural sector. The actual effects will depend on the way in which support is given. The elements of a low price policy in the present price system have mostly applied to milk, which is a predominant source of income for small farmers, and have in other respects, too, been designed to support small farmers, especially in the north. If the principle of uniform price support were to be applied, the distribution of income in agriculture would have to be steered by other means than the price relations of different agricultural products.

We have here considered three different methods of maintaining farmers' incomes – tariffs, income subsidies, and price subsidies. Another possibility would be for the state to regulate agricultural production directly, e.g. through acreage limitations (such as a soil bank). But this method will not work in isolation in an economy with free foreign trade; it has to be combined with tariffs (or import levies) or with quantitative import restrictions.

All four methods call for government financial measures. A comparison of the budgetary consequences of the various methods is given in Appendix K, in which a study is also made of the effects on consumers' food expenditure. The analysis indicates that direct income support will increase farmers' incomes more compared to expenditure by the state and consumers than tariffs and price subsidies would. The relation of the increase in farmers' incomes to the additional expenditure incurred by the state will depend on the size of supply and demand elasticities and on the extent to which prices are increased. The greater the elasticity of demand in relation to the elasticity of supply, the lower the cost to the state of using tariffs as opposed to price subsidies (if price subsidies are taken so far that all production is marketed at home). Cash payment is invariably cheaper than price subsidies and – given very small supply and demand elasticities – tariffs.

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[9] According to the 1958 consumption survey, consumption of agricultural products in the form of raw materials and semi-manufactures amounted to 19.8 per cent of the total consumption of households with incomes of less than Sw.kr. 5 000 a year. The corresponding figure for all households was 13.6 per cent. The corresponding percentages for agricultural final products were 9.0 and 7.0. Assuming that the farm value of these two groups of products comprised 60 and 30 per cent, respectively of their consumption value, the farmers' share of the receipts of the consumption value of the two groups of households amounts to (19.8 x 0.6 + 9.0 x 0.3 =) 14.6 and (13.6 x 0.6 + 7.0 x 0.3 =) 10.2 per cent. The proportion of consumption value comprised by state price support is obtained by multiplying these figures by the expression $p/(100+p)$, in which p is price support expressed as a percentage. If p is put at 70, the share of state price support in consumption value is 6 and 4.2 per cent, giving a difference of 1.8 per cent.

The fourth method, production control, calls for an elasticity of demand less than 1 if the control is to raise the total receipts of farmers. In the event of steep price rises, however, elasticity of demand must be far less than 1 in order for total receipts to increase; the more prices are to be increased, the smaller the elasticity of demand must be in order for incomes to rise. In this case the costs incurred by the state will largely depend on how much farmers have to be paid to limit their production. One problem of price controls via acreage restrictions, e.g. in the form of a soil bank, is that farmers are encouraged to intensify production on the remaining acreage, so that acreage has to be reduced more than would otherwise be necessary to attain the desired limit on production.

PRICES IN AN »OPTIMAL» PRICE SYSTEM

So far we have discussed the principles of a price system for agricultural products in which the general level of agricultural prices is adapted to suit the emergency objective and the price relations of different products are determined by the principle of uniform price support. A hypothetical calculation of the actual prices that might apply to various agricultural products if such a price system were put in practice could be instructive. We shall calculate both consumer and producer prices according to high and low price policies, assuming that the prices of agricultural supplies are raised by taxation to the same extent as product prices. The prices thus calculated will then be compared with current domestic prices as well as world market and EEC prices.

The estimates in Table 27 are based on conditions with controls in the year 1966/67. World market prices are shown in column 1, domestic producer prices in column 2 and the producer prices that would apply without support to agriculture in column 3. Columns 4 and 5 show the estimated prices applying in the event of uniform price support, either at the current rate (column 4) or reduced by 15 per cent, this latter being the level which according to our estimates would be required to guarantee long-term emergency preparedness (column 5). EEC producer prices are shown in column 6.

As can be seen from the estimates, uniform price support causes relative price to deviate considerably from the present-day pattern in several respects. The biggest differences concern pork, which would become far dearer, and sugar, the price of which would fall so heavily as to reduce sugar beet prices to nil after manufacturing costs had been met. If we also reduce the general price level to what is required for purposes of emergency preparedness (column 5), sugar beet and eggs would register the greatest price reductions of all. Milk and wheat prices would also fall relatively heavily.

If EEC prices came to apply on the Swedish market instead, producer prices would fall by an average of 7 per cent. This fall is mainly confined to animal products, while vegetable product prices would remain much the same. On the

Table 27. *Calculated prices with alternative price systems (based on conditions in 1966/67)*

Commodity	Producer prices						Consumer prices		
				uniform support at				at 15 % lower level of support	
	Import prices	current (63% price support)	at world market level	unchanged level (79 % price subsidy)[a]	15% lower level (52% price subsidy)	EEC prices	current	high price policy, uniform support	low price price policy[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Öre per kg.								
Wheat	30	56	28	50	43	57			
Wheat flower							139	117	88
Food potatoes	–	30	18	32	27	26 6	77	71	58
Sugar beet	11	0	0	0	11				
Sugar	45						159	113	78
Winter rape		85	59	106	90	87			
Edible oils	153								
Margarine							397	400	307
Producer milk	–	54	28	49	42	49			
Consumer milk	–						105	99	68
Cheese	334						1 048	1 047	797
Butter	495						714	912	530
Beef	373	627	413[d]	740	629	553	1 221	1 201	922
Pork	438	465	428	767	652	465	1 085	1 240	910
Eggs	245	352	155	278	236	322	609	604	418
Broilers	570	500	300	538	457	383	950	1 122	683
Feed grains	30	49	28	54	46	43			
Oil cakes[c]	66	71		118	101	66			

[a] This percentage is higher than the current price support because uniform price support involves the taxation of agricultural supplies, so that an unchanged level of support requires a higher product price subsidy.

[b] Assuming that the low price policy is financed with a general sales tax of 1.9 per cent (yielding a revenue of 1 100 million Sw.kr.), and a 52 per cent tax on farmers' purchases of supplies (revenue: 730 million Sw.kr.), giving a total revenue of 1 800 million Sw.kr., estimated to cover the funds required for uniform price support at 15 per cent below the current level, corresponding to a subsidy of 52 per cent.

[c] Price of soyaflour to buyers who use the goods for their own production.

[d] Because the value of side products exceeds the slaughter cost, the producer price for beef at world market level will exceed the import price.

Source: Appendix L.

other hand, the fall in animal product prices would to a certain extent be counterbalanced from the point of view of profitability by a fall in the prices of feed grains and oil plants (cf. columns 6 and 2). Means of production are subsidized to a certain extent within the EEC in connection with state rationalization. Summing up, we can say that price relations between final products within the EEC reflect more or less the same autarchic objectives as in Sweden, at the same time as feed production in Sweden receives rather less support.

Consumer prices resulting from uniform price support are compared in Table 27 with current prices. Two alternatives are given, one for a high price policy and the other for a low price policy, both of them at the lower level of support. As regards the low price policy, we have assumed that agricultural support is financed by means of an increase in general turnover tax. The tax levied on purchases of agricultural supplies in accordance with the principle of supporting value added (see p. 154) can also help to finance the price subsidies on agricultural products. The size of the two taxes is determined by the level of price support.

The adoption of uniform price support is bound to change consumer prices in the same direction as producer prices, though in some cases consumer prices may be reduced more. This is because protection has not been efficient as regards certain products in excess supply and in cases where export losses in the present system are financed by means of internal charges; as a result, domestic producer prices have been lower than the sum of world market prices and import levies. The reverse will apply to certain other products, i.e. consumer prices will not fall as heavily as producer prices. This is especially true of sugar and to a certain extent of milk, since, as we have seen, price controls contain an element of the low price policy in regard to these commodities.[10] The consumer prices of all agricultural products should fall by an average of 25 per cent including tax.

THE EFFECTS OF ALTERNATIVE PRICE SYSTEMS ON FOOD DEMAND AND SUPPLY

What effect would these calculated prices exert on domestic production, consumption and foreign trade? We have tried to illustrate this by means of schematic estimates based on assumed price elasticities. Owing to the difficulty of obtaining reliable measurements of producer and consumer price reactions, these estimates are rather uncertain and should be interpreted with reservations. In view of the considerable changes of volume involved, at least for an assumed reduction of production to the level required to meet an emergency, there is

[10] In the case of sugar, import duty revenues are used to keep consumer prices lower than the sum actually corresponding to the support given to domestic sugar producers. Certain price subsidies for milk are included in the budget, though it has been decided to abolish these by 1970.

bound to be a transitional period lasting several years. We have not made any allowance for the changes of productivity, factor prices and household preferences that might occur during such a period. The estimates should therefore not be regarded as forecasts of future development but rather as calculations to illustrate the effects of certain hypothetical changes in the price system. The results set out in Tables 28 and 29 are best regarded as long-term equilibrium

Table 28. *Production under alternative price systems (hypothetical calculations)*

Commodity	Production at current prices 1966/67 (1)	high price policy, uniform price support at unchanged level (2)	low price policy, uniform price support at emergency level (3)	EEC prices (4)	production envisaged during a blockade (5)
	Millions of kg				
Bread grain	470	442	290	483	400
Potatoes	900	955	627	812	650
Sugar beet	1 500	0	0	1 464	0
Oil seeds	100	132	87	113	160
Milk	3 390	3 476	2 283	3 231	2 200
Beef	182	174	114	162	110
Pork	223	445	292	242	260
Poultry meat	22	23	15	18	10
Eggs	91	71	47	87	55
Protein					
animal	183	205	134	175	128
total	227	248	163	218	163
	1 000 billions				
Harvest units	8.7	9.8	6.4	8.4	6.4
Kg calories	6.7	6.8	4.5	6.6	4.9
	Billions of Sw.kr.				
Volume[a]	5.2	6.0	4.0	5.0	
Value[b]	5.2	7.4	4.1	4.7	
	Per cent				
Support, average	63	79	52	58	
Degree of self-sufficiency					
Volume	98	108	79	103	
Calories	81	80	48	80	
Protein					
animal[c]	147	162	96	133	
total	126	136	83	117	

[a] In 1966/67 prices.
[b] In the prices calculated for the price system.
[c] Incl. protein in skim milk from butter production.
Source: Appendix L.

solutions on the assumption of ceteris paribus.[11]

The level of production arrived at in the hypothetical estimates is compared in Table 28 with the present level of output. It will be seen that sugar beet cultivation would be abandoned entirely if uniform support were introduced, since the fall in sugar prices would be so drastic as to rule out any domestic production. No matter what average price level was chosen, the main emphasis of production would be transferred from vegetable to animal products. If we assume that the composition of output is governed by the relative prices of different products, oil seeds will fare best and bread grain worst (next to sugar beet) as far as vegetable products are concerned. Among animal products, pork production would fare best and egg production worst.

The adoption of uniform price support at the same level of support as previously would probably lead to a rise in production, measured either in domestic or in international prices, since the resources in agricultural production would be put to better use in terms of their comparative advantage in different branches of production, thus increasing both productivity and the value of output. This productivity gain in turn increases the demand for factors of production, causing output to rise still further. Allowance has been made for this effect in the estimates by assuming that the total volume of production reacts to changes in price levels according to the elasticity figures given in Chapter 8. According to the results in Table 28, the total volume of production would rise by about 15 per cent if uniform support were introduced and the present level of support retained.

On the basis of our estimates in Chapter 8, we have assumed that a 15 per cent fall in prices would in the long run cause plant production to fall to the level required to meet an emergency. The total volume of production would then fall by 1/4 and calory production by 1/3. This would reduce the peacetime degree of self-sufficiency, measured in calories, by almost 50 per cent, without reducing emergency requirements. The main reason for this low self-sufficiency in calories is to be found in the elimination of sugar production. A comparison of columns (3) and (5) in Table 28 indicates the extent to which emergency requirements are fulfilled by individual products. It will be seen that production need not be reorganized to any great extent in an emergency. The adjustment indicated by the calculation is mainly concerned with an increase in bread grain and oil seed production at the expense of pork production.

The adoption of EEC prices would not occasion any considerable reorganization of current production. Food supplies would remain fundamentally the same in spite of a 7 per cent reduction of support, above all because cheaper feed would help to counterbalance the reduction of the support to animal production. As regards individual branches of production, the most significant changes would comprise a certain fall in the production of milk and beef and a rise in pork production.

[11] A detailed account of the methods of calculation will be found in Appendix L.

Table 29. *Consumption and trade balance under alternative price systems (hypothetical calculations)*

Commodity	Current prices 1966/67		High price policy, uniform price support at unchanged level		Low price policy, uniform price support at preparedness level		EEC prices	
	Consumption	Balance[a]	Consumption	Balance[a]	Consumption	Balance[a]	Consumption	Balance[a]
	Millions of kg.							
Flour	495	−175	495	−155	495	−272	495	−123
Potatoes	910	−10	910	45	910	−283	910	−98
Sugar	340	−130	404	−404	484	−484	344	−139
Margarine	125	−85	137	−84	144	−109	142	−97
Butter	66	7[d]	52	23[d]	61	−58[d]	48	10[d]
Total edible fats	191	−78	189	−61	205	−167	190	−87
Consumer milk	1 380	0[d]	1 411	0[d]	1 611	0[d]	1 522	0[d]
Cheese	64	0[d]	64	0[d]	80	0[d]	66	0[d]
Beef	165	17	176	−2	185	−71	172	−10
Pork	198	25	196	249	186	107	195	47
Poultry meat	22	0	20	4	28	−12	24	−7
Total meat	385	42	392	251	399	24	391	30
Eggs	92	−1	92	−21	99	−53	93	−6
Protein								
animal	124	59[e]	126		140	−6[e]	131	44[e]
total	180	47	182		196	−33	186	
	1 000 billions of kg. calories							
Calories	8.3	−1.4	8.5	−1.7	9.2	−4.8	8.3	−1.7
	Billions of Sw.kr.							
Volume[b]	5.3	−0.1	5.3	0.7	5.7	−1.7	5.3	−0.3
Value[c]	5.3	−0.1	5.6	1.8	5.0	−0.9	4.9	−0.2

[a] Positive numbers = surplus, negative numbers = deficit.

[b] In 1966/67 producer prices.

[c] Calculated in the producer prices on which the calculations for each column were based.

[d] For technical reasons, surpluses and deficits of milk products are expressed in the volume of butter.

[e] Incl. protein in skim milk from butter production.

Source: Appendix L.

In order to assess the effects on consumption of changes in agricultural prices, a distinction must be drawn between high and low price policies. We have calculated retail prices for a low price policy by deducting import and compensation charges from present retail prices.[12] We then calculated the composition of consumption on the basis of our estimates of price elasticities. The results are shown in Table 29, which for purposes of comparison also includes present consumption.

It will be observed that consumption of several agricultural products will increase if a low price policy is adopted. Since, however, the real disposable income of households will be much the same whether a high or low price policy

[12] This presupposes that costs and margins in domestic distribution, expressed in absolute figures, remain unaffected. The percentage increment within distribution would then rise.

is adopted, this increase would merely occur at the expense of other commodities. Consumption will rise particularly steeply in the case of products such as sugar, milk and cheese, whose prices fall relatively drastically. Since the price of margarine falls more than that of butter, consumption of edible fats would tend to centre more on margarine, just as beef for similar reasons would become a more conspicuous item of meat consumption.

A high price policy at the same level of support would cause consumption of agricultural products to rise somewhat if uniform price support were adopted. The increase would apply to sugar, milk and beef. The adoption of EEC prices would not have any significant effect on consumption, owing to the small percentage change in consumer prices that this would entail.

The authorities might find it desirable for nutritional reasons to obtain a different pattern of consumption from that which we have calculated. This can be done by imposing specific taxes on commodities which are thought to be consumed in quantities detrimental to the public health, possibly in combination with subsidies on other products.

Table 29 also contains balances between production and consumption for different products. These balances express the size of foreign trade if food stores are kept constant year by year. The greatest change in foreign trade occurs when a reduction of price support is combined with the introduction of a low price policy. Imports would then rise considerably in the case of sugar, edible fats and bread grain. Beef and eggs would also come to be imported in large quantities. Pork is the only product which is likely to retain an export surplus.

The estimates in Tables 27–29 are based on the assumption that world market prices are given, i.e. unaffected by Swedish imports and exports. As we saw in Chapter 2, world market agricultural prices would not be significantly affected even if Sweden were to cater for all its consumption requirements of agricultural products – apart from such products as potatoes, cheese and butter. This means that the reduction of domestic self-sufficiency calculated in Tables 27–29 – a rise in import requirements by about 20 per cent of the volume of consumption, i.e. over Sw.kr. 1/2 billion, expressed in import prices – would have no significant effect on the world market prices of all these products. Sweden's consumption of sugar and bread grain – the imports which would rise most – is only a small proportion of the world market. Thus domestic production can be planned without making special allowances for the effects of our imports on world market prices.

As already emphasized, the estimates presented here are to be taken as hypothetical calculations designed to illustrate probable changes in production and consumption resulting from a revision of price policy. In spite of the difficulties of making realistic quantitative estimates of this kind, we considered it worthwhile to quantify our arguments of principle concerning the importance of the price system. We hope that the *magnitude* at least of the effects we have deduced will prove correct.

APPENDIX A

MEASUREMENTS OF PRODUCTIVITY

BY ODD GULBRANDSEN

This appendix contains a theoretical section on suitable measures of productivity for comparisons of productivity within agriculture and between agriculture and other sectors, together with a description of the data and methods of calculation on which the comparisons have been based.

The following will be employed:

Q = volume of production
D = inputs, excluding capital goods, from other sectors
A = depreciation and maintenance of real capital
L = volume of labour
C = real capital input
G = value added
T = technology factor.

The volume of production Q is determined by the production technology used and by the inputs of the various factors of production. This can be written in the form of a production function

$$Q=f(L, C, D). \tag{1}$$

The function f is determined by the production technology employed. Various productivity concepts will be defined in connection with this function. The average productivity of a factor is defined by

$$AP_L = \frac{Q}{L} \tag{2}$$

$$AP_C = \frac{Q}{C}. \tag{3}$$

The marginal productivity of a factor is defined by the derivates

$$MP_L = \frac{\partial Q}{\partial L} \tag{4}$$

$$MP_R = \frac{\partial Q}{\partial C}. \tag{5}$$

The marginal productivities thus show how the volume of production changes with reduced or increased factor input, while the average productivities show the volume of production per unit employed of the factor in question.

Marginal productivities (which are of considerable theoretical interest) are, however, difficult to estimate empirically, and are therefore often approximated by average productivities in studies of productivity growth.

In empirical studies the volume of production is often measured by value added, i.e. total production minus inputs from other sectors. This is because value added tells us to what extent the enterprise or sector in question has processed the semi-manufactures and raw materials received by it. The value of final products, on the other hand, includes the value of semi-manufactures and raw materials not produced by the enterprise or sector.

For the same reason it can sometimes be advisable to use the net value added, which is derived by subtracting depreciation and the maintenance of real capital from gross value added; for the production of finished goods also entails wear on machinery, buildings, etc., something which should be taken into account in productivity estimates.

When comparing the productivity of different sectors or groups of enterprises using different proportions of raw materials and real capital, the comparability of productivity rates can be improved by subtracting these inputs from the total volume of production. In this way the average gross productivities are defined as

$$ABP_L = \frac{Q-D}{L} \tag{6}$$

$$ABP_C = \frac{Q-D}{C} \tag{7}$$

and the average net productivities

$$ANP_L = \frac{Q-D-A}{L} \tag{8}$$

$$ANP_C = \frac{Q-D-A}{C}. \tag{9}$$

When attempting empirically to estimate a production function f the input of labour and real capital often prove inadequate to explain the growth of the volume of production. This is attributed to technological advance continually »lifting» the production function, and a special factor is therefore introduced for technological advance, T, which is a function of time. The production function can now be written (value added $G = Q-D$)

$$G = T \cdot f(L, C). \tag{10}$$

So as to be able to estimate this function empirically, assumptions must be made regarding its form. Two alternative assumptions will be introduced here,

first that it is linear as regards L and C, second that it is logarithmically linear, i.e. of the Cobb-Douglas' variety.

Alternative 1

Assume that the production function can be written

$$G = T(\alpha L + \beta C), \tag{11}$$

in which α and β are technically given constant terms.

In order to determine the constant terms α and β and the technology factor T from time series material on L, C and G, these variables are measured as indices.

This involves the following transformations

$$L \rightarrow \frac{L}{L_0} \cdot 100 = I_L \tag{12}$$

$$C \rightarrow \frac{C}{C_0} \cdot 100 = I_C \tag{13}$$

$$G \rightarrow \frac{G}{G_0} \cdot 100 = I_G, \tag{14}$$

in which L_0, C_0 and G_0 are labour input, capital input and volume of production (expressed as value added) at a particular point in time. Following these transformations the production function can be written

$$I_G = \frac{T}{G_0}(\alpha L_0 I_L + \beta C_0 I_C). \tag{15}$$

Since

$$G_0 = T_0(\alpha L_0 + \beta C_0) \tag{16}$$

we obtain

$$I_G = \frac{T}{T_0}\left(\frac{\alpha L_0}{\alpha L_0 + \beta C_0} I_L + \frac{\beta C_0}{\alpha L_0 + \beta C_0} I_C\right) \tag{17}$$

$$a = \frac{\alpha L_0}{\alpha L_0 + \beta C_0} \tag{18}$$

$$I_G = \frac{T}{T_0}(aI_L + (1-a) I_C). \tag{19}$$

The term a denotes the proportion of total income generated within the sector which accrues to labour. Labour's share of income in agriculture is c. 0.7 and in industry 0.6. Using index series of volume of production, volume of labour and volume of capital, we can now calculate T/T_0, i.e. an index series for the technology factor. In the main text this index is referred to as the index of net productivity according to method 1. Thus it shows the growth in

production resulting from improved techniques, better size structure, etc. given the same factor input.

Alternative 2

In this alternative the production function is assumed to be a Cobb-Douglas' function

$$G = TL^{a}C^{1-a}. \tag{20}$$

If this function is derived logarithmically with regard to time, we get

$$\frac{1}{G}\frac{dG}{dt} = \frac{1}{T}\frac{dT}{dt} + a\frac{1}{L}\frac{dL}{dt} + (1-a)\frac{dC}{dt}\frac{1}{C}. \tag{21}$$

Here too a can be interpreted as labour's share of income, which is known, and the relative change in the technology factor T can therefore be calculated through our knowledge of index series for G, L and C. This method of calculating productivity changes is referred to in the main text as net productivity according to method 2.

Another way of measuring net productivity is to relate total production to the total volume of inputs. This procedure is based on the assumption that the production function has the form

$$Q = T \cdot K \tag{22}$$

in which

$$K = P_D D + P_A A + P_L L + P_C C, \tag{23}$$

which implies that production is a function of all inputs, weighted with their prices. Analogeous to transformations (12)–(19), we obtain the index relation

$$I_Q = \frac{T}{T_0} \cdot I_K, \tag{24}$$

in which I_K is a volume index with fixed prices or is calculated as a chain index. This method of determining net productivity has been used in calculating the productivity variable in the supply elasticities in Appendix G.

Tables A 1 (agriculture) and A 2 (industry) give index series for Q, G, L and C and for labour productivity according to formula (6) and net productivity according to formula (19). A logarithmic function with regard to time has been fitted to these series as well as to index series for productivity measurements according to formula (21), in accordance with the regression equation

$$I = a \cdot e^{bt} + \varepsilon, \tag{25}$$

in which b expresses the average annual percentage change of index I, a is a constant, e the logarithmic base and ϵ a random component. These percentages are given in Table 2 in the main text.

ESTIMATES OF THE VOLUME OF LABOUR

An account will now be given of the methods used to calculate the labour volumes in Table 1 in the main text. We shall also consider estimates concerning the volume of agricultural labour, based on various statistical sources.

The estimate of total labour volume in Sweden has been based on the labour force surveys now conducted by the Central Bureau of Statistics. These sample surveys comprise 1 per cent of the labour force and contain details of the volume of labour for one week of every quarter giving among other things the total number of hours and hours per week. By dividing these figures we can arrive at an estimate of the number of full-time workers, while the average per year gives us an idea of the number of man-years.

Labour input in industry comprises both workers and salaried staff, the total labour input in hours of the former being converted to annual labour inputs with the factor 1 920 hours per annum. The basic data have been taken from industrial statistics, but the years for which these statistics were not available have been projected with the aid of the employment figures given in the labour force surveys.

The estimate of the agricultural labour force has been made in two ways. The first of these is based on the sample inventories made by the Central Bureau of Statistics of the agricultural labour force on June 1st every year. The National Agricultural Marketing Board have used these data in their estimate of annual labour consumption on the basis of certain assumptions regarding the annual employment rate of various labour categories (published in *Jordbruksekonomiska meddelanden* (The Journal of Agricultural Economics)). Labour input in hours according to these estimates has been divided by an annual labour input of 1 920 hours per annum, and these figures have been used in calculating time series for productivity growth,

In the productivity estimates in Table 1 in the main text, however, the number of man-years thus obtained has been reduced by the estimated labour input in the farmers' own forests. Following the weighting procedure applied to the farmer groups in JEU in Appendix G, we obtain an average labour input in own forests by groups 5–50 hectares of 6.9 hours per hectare in 1964 and 6 hours per hectare in 1966. According to *Statistiska meddelanden* (Statistical Reports) J 1964:31 the total area of farmer-owned forest is 8.37 million hectares. This makes the number of man-years done in the farmers' own forests approximately 30 000 in 1964 and 25 000 in 1966.

The other method of calculating the volume of the agricultural labour force is based on the samples by the Central Bureau of Statistics of farmers' income tax returns to cover the acreage categories concerning which JEU has no information to offer. The method is as follows.

The labour input in hours of hired labour has been obtained by dividing total wage costs according to income tax returns by agricultural workers' wages according to JEU. From this was deducted the labour input of the hired labour force in own forest, as indicated by the JEU labour input per hectare and the forest acreage mentioned previously. Family labour input in agriculture has been calculated as regards the 5–50 hectare groups on the basis of the accounted costs of manual work by families in agriculture according to JEU, converted into hours. The total labour input of the family in the 2–5 hectare group has been assumed to be equal to that of the 5–10 hectare JEU group, while that of families in the over 50 hectare groups has been assumed to equal to that of the 30–50 hectare JEU group. But labour input outside agriculture by the groups not covered by JEU is larger than that of the groups covered by JEU. Family input in agriculture has been assumed to be correspondingly less. Additional labour input outside agriculture has been calculated as additional income according to the statistics of income tax returns divided by agricultural workers' wages.

Hourly earnings are probably higher, so that this method of calculation tends to under-estimate labour input in agriculture. On the other hand, the families in these acreage groups are probably somewhat smaller than in the 5–50 hectares groups.

An estimate on these lines of total labour input in agriculture indicated 615 million work hours in 1964, which divided by 1 920 corresponds to 320 000 man-years. It should be noted that, according to JEU, farmers worked an average of 2 620 hours annually, of which 1 950 hours in agriculture. This gives an additional labour input by the farmer of 700 hours over and above the »normal» input of 1 920 a year, corresponding, if this input is taken to comprise agricultural work, 78 000 man-years, provided the number of farmers is the same as the number of farms – 215 400 according to the 1964 acreage inventory. This gives a net total of about 240 000 man-years. The National Agricultural Marketing Board based their estimates on an annual labour input of 1 920 hours, so that an estimate for the same year (1964) following the first method gives us 260 000 man-years. Since the JEU survey is concerned with hours put in by first-class labour, the result might a priori be expected to be lower, but in view of the margins of error in both calculation methods, there cannot be said to be any significant difference between the figures.

Table A 3 gives a summary of the age and occupation distribution of farmers according to the 1960 census.

Table A1. *Growth of agricultural productivity, 1938/39–1967/68*
Index 1950/51=100

Year	Net production	Gross value added	Volume of labour (man-years)	Volume of capital	Labour productivity	Net productivity
1938/39	86.09	90.10	126.72	94.94	71.10	76.88
1939/40	86.31	90.30	125.18	95.21	72.14	77.72
1940/41	75.99	78.90	123.64	93.51	63.82	68.85
1941/42	66.49	68.30	122.10	92.90	55.94	60.26
1942/43	77.96	81.80	120.55	94.05	67.85	72.64
1943/44	86.84	91.30	119.12	95.76	76.65	81.44
1944/45	82.71	86.90	117.57	96.51	73.91	78.11
1945/46	87.54	91.20	116.03	97.47	78.60	82.56
1946/47	74.92	76.00	112.64	97.66	67.47	70.27
1947/48	81.72	82.90	109.35	97.83	75.81	78.29
1948/49	92.81	95.00	106.06	99.34	89.57	91.31
1949/50	101.33	102.50	102.98	99.22	99.53	100.63
1950/51	100.00	100.00	100.00	100.00	100.00	100.00
1951/52	97.97	99.00	95.99	100.37	103.13	101.74
1952/53	102.46	101.80	92.09	100.96	110.55	107.44
1953/54	104.29	103.20	88.39	101.71	116.76	111.71
1954/55	99.62	97.90	83.86	101.48	116.74	109.82
1955/56	89.75	87.20	79.14	100.99	110.19	101.76
1956/57	100.08	98.30	76.26	100.15	128.90	117.83
1957/58	101.63	100.50	75.33	100.93	133.41	121.07
1958/59	95.27	93.60	72.56	101.64	129.00	115.15
1959/60	95.51	93.00	66.60	101.07	139.64	120.87
1960/61	96.92	94.70	67.32	100.13	140.68	122.73
1961/62	104.11	102.40	63.93	100.79	160.19	136.56
1962/63	101.89	100.00	60.53	101.02	165.20	137.59
1963/64	94.59	91.50	56.94	100.46	160.70	130.73
1964/65	100.30	96.90	53.24	99.30	182.01	144.51
1965/66	101.39	97.30	49.02	97.83	198.48	152.83
1966/67	94.01	87.30	45.10	100.10	193.57	141.17
1967/68	106.09	103.95	41.49	101.23	250.54	174.97

Sources: Net production = gross production minus imported and manufactured feed according to data from the Agricultural Marketing Board. Gross value added = net production minus consumption of commercial fertilizers according to data from the Agricultural Research Institute and the consumption of electricity, motor fuel, services, etc., which are assumed to increase by 2 per cent p.a. and amount to Sw.kr. 500 million in 1964/65. Labour productivity is calculated according to formula (6) and net productivity according to formula (19), using weights of 0.7 and 0.3 for labour and capital respectively.

Table A2. *Growth of industrial productivity, 1947–67*
Index 1950 = 100

Year	Gross value added	Volume of labour (man-years)	Volume of capital	Labour productivity	Net productivity
1947	87.00	97.00	85.00	89.69	94.36
1948	93.00	99.00	88.00	93.94	98.31
1949	96.00	99.00	93.00	96.97	99.38
1950	100.00	100.00	100.00	100.00	100.00
1951	105.00	102.00	107.00	102.94	100.96
1952	104.00	100.00	114.00	104.00	98.48
1953	105.00	97.00	120.00	108.25	98.87
1954	113.00	101.00	129.00	111.88	100.71
1955	119.00	105.00	136.00	113.33	101.36
1956	125.00	104.00	142.00	120.19	104.87
1957	131.00	104.00	148.00	125.96	107.73
1958	134.00	102.00	154.00	131.37	109.12
1959	143.00	102.00	160.00	140.20	114.22
1960	157.00	107.00	171.00	146.73	118.40
1961	169.00	110.00	181.00	153.64	122.11
1962	179.00	111.00	193.00	161.26	124.48
1963	190.00	110.00	203.00	172.73	129.08
1964	209.00	115.00	214.00	181.74	135.19
1965	226.00	116.00	219.00	194.83	143.77
1966	235.00	115.00	238.00	204.00	143.00
1967	241.00	110.00	238.00	219.00	150.00

Sources: Gross value added, volume of labour and of capital are based on industrial statistics according to calculations by the Industrial Institute for Economic and Social Research. Labour productivity is calculated according to formula (6) and net productivity according to formula (19), using weights of 0.6 and 0.4 for labour and capital respectively.

Table A3. *Age and main occupation of farmers, 1960*

Category	Age of farmer (years)	Primarily engaged as farm proprietor	Primarily engaged in some other occupation	Not gainfully employed	Total
		Thousands of persons			
2–10 hectares arable	under 55	46	31	4	81
	55–64	31	12	6	49
	over 64	20	3	23	46
	all ages	97	46	33	176
more than 10 hectares arable	all ages	84	5	4	93
all farmers with arable	under 55	102	35	5	142
	55–64	52	12	7	71
	over 64	27	4	25	56
	all ages	181	51	37	269
without arable[a]	all ages	51			
total	all ages	232			

[a] Entrepreneurs chiefly engaged in specialized livestock farming (ca. 23 000), horticulture (ca. 6 000), forestry (ca. 6 000) and fishing (ca. 16 000).

Source: Sveriges Officiella Statistik, Folkräkningen 1960 (Census of the Population in 1960, parts IX and X.

APPENDIX B

AGRICULTURAL PROTECTION AND THE WORLD FOOD MARKET

BY ODD GULBRANDSEN

The aim of this appendix is to calculate:

1. The size of tariff protection in post-war Sweden.
2. The development of the world food market.
3. The development of Swedish and Western European self-sufficiency in food.
4. The effect on world market prices and trade of an abolition of agricultural protection in Sweden and throughout Western Europe.

ESTIMATES OF SWEDISH PROTECTION 1948–67

The protection of Swedish agricultural products has in principle been regarded here as the percentage difference between domestic consumption of agricultural products valued at domestic retail prices and the same consumption valued at world market prices. Since export prices are generally quoted f.o.b., this may tend to exaggerate protection. On the other hand, export figures include receipts for special qualities, while domestic retail prices refer to standard prices, thus tending to under-estimate protection. The results of the calculations are given in Table B 1. For purposes of comparison, this table also contains estimates by the National Agricultural Marketing Board of the average size of protection between September and December of certain years. As will be seen from the table, these figures are generally somewhat lower, partly because the National Agricultural Marketing Board's estimates refer to a smaller proportion of total consumption than the author's estimates.

An estimate of total price support – tariffs + other forms of price support – has been made for certain years in Appendix L. The protection indicated there differs in certain respects from the estimates given here. This is because whereas in the present estimates an unbroken time series – requiring a certain amount of schematization – was aimed at, the estimates in Appendix L could be made more detailed.

ESTIMATE OF SWEDISH SELF-SUFFICIENCY

The net agricultural imports in current prices also shown in Table B 1 are taken from foreign trade accounts published in *Jordbruksekonomiska meddelanden.* Average net imports between 1962 and 1967 were Sw.kr. 303 million, while consumption during the same period, in world market prices amounted to Sw.kr. 2 934 million. Thus the degree of self-sufficiency expressed in value (i.e. not calories) can be put at approximately 90 per cent.

ESTIMATES OF WORLD TRADE AND WESTERN EUROPEAN FOOD SUPPLIES

The estimate of the volume of world trade in agricultural foodstuffs and of Western European imports of foodstuffs is given in Table B2. Western European consumption was obtained by adding the value of net imports to Western European production. According to this method, in which production of wheat, rye, sugar, edible oils, milk, meat, pork and eggs has been taken into account and the world market price of milk put at 25 öre per kg, a consumption value of about Sw.kr. 182 billion was obtained for 1966. Since imports the same year were valued at Sw.kr. 20 billion, this gives 91 per cent self-sufficiency. FAO statistics indicate that Western European production rose by 27 per cent between 1953–57 and 1966. Table B2 shows a 32 per cent rise in net imports between 1953–57 and 1966. Thus Western European self-sufficiency has not changed significantly since the beginning of the 1950's. The annual rise in consumption throughout the period can be put at around 2 1/2 per cent.

THE EFFECT OF SWEDISH AGRICULTURAL PROTECTION ON WORLD MARKET PRICES

The following is a rough estimate of how world market prices would be affected if Sweden's entire consumption of agricultural foodstuffs were to be imported. The estimates exaggerate the effect of Swedish agricultural protection on world market prices, since a certain amount of domestic production would probably survive even if protection were abolished altogether. However, these estimates are solely intended to measure the relative magnitude of the effects, in addition to which they are based on such tenuous assumptions that a more refined analysis would be pointless.

The following formula has been used to determine the effect on price of changes in demand:

$$\text{relative price change} = \frac{\text{relative change in demand}}{\text{supply elasticity} - \text{demand elasticity}}$$

The figures given in Table 8 of the main text for Swedish consumption as a percentage of world exports have been used to express the relative change in demand.

Swedish consumption of three staple products, wheat, vegetable oils and sugar, comprises no more than about one per cent of total world trade, so that world prices would hardly be affected if Sweden were to start purchasing all its requirements of these products abroad. Rye is probably to be classed in the same group as wheat, since it would probably be replaced to a great extent by wheat.

Feed grain is somewhat different. The Swedish output volume is about five times as large as for bread grain and comprises about 1/10 of world trade in this product. But, in the hypothetical situation, no feed grain would be imported to Sweden – animal products would be imported instead, causing feed grain demand to rise in the exporting countries. The demand elasticity of feed grain is assumed to equal the average demand elasticity of all the animal products for which it is used, above all pork and eggs, followed by milk and beef. The elasticity of demand thus deduced has been put at between 1/2 and 1. On the supply side this will involve the long-term adaption of production which at

present, owing partly to low fertilizing intensity, has unused capacity and good chances of competing with roughage production, which at present accounts for several times the amount of acreage put down to feed grain. Consequently the elasticity of supply should not be less than the elasticity of demand. Inserting this in the formula, a relative price rise is obtained amounting at most to the same percentage as the increase in demand and probably somewhat less, i.e. 5–10 per cent.

Swedish demand for pork and eggs is large in relation to world trade. One might therefore expect a rise in demand for these commodities to have a considerable effect on prices in the hypothetical situation. This will probably be the case in the short run, but in the long run these industrialized branches of production can probably be expanded rapidly, and the long-run supply elasticity is high. Moreover, the cost estimates for these branches of production are entirely dominated by feed costs, especially feed grain, the price movement of which will probably be decisive. Consequently, the effect of increased demand on prices can be estimated at about the same as for feed grain, 5–10 per cent.

Whereas the demand elasticity of consumer milk is quite low, 0–0.3, it is higher for the other products, especially butter, owing to the competition offered by margarine. Average elasticity is probably between 1/2 and 1. Since milk production at present costs is based on high quality roughage and requires large investments of technical equipment and labour, its supply elasticity, generally put at 0.3 in the short run, is probably quite low in the long run as well. All this would seem to indicate a price rise of the same dimensions as the rise in demand, i.e. 15–20 per cent.

Both the demand for and the price of beef have risen during the past decade. This suggests a relatively low supply elasticity. Since the elasticity of demand for beef in general is usually put at between 1/2 and 1 and if the elasticity of supply, in view of these trends, can be put at about 1/2, the expected price rise resulting from an increase in demand the size of Swedish requirements would amount to between 5 and 10 per cent.

The effects on potato prices are hard to assess, owing to the sharp qualitative and quantitative fluctuations of the harvest from one year to another and to the variety of uses to which potatoes are put. This coupled with high transport costs results in local monopolies, hence the small scale of world trade. Elasticity of demand is low, less than 1/2, and supply elasticity is probably low too, perhaps about 1/2, owing to the large investments in machinery and stores required for the expansion of high quality production and distribution. This suggests that an increase in demand of the size of Swedish consumption would lead to fairly considerable price rises, perhaps by 30 per cent or more.

Summing up the effects of the hypothetical situation examined, a decision by Sweden to import all the foodstuffs it required, would have virtually no effect on the world prices of bread grain, vegetable oils and sugar, while feed grain prices would rise by about 5 per cent, meat, pork and egg prices by 5 or 10 per cent, dairy products by 15 or 20 percent and potatoes by 30 per cent. As already remarked, these estimates are to be seen as preliminary, leading to conclusions with wide margins of error concerning the effects of Swedish protection on world market prices.

THE EFFECT OF WESTERN EUROPEAN AGRICULTURAL PROTECTION ON WORLD MARKET PRICES

The following is an account of the assumptions, methods and results of estimates intended to determine the equilibrium price level that would emerge on the world market if Western European protection were abolished. The calculations are intended to determine the equilibrium price which would equate the rise in import demand in Western Europe, as a result of protection being successively abolished, and the rise in exports on the world market from developing countries and other exporters of agricultural products outside Western Europe as a result of rising world market prices. The magnitude of changes in imports and exports is determined with the aid of assumed elasticities of supply and demand. The effect on demand in the developing countries of the increased income resulting from rising exports and rising prices has also been taken into account.

The estimate is based on the following assumptions relating to conditions in 1966: Western European consumption of agricultural foodstuffs Sw.kr. 182 billion, production Sw.kr. 162 billion and net imports Sw.kr. 20 billion, all in world market prices, Western European prices being 50 per cent above this level. World trade in these commodities is estimated at Sw.kr. 80 billion, and the developing countries' consumption at Sw.kr. 200 billion.

Concerning the elasticities of agricultural foodstuffs, it is assumed that the price elasticity of demand in Western Europe is −0.3 as against −0.5 in the exporting countries, while income elasticity is 0.8 or 1.2 in the developing countries and 0 in other countries. Supply elasticity in Western Europe is varied between 1/2 and 1 1/2, while supply elasticity on the world market is varied between 1 1/2 and 3 1/2.

Other conditions required for the estimate are the developing countries' share of world exports, put at 1/2, and the initial proportion of total consumption in the developing countries comprised by agricultural foodstuffs, which is assumed to be 0.6.

The following formula is used to determine the effect of prices on Western European demand and supply, supply on the world market and demand in the developing countries

$$\frac{Q}{Q_0} = \left(\frac{P}{P_0}\right)^e, \tag{1}$$

in which Q denotes volume in Sw.kr. billion, P the ratio between the equilibrium and the initial price, the initial world market price being $P_0=1$ and the initial Western European price being $P_0 = 1.5$ and e elasticity.

The rise in the developing countries' demand due to increased foreign exchange income has been determined with the aid of the customary formula for the effect of income on demand

$$\frac{Q}{Q_0} = \left(\frac{I}{I_0}\right)^E, \tag{2}$$

in which I denotes income and E income elasticity. If the share of agricultural foodstuffs in total consumption is g, we obtain the basic income

$$I_0 = \frac{Q_0}{g}. \tag{3}$$

The increase in foreign exchange income consists of the developing countries' share of the rise in export earnings. It is assumed by way of approximation that the entire increase in foreign exchange receipts will be available for consumption. Income in the equilibrium we are seeking will thus be

$$I = \frac{Q_0}{g} + h \cdot (V \cdot P - V_0), \tag{4}$$

in which h is the developing countries' export trade and V is world exports. Substituting equations (3) and (4) in (2) we obtain, after simplification, the following increase in the developing countries' demand due to increased foreign exchange receipts:

$$Q = Q_0^{1-E} \cdot (Q_0 + h \cdot g(V \cdot P - V_0))^E. \tag{5}$$

The results of these estimates are given in Table B 3, which indicates an equilibrium price between 15 and 37 per cent greater than the current level of world market prices.

Table B1. *Level of protection for Swedish agriculture, 1948–70*

Year	Total value		Border protection		Price, index 1949=100		Net import of agric. products
	World market prices	Domestic wholesale prices	Present estimate	Nat.Agr. Marketing Board	World market	Domestic whole-sale	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Millions of Sw.kr.		*Per cent*		*Index*		*Millions of Sw.kr.*
1948	2 075	2 773	34		91	100	
1949	2 271	2 778	22		100	100	
1950	2 433	2 764	14		107	99	
1951	2 727	3 137	15		120	113	
1952	2 857	3 620	27		126	130	
1953	2 723	3 678	34		121	132	
1954	2 687	3 562	33		118	128	
1955	2 625	3 769	44		116	136	475
1956	2 703	4 163	54	28	119	150	470
1957	2 648	4 104	55	33	117	148	355
1958	2 525	4 087	62	35	111	147	150
1959	2 687	4 154	55	38	118	150	315
1960	2 679	4 366	63	41	118	157	334
1961	2 568	4 330	69	53	113	156	231
1962	2 518	4 437	76	59	111	160	194
1963	2 984	5 010	68	42	131	180	325
1964	3 031	5 114	69	53	133	184	392
1965	2 976	5 301	78	63	131	191	279
1966	3 071	5 408	76	71	135	195	354
1967	3 026	5 398	78	80	133	194	273
1968	2 796	5 386	93	92	123	191	329
1969	2 964	5 569	88	78	131	197	223
1970	3 133	5 862	87	85	138	208	

Sources: The sums in column 1 refer to the volume of Swedish consumption of bread, grai sugar, edible oils, potatoes, milk, cheese, butter, beef, pork and eggs (volumes in 1964) expressed in unit export values according to FAO, *The State of Food Agriculture.* For 1957 onwards, however, these export figures have been chained with the prices according to the Agricultural Marketing Board's index of world market prices (applies to sugar, edible oils, butter, cheese and eggs).

The sums in column 2 refer to the same volumes of consumption expressed in domestic wholesale prices according to the Agricultural Marketing Board.

The price of wheat has been taken as the price of bread grain and the price of beef as the price of meat. For edible oils the domestic price has been taken as the price of rapeseed converted to oil (using a factor of 2.63), while the price of groundnut oil has been taken as the world market price. Since fresh milk does not feature in international trade, a price calculated as the price of butter divided by 21 has been used for evaluating the consumption of milk at world market prices.

Column 3 represents the difference between columns 2 and 1, expressed as a percentage of column 1. Columns 5 and 6 express columns 1 and 2, respectively, as an index.

The sums in column 7 are taken from annual articles on foreign trade in food, published in *Jordbruksekonomiska meddelanden* (The Journal of Agricultural Economics).

Table B2. *World trade in agricultural products and net imports to Western Europe, 1934–66*

	Billions of Sw.kr.						
	1934–38	1948–52	1953–57	1958–62	1964	1965	1966
Volumes in 1958–62 prices							
World exports							
Wheat, rice and potatoes	11.01	11.34	12.21	14.83	22.29	22.42	22.7
Sugar and edible oils	11.19	10.82	13.44	15.83	17.05	17.84	17.7
Feed grain and oilcake	3.89	3.27	4.77	7.42	10.82	12.74	14.3
Vegetable products, total	26.09	25.43	30.42	38.08	50.16	53.00	54.8
Milk products	3.48	3.81	4.54	5.66	6.95	7.13	7.6
Beef, pork and eggs	5.30	4.56	5.86	8.02	9.68	9.54	9.3
Animal products, total	8.78	8.37	10.40	13.68	16.63	16.67	16.9
Agricultural products, total							
World exports	34.87	33.80	40.82	51.76	66.79	69.67	71.8
Net imports to Western Europe	15.68	14.19	13.48	15.15	16.08	16.88	17.8
Value in current prices for agricultural products							
World exports	10.26	36.33	43.83	51.76	74.08	76.73	79.4
Net imports to Western Europe	4.46	15.48	14.35	15.15	18.41	19.14	20.0
Volume of net imports to Western Europe as a share of world exports							
Wheat, rice and potatoes	40	43	34	24	10	11	12
Sugar and edible oils	44	47	43	40	38	36	40
Feed grain and oilcake	91	76	62	71	59	59	56
Vegetable products, total	49	49	43	40	30	36	32
Milk products	31	18	2	−2	1	−8	−13
Beef, pork and eggs	33	24	7	0	10	11	11
Animal products, total	32	21	5	0	6	3	0
Agricultural products, total	45	42	33	29	24	24	25

[a] Preliminary figures.

Sources: FAO's statistics on volumes and prices for the trade in wheat, rice, potatoes, sugar, edible oils, barley, maize, oilcake, butter, cheese, dried milk, live-cattle, meat from cattle, sheep and poultry, pork and eggs. The major part of the material comes from Annex tables i *The State of Food and Agriculture* 1965 and 1967, supplemented in certain respects (particularly in the case of beef and pork) with data from FAO's Production and Trade Yearbooks. The prices are unit export values. Volumes for groups of products have been calculated by multiplying the quantities of the individual products by the mean of the unit values in 1958-

Table B3. *The equilibrium price level of the world food market during free trade*

Calculations for certain combinations of income and supply elasticities.

Assumed elasticities of				Billions of Sw.kr.					
	supply			Western Europe's			Developing countries		
income in developing countries	in Western Europe	on the world market	Equilibrium price [a]	consumption	production	import demand	foreign exchange increment	consumption	World exports
0.8	0.5	1.5	128	191	150	41	34	184	148
	1.5	1.5	135	188	138	50	45	181	169
	1.5	2.5	126	192	125	67	50	189	180
	0.5	3.5	115	197	142	55	35	194	150
	1.5	3.5	121	194	117	77	54	194	189
1.2	0.5	1.5	130	190	151	39	37	187	154
	1.5	1.5	137	187	141	46	48	186	176
	1.5	2.5	128	191	128	63	55	194	190
	0.5	3.5	116	197	142	54	38	198	156
	1.5	3.5	122	194	119	75	58	200	196

[a] Expressed as an index, current world market price = 100.

APPENDIX C

THE DETERMINANTS OF FARM LAND VALUES

BY KARL GÖRAN MÄLER

THE EFFECT OF PRICE CHANGES ON LAND PRICES

In this appendix we shall endeavour to illustrate theoretically the effect of exogenous changes in agricultural prices on land values. We shall assume that a rise in prices increases the profitability of agriculture and with it the demand for the factors of production used in agriculture. The price of factors of production in infinitely elastic supply will not change, but the price of factors in inelastic or finite elastic supply will. As the prices of these latter factors increase, the profitability of agriculture diminishes and a new equilibrium arises in which the profit brought about by the rise in prices is eliminated by the increased factor costs. The object of this appendix is to investigate what factors determine the extent to which the prices of factors of production in inelastic supply need to change in order for the initial change in profit to disappear.

As regards agriculture, which constitutes a small part of the total economy we can assume that in the short run inputs of labour, raw materials, semi-manufactures and real capital draw on an elastic supply, while the supply of land, on the other hand, is completely inelastic. In other words, a change in the price of a product causes the price of agricultural land to change. We shall study this relation in a highly simplified model.

Consider a »representative» farm which, with the aid of the factors of production real capital C, labour L and land M, produces a commodity Q according to the production function

$$Q=f(L, C, M, T) \tag{1}$$

in which T stands for net productivity (T is assumed to be a function of time). Purchased supplies D are used in a fixed proportion a to output Q.

$$D=aQ \tag{2}$$

a being constant.

Assume that this enterprise is confronted by given prices for output p_Q, labour w, real capital p_C, land p_M and purchased supplies p_D. Assume further that at the beginning of the period under consideration the enterprise has optimally adapted its stock of real capital and its acreage in relation to the given prices. If the capital is written off at a rate of 100 d per cent per unit of time, capital expenditure during the period amounts to $(r+d)p_C$C and land costs to $rp_M M$, in which r stands for alternative yield. Thus the profit of the enterprise can be written

$$V = p_Q Q - wL - (r+d)p_C C - rp_M M - p_D D.$$

If the enterprise is a profit maximizer, its behaviour can be described by equations

$$(p_Q - ap_D) f'_L - w = 0 \tag{3}$$

$$(p_Q - ap_D) f'_C - (r+d) p_D = 0. \tag{4}$$

We also assume that, in the short run, the farmer is either unwilling or unable to alter the use to which he puts his land, i.e. $dM=0$.

Assume now that other agricultural enterprises, existing or potential, are characterized by the same behaviour equations (this applies if they have the same production function). This assumption is far from realistic, but we shall later be discussing the effects of enterprises having different production functions and the effects of economies of scale. We shall also assume that the supply of labour, real capital and supplies is infinitely elastic. Assume now that product price, factor prices and net productivity change autonomously. The effect on profit is obtained by differentiating the profit function

$$dV = \{(p_Q - ap_D) f'_L - w\} dL + \{(p_Q - ap_D) f'_C - (r+d) p_C\} dC + Q dp_Q - L dw - (r+d) C dp_C$$
$$- rM dp_M + (p_Q - ap_D) f'_T dT = Q dp_Q - L dw - (r+d) C dp_C - rM dp_M + (p_Q - ap_D) f'_T dT.$$

The change in prices will cause profit to change as above, and this will elicit a change in the demand for factors of production. As we saw in the introduction, land values will now change to such an extent as to negate the change in profits, i.e. $dV=0$. Using this expression, we can solve dp_M/p_M.

$$\frac{dp_M}{p_M} = \frac{p_Q Q \frac{dp_Q}{p_Q} - wL\frac{dw}{w} - (r+d) p_C C \frac{dp_C}{p_C} - p_D D \frac{dp_0}{p_0}}{rp_M M} + \frac{(p_Q - ap_D) Q \frac{f'_T}{Q} dT}{rp_M M}. \tag{5}$$

This gives an expression showing how much land value will change as a result of changes in the price of the product, the price of other factors besides land and changes in net productivity. Intuitively speaking, this formula is readily understandable. For every change in price there is a multiplier, the numerator of which shows how much profit changes; if this change in profit is distributed over the land by dividing it by land costs, we obtain the relative rise in land value. Note that the numerator of the multiplier for changes in net productivity is value added. If, as in Appendix A, we assume that technical advance or net productivity is included a multiplier in the production function $f(L, C, M, T) = e^{\eta t} f(L, C, M)$, it is clear that the last term in the formula can be written

$$\frac{(p_Q - ap_D) Q}{rp_M M} \eta \, dt, \text{ in which } t \text{ stands for time.} \tag{6}$$

In our deduction of the formula for the increase of land values, we envisaged a »representative» enterprise, assuming that all farms had the same production functions. But formula (5) can be interpreted marginally to allow different farms to have different production functions. Thus imagine a potential buyer of land,

a farmer wishing to supplement his acreage of a person wishing to set up as a farmer. For a buyer of this kind the production function f can be interpreted as a production function for the marginal land and a corresponding analysis effected. But this interpretation entails problems regarding the effect of net productivity, which has to be attributed to the total activity of the farm, not to marginal land alone.

Another problem connected with formula (5) is the possibility of the entire profit not being capitalized. Two extremes can be conceived, namely capitalization of the financial profit and capitalization of the farmer's income. In the former case labour costs must include the alternative cost of the farmer's family's labour input, while in the second case labour costs will be confined to the cost of hired labour.

A hypothetical calculation will serve to illustrate the effects, according to formula (5), of changes in product price, factor price and productivity on land price movements. The estimates are based on material taken from statistics of farmers' incomes and expenditure, according to income tax returns, and from price and productivity index series given in Appendices A and G and elsewhere. The calculation refers to the average for all farms in the country and for all farms of more than 100 hectares. Two cases of capitalization have been studied, one in which the farmer's entire income is capitalized and the other in which only profits are capitalized. On the basis of the data given in Table C1 for the period 1952/53 – 1965/66 we obtain, after substituting formula (5) for the average, the expected rise of 8.9 per cent in land prices when incomes are capitalized and – 2.6 per cent when profits are capitalized. The corresponding figures for farms of more than 100 hectares are 7.7 and 6.8 per cent.

Table C1. *Data for a numerical example of land price formation*

		Total sum in 1966 (million Sw.kr.)	Multiple	Units with more than 100 hectares (Sw.kr./unit)	Multiple		Trend 1952/53–65/66 per annum
Production	$p_Q Q$	6 706[a]	5.1	344 744[a]	5.5	dp_Q/p_Q	2.8
Hired labour	wL	586	0.4	94 371	1.5	dw/w	4.8
Total labour	wL	3 600[b]	2.8	110 771[e]	1.7	dw/w	4.8
Real capital	$rp_C C$	1 699[c]	1.3	85 394[c]	1.4	dp_C/p_C	4.1
Supplies	$p_D D$	3 597	2,7	186 474	3,9	dp_D/p_D	2,0
Value added		3 109	2.4				3.0
Value added	$p_Q Q - p_D D$			158 300	2.5	η	4,5[f]
Land	$rp_M M$	1 314[d]		63 348[d]			

[a] Denotes the value of products sold plus taxable payment in kind.

[b] Calculated assuming that agricultural labour is paid according to an annual wage of (1 940 · 8.46 Sw.kr. per hour=) 16 400 Sw.kr. and a total labour input of 220 000 man-years.

[c] Comprises interest on a real capital of 7 256 million Sw.kr., and 317 500 Sw.kr. at 6 per cent interest, respectively, plus expenditure on maintenance and depreciation on fixtures, buildings, roads and ditches.

[d] Refers to interest on taxable real estate adjusted upward by 75 per cent (=market price conversion factor) at a rate of 6 per cent.

[e] Includes the farmer's labour input valued at agricultural wages.

[f] Net productivity derived from data in Appendix H concerning annual changes in value added, volume of labour and capital input for the acreage groups in question using formula (19) in Appendix A. The increase in capital input has been assumed to equal the growth of indebtedness (20 000 Sw.kr. expressed as a percentage of 1 million Sw.kr. in invested capital).

Sources: Total sums and sums for units of more than 100 hectares according to Farmers' taxed incomes, expenditure, net receipts, liabilities and assets in 1966, *Statistiska meddelanden* (Statistical Reports) J 1968:10. Trends calculated from the Agricultural Research Institute's index series for farm receipts and costs.

APPENDIX D

PROFITS IN AGRICULTURE

BY ODD GULBRANDSEN

This appendix contains three empirical sections:

1. A study of the growth of farm land prices.
2. A study of the relation between regional differences in land prices and agricultural profitability.
3. A study of the effects of profit capitalization on the profitability of farms of different sizes.

In this appendix an account is given of the assumptions and methods of these calculations together with tables showing the results. The conclusions drawn from the studies are presented in Chapter 4, pp. 68 ff.

THE GROWTH OF FARM LAND PRICES

The Central Bureau of Statistics (SCB) compiles annual data concerning the sale and taxable values of agricultural land, based on registrations of title in connection with land purchases. Dividing purchase prices by taxable values gives purchase price coefficients (overprice percentages) which for the duration of a given rate of taxation can be used to calculate a price index. However, changes in taxation make price changes difficult to calculate. SCB surmounts this problem by linking the periods together with the intervening rise in taxable values according to studies of taxation revenue made by the Ministry of Finance (the indices of the purchase price coefficients are multiplied by indices of the taxable values).

The method used in the present study is based on the same principle. Since, however, interest is primarily focused in the rise in agricultural land prices, the rise in taxable values has been measured in terms of the rise in land values per hectare as indicated in the 1952 and 1957 surveys of tax revenue (*Statens Offentliga Utredningar* 1956:57 and 1963:14). The rise in taxable values in 1965 has been put at 25 per cent. Studies of price movements during the tax periods have moreover been concentrated on real estate whose value is primarily determined by the agricultural land it incorporates. Price trends have therefore only been calculated for agricultural real estate where not more than 50 per cent of the taxable value derives from appurtenant forest and forest land. This category has been divided into three groups, namely farms of which 0, 0.1–25 and 25.1–50 per cent of the taxable value derives from appurtenant forest and forest land. Calculations have been made for each year during the period 1952–66, for individual counties and for certain groups of counties as shown below. The results of the calculations for certain years are given in Table D1.

County group	*Comprising the counties*
Stockholm region	Stockholm, Uppsala, Västmanland
Malmöhus region	Malmöhus
Göteborg region	Göteborg–Bohus
Plainland counties with	
stable share of population (neutral plainland counties)	Södermanland, Halland, Örebro
declining share of population (declining plainland counties)	Kalmar, Gotland, Blekinge, Kristianstad, Skaraborg
Southern forest counties	Jönköping, Kronoberg, Älvsborg
Northern Sweden	Värmland, Kopparberg and Norrland

LAND VALUES AND REGIONAL DIFFERENCES IN AGRICULTURAL PROFITABILITY

The effects of profit capitalization on regional differences in agricultural profitability have been studied with the aid of further processing of the cross-sectional studies described in Appendix G and based on material from JEU. This further processing was designed to elicit the relation between the agricultural value of agricultural real estate and the profitability of farming operations. Profitability (V) has been correlated with the agricultural value of the farm (U) according to the relation $U = a + b \cdot V$, in which the regression coefficient b corresponds to the capitalization factor.

In defining the criterion of profitability, allowance must be made for the different values that the farming family can put on their enterprise, according to capital input and employment requirements. An attempt has been made to do so by inserting various wage demands on the family's labour input. If wage demands are put at zero, this corresponds to the hypothesis that it is the family's labour return as well as capital yield that is capitalized in the agricultural value of the farm. If wage demands are equated with agricultural wages, this corresponds to the hypothesis that only capital yield is capitalized.

Data for each area of production have been used as observations in the calculations, i.e. 5–8 observations in each acreage class. The regressions have been calculated for each acreage class separately.

The results given in Table D2 show coefficients without any correction for wage demands (wages = Sw.kr. 0 per hour) and the alternatives most closely resembling agricultural wage levels (Sw.kr. 3 and 6 in 1954 and 1963, respectively). No significant difference is to be observed between the sizes of the coefficients used in these two calculation methods. The coefficients clearly rise in proportion to farm size, since the ratio of capital input to the family's total return increases in proportion to farm size.

But JEU only covers farm sizes up to 50 hectares. Similar calculations have therefore been made using income tax returns (SCB's sample surveys, *Statistiska meddelanden* (Statistical Reports) J 1965:17 and J 1967:18), using the taxable value of farms, converted to market values, as land values and net receipts from agricultural property plus interest charges as family income. Regressions have been calculated for 1963 and 1965 (the necessary data are lacking for 1954). The results are given in Table D2.

Overprice percentages taken from the survey of farmland price movements described earlier in this appendix have been used as factors for adjusting taxable value to market value. The following factors have been applied.

	Götaland				Svealand			
	southern plains	central districts	northern plains	forest districts	plain-lands	forest districts	Lower Norr-land	Upper Norr-land
1963	1.60	1.50	1.40	1.42	1.40	1.41	1.36	1.36
1965	1.73	1.64	1.56	1.53	1.56	1.52	1.44	1.44

PROFIT CAPITALIZATION AND PROFITABILITY IN FARMS OF DIFFERENT SIZES

The following study is designed to illustrate the changes that can occur in the relative profitability of different-sized farms if the capital invested in the enterprise is valued according to alternative value instead of market value. The principle is for real capital such as machinery, buildings and plant to be valued at replacement cost and for farm land to be valued according to its alternative use value, e.g. as forest. Three sources have been analyzed, namely income tax returns by proprietor farmers, accounts from JEU and material from Hjelm's calculations regarding the profitability of optimal farms.

The calculations aim at deriving a numerical expression of the profitability criterion:

$$R_i = \frac{V}{C_i},$$

in which R denotes the interest (percentage) and V the profit remaining when all costs except interest charges on total capital input have been deducted from receipts. C denotes the assets of the enterprise valued in three different ways, namely $i = 1$ at market value, $i = 2$ real capital at production cost and non-reproducible assets (land) at market value, and $i = 3$ real capital at production cost and non-reproducible assets at alternative value. The detailed methods used to calculate V and C in the various sources were as follows.

Income tax returns.[1] V was obtained by adding interest charges to total income (of both husband and wife where appropriate) and then deducting an estimated return on the labour input of husband and wife. C_1 comprises the value of total assets as stated in income tax returns plus the value of the farm over and above its taxable value according to the purchase price coefficient. Since the market prices of developed and undeveloped land are practically the same, C_2 was obtained by adding to C_1 half the building costs of necessary buildings and housing.

The volume of farm buildings has been presumed proportional to the livestock value as stated in tax returns. The cost of new building, expressed in Sw.kr. per Sw.kr. of livestock values, has been assumed to vary inversely to hard size according to a scale derived from a data manual.[2] The construction cost of housing

[1] *Statistiska meddelanden* (Statistical Reports) J 1968:10.

[2] Databok för driftsplanering (Data Book for Operational Planning). *Report from the Agricultural College* Series B No. 1, Uppsala 1963.

is taken from JEU, the figures for acreage groups exceeding 50 hectares being equated with those for the 30–50 hectare group.

C_3 was obtained by adding half the construction cost of farm buildings, housing and plant together with land value according to forest land prices, to assets according to income tax returns excluding the value of farm property. Plant includes the cost of draining the proportion of land stated in JEU to have been drained. Calculations have been made for the plains of southern Götaland (Gss) and the plains of Svealand (Ss) and refer to 1966. The results are given in Table D3.

The JEU statistics.[3] V comprises capital yield in agricultural production and C_1 comprises the capital invested in agricultural production, with interest charges based on JEU's principles. C_2 has been obtained by adding half the replacement value of farm buildings to C_1. C_3 has been calculated by adding the value of farm land valued at forest land prices and half the replacement costs of farm buildings and plant to the capital invested in agricultural production, excluding property value. Calculations have been made for the same years and areas as in the case of the income tax returns. The results are given in Table D4.

Hjelm's study.[4] V was obtained by deducting a required corresponding to agricultural workers' wages from the accounted labour return per hour, multiplying the difference by the number of working hours employed and adding the anticipated interest on the capital invested. C_1 is shown for the alternatives referring to short-term plans. C_2 is irrelevant to these plans, just as C_1 is irrelevant to long-term plans. C_2 is matched by the volumes of invested capital shown for the long-term plans. C_3 was obtained by deducting from C_1 the surplus value of undeveloped agricultural land compared to its long-term production costs, i.e. forest land value, and half the cost of plant (drainage only) has been taken into account.

Results for the Götaland southern plains and the Svealand plainlands are given in Table D5 regarding four acreage groups between 5 and 50 hectares and for enterprises which in the long run can make optimal use of 3 000, 5 000 and 7 000 hours labour input per annum respectively.

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[3] Räkenskapsresultat från svenska lantbruk skördeåret 1963. (Accounted profits of Swedish farming for the crop-year 1963). *Report from the National Board of Agriculture* Series B No. 57, Solna 1965.

[4] Hjelm, *op.cit.*

Table D 1. *Development of prices for farm property, by counties, 1952–66*

Area	Value of forest land and forest as a percentage of total taxable value					
	0–25		25–50		0–50	
	1966 index 1952 =100	Per cent per annum	1966 Index 1952 =100	Per cent per annum	1966 Index 1952 =100	Per cent per annum
County						
Stockholm	217.2	5.7	223.8	5.9	209.8	5.4
Uppsala	186.1	4.5			187.5	4.6
Södermanland	196.2	4.9	227.1	6.0	200.1	5.1
Östergötland	202.3	5.2	247.1	6.7	213.7	5.6
Jönköping	200.6	5.1	206.5	5.3	204.0	5.2
Kronoberg	193.2	4.8	220.6	5.8	210.1	5.4
Kalmar	219.0	5.8	214.6	5.6	213.0	5.5
Gotland	169.9	3.9			169.3	3.8
Blekinge	204.6	5.2	231.4	6.2	221.9	5.9
Kristianstad	190.2	4.7	301.9	8.2	192.0	4.8
Malmöhus	252.9	6.9			252.1	6.8
Halland	236.6	6.3	255.0	6.9	237.7	6.4
Göteborg-Bohus	236.4	6.3	257.9	7.0	240.2	6.5
Älvsborg	178.8	4.2	200.9	5.1	188.7	4.6
Skaraborg	215.0	5.6	216.7	5.7	214.9	5.6
Värmland	164.3	3.6	199.4	5.1	180.9	4.3
Örebro	173.2	4.0	214.1	5.6	177.5	4.2
Västmanland	186.0	4.5	210.4	5.5	191.2	4.7
Kopparberg	183.9	4.4	128.0	1.8	159.7	3.4
Gävleborg	164.2	3.6	202.7	5.2	181.8	4.4
Västernorrland	168.8	3.8	227.1	6.0	179.6	4.3
Jämtland	195.6	4.9	185.0	4.5	194.7	4.9
Västerbotten	166.5	3.7	114.9	1.0	158.0	3.3
Norrbotten	183.3	4.4	540.1	12.8	228.8	6.1
Group of counties						
Stockholm region	196.5	4.9	199.5	5.1	195.9	4.9
Malmöhus region	252.9	6.9			252.1	6.8
Göteborg region	236.4	6.3	257.9	7.0	240.2	6.5
Neutral plainland counties	203.9	5.2	225.9	6.0	209.2	5.4
Declining plainland counties	199.8	5.1	209.8	5.4	201.7	5.1
Southern forest counties	181.9	4.4	208.1	5.4	197.6	5.0
Northern Sweden	172.6	4.0	201.3	5.1	181.0	4.3
All Sweden	209.1	5.4	213.3	5.6	209.9	5.4

Note: For the counties included in each group, see the text in Appendix D.

Table D 2. *Relation between farm land values and family income in agriculture*

Acreage group (hectares arable)	Year	JEU				Tax Return Study		
			Result of regression			Result of regression		
		Family's wage requirement Sw.kr. /hour	Constant	Regr. coefficient	R^2	Constant	Regr. coefficient	R^2
2– 5	1963					16 677	4.0	0.61
	1965					16 574	7.4	0.72
5–10	1954	0	685	5.0	0.84			
		3	7 115	8.4	0.71			
	1963	0	2 489	3.1	0.84	16 376	5.0	0.49
		6	10 593	6.2	0.74			
	1965					– 16 662	10.5	0.83
10–20	1954	0	324	6.2	0.63			
		3	4 417	6.2	0.49			
	1963	0	821	5.0	0.80	1 545	6.9	0.56
		6	7 697	7.8	0.89			
	1965					– 12 391	8.9	0.64
20–30	1954	0	– 1 790	12.6	0.49			
		3	3 383	10.6	0.47			
	1963	0	– 7	7.4	0.78	– 5 536	8.5	0.88
		6	6 052	9.4	0.79			
	1965					– 119 700	14.5	0.76
30–50	1954	0	62	10.0	0.24			
		3	2 317	13.5	0.33			
	1963	0	991	6.2	0.46	– 101 630	14.0	0.61
		6	3 938	7.9	0.63			
	1965					– 201 830	17.9	0.86
50–100	1963					– 58 369	14.4	0.52
	1965					– 284 130	20.6	0.84
more than 100	1963					– 547 980	29.1	0.93
	1965					– 978 450	34.5	0.97

Note: The variables included in the regression calculations are described in Appendix D, p. 190.

Table D3. *Agricultural profitability assessed from farmers' income tax returns, 1966*

Acreage group (hectares arable)	Return	Value of assets (1000's of Sw.kr.)			Measure of profitability (per cent)		
	V	C_1	C_2	C_3	R_1	R_2	R_3
Southern plains of Götaland (Gss)							
2–5	−9 435	87	123	54	−10.7	−7.6	−17.3
5–10	−8 734	148	207	103	−5.9	−4.2	−8.4
10–20	−1 865	243	314	148	−0.8	−0.6	−1.3
20–30	4 607	387	485	210	1.2	0.9	2.2
30–50	14 477	582	686	257	2.5	2.1	5.6
50–100	30 278	963	1 093	395	3.1	2.8	7.7
more than 100	86 533	3 086	3 279	994	2.8	2.6	8.7
Plains of Svealand (Ss)							
2–5	−10 435	69	100	50	−15.0	−10.4	−20.6
5–10	−13 683	99	139	75	−13.7	−9.8	−18.0
10–20	−9 436	160	211	104	−5.9	−4.5	−9.0
20–30	−4 861	225	296	142	−2.2	−1.6	−3.4
30–50	−247	322	402	183	−0.1	−0.1	−0.1
50–100	12 378	581	666	271	2.1	1.9	4.6
more than 100	45 773	1 606	1 736	652	2.8	2.6	7.0

Note: The concepts V, C and R are explained in Appendix D, p. 191. The calculations are based on the following assumptions in addition to those in the tax return: family's labour return 25 400; purchase price coefficient 0.75; price of forest land 300 Sw.kr. per hectare in Gss and 150 Sw.kr. in Ss; land improvements for drained acreage 1 200 and 600 Sw.kr. per hectare respectively; mean acreage in the different groups 4, 8, 16, 25, 40, 70 and 180 hectares; building investments per Sw.kr. animal value 4.0, 3.7, 3.4, 3.2, 3.2, 3.1 and 3.0 Sw.kr. and dwellings 55 000, 62 000, 66 000, 85 000, 91 000 and (over 50 hectares) 100 000 Sw.kr. per farm unit.

Table D4. *Agricultural profitability assessed from JEU, 1966*

Acreage group (hectares arable)	Return in Sw.kr.	1966						1960
		Value of assets (1000's of Sw.kr.)			Measure of profitability (per cent)			
	V	C_1	C_2	C_3	R_1	R_2	R_3	R_1
Southern plains of Götaland (Gss)								
5–10	−7 069	180	261	161	−3.9	−2.7	−4.3	−0.3
10–20	910	290	385	208	0.3	0.2	0.4	3.4
20–30	5 837	425	548	281	1.3	1.0	2.0	3.7
30–50	17 395	605	748	352	2.8	2.3	4.9	6.0
Plains of Svealand (Ss)								
5–10	−12 965	107	191	134	−12.1	−6.7	−9.6	−10.2
10–20	−11 919	161	260	178	−7.4	−4.5	−6.6	−5.1
20–30	−10 252	228	350	238	−4.4	−2.9	−4.3	−2.0
30–50	−6 393	317	460	294	−2.0	−1.3	−2.1	−0.4

Note: The concepts V, C and R are explained in Appendix D, p. 191. The calculations are based on the following assumptions in addition to those in JEU: purchase price coefficient 1.75 for 1966; value of forest land for Gss 280, 330, 220 and 310 Sw.kr. per hectare and for Ss 140, 140, 150 and 160 Sw.kr. per hectare in the respective acreage groups.

Table D5. *Agricultural profitability assessed from Hjelm's study, 1960*

Acreage group	Acreage (hectares arable)	Return in Sw.kr. V	Value of assets (1000's of Sw.kr.) C_1	C_2	C_3	Measure of profitability (per cent) R_1	R_2	R_3
Plains of Götaland (Gss)								
Short-term plans								
Hectares arable								
5–10	9	−1 303	102		48	−1.2		−2.6
10–20	15	5 544	168		72	3.2		7.6
20–30	25	16 725	262		106	6.3		15.7
30–50	38	28 470	383		145	7.4		19.5
Long-term plans								
Hours per year								
3 000	60	57 135		570	225		10.0	25.3
5 000	120	116 747		1070	381		10.9	30.6
7 000	150	152 764		1363	502		11.2	30.4
Plains of Svealand (Ss)								
Short-term plans								
Hectares arable								
5–10	9	−3 725	71		46	−5.2		−7.9
10–20	17	−185	117		71	−0.1		−0.2
20–30	26	4 477	166		96	2.6		4.6
30–50	40	8 450	226		119	3.7		7.0
Long-term plans								
Hours per year								
3 000	56	23 762		313	189		7.5	12.5
5 000	112	57 072		600	353		9.5	16.1
7 000	140	75 204		779	471		9.6	15.9

Note: The concepts V, C and R are explained in Appendix D, p. 191. The calculations are based on the following assumptions in addition to those in Hjelm's study: value of farm lands in Gss 7 000 Sw.kr. per hectare, in Ss 3 000 Sw.kr. per hectare; value of forest land 360 and 150 Sw.kr. per hectare respectively. Using Hjelm's data on the replacement value of drainage in long-term plans and the acreage drained according to JEU, production costs for land improvements in Gss are calculated to 440 Sw.kr. per hectare for short-term plans and 900 Sw.kr. per hectare for long-term plans; the corresponding figures for Ss are 180 and 650 Sw.kr. per hectare. The additional market value of farm land over and above the opportunity costs has been calculated on the basis of these figures to (7 000 − 360 − 440 =) 6 200 Sw.kr. per hectare for short-term plans in Gss and, for the other three groups, 5 740, 2 670 and 2 200 Sw.kr. per hectare.

APPENDIX E

INCOME AND WEALTH IN AGRICULTURE

BY ODD GULBRANDSEN

This appendix contains the methods and main tables of the following studies:

1. Income calculations based on data from JEU.
2. Trend estimates for a comparison of the incomes of farmers with those of other groups.
3. The distribution of income in agriculture, calculated using data from JEU.
4. The distribution of income and wealth in agriculture, calculated on the basis of income tax returns.
5. Summary of data from the savings surveys by the National Institute of Economic Research concerning income and wealth.

The conclusions of these studies are given in the main text, mostly in Chapter 5.

INCOME CALCULATIONS BASED ON DATA FROM JEU

About half the main tables in JEU were transferred to punch cards and processed to provide the basis for the analyses of income and profitability contained in this book.[1] Lack of space has made it impossible to tabulate more than a certain number of total income estimates in this appendix.[2] The analysis was made in two stages. First, JEU data for separate areas and acreage groups were weighted together into means for larger areas. Secondly, new income and profitability concepts not calculated in JEU were formed.

Weighting was uniform for all data covering the years 1954–66. The number of farms registered in the 1961 agricultural census was used as a weight. The larger areas formed are the three so-called national regions and the entire country. Totals and averages per hectare were calculated for four acreage groups in each of these areas except northern Sweden, where there were two acreage groups only. Totals and means were also calculated for all the acreage groups included in each area.

Table E 1 shows the growth of income between 1954 and 1966 in the acreage groups of the central and southern Swedish plainlands. The items included in the table were calculated as follows:

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[1] Räkenskapsresultat från svenska lantbruk (Accounted profits of Swedish farming), *Report from the National Board of Agriculture,* Series B, main tables I–XIII.

[2] The other estimates have been filed, together with the analytical programme, at the Institute for Economics and Statistics of the Agricultural College, 750 07 Uppsala 7, Sweden.

Consumption: payments in kind + private household expenditure + cash wages to children and older relatives – food for employees, etc.

Tax: as in JEU, except for 1954, when JEU does not distinguish between taxes and private household expenditure. Tax this year is assumed to have been equal to that paid in 1955, and consumption has been reduced accordingly.

Savings: three methods have been used to calculate this item, one concerning real savings excluding capital profits (method A) and the other two including capital profits in real savings, and calculated in two different ways (methods B and C).

Savings, method A: accumulation of wealth as in JEU.

Savings, method B: savings according to method A plus the rise in the real value of the farm between current year and the next year times the value of the farm at the beginning of the year plus the decline in the real value of debts.

Savings, method C: net wealth at the close of the year according to JEU, increased by the rise in the value of the farm owing to the rise in land prices during the year and deflated to the value of money at the beginning of the year minus net wealth according to JEU at the beginning of the year.

Children's allowance, etc.: incomes derived from children's allowance,sales of stone, gravel and turves, and producer subsidies.

Total income according to JEU: the total income of the family according to JEU.

Total income A: total income according to JEU.

Total income B: consumption plus tax plus savings, method B, minus children's allowance , etc.

Total income C: consumption plus tax plus savings, method C, minus children's allowance, etc.

Changes in the consumer price index per calendar year have been used as deflation factors. The annual change in the so-called overprice percentages (purchase price coefficients) has been used as a basis for determining the rise in farm land values. Price rises between the new land assessments in 1956 and 1965 have been put at 3 and 18 per cent respectively.

TREND ESTIMATES FOR A COMPARISON OF INCOMES

Agricultural incomes vary considerably from one year to another, above all on account of weather conditions. Income trends have therefore been calculated to facilitate a better comparison of income growth during the period among farmers and other categories. These trends have been obtained by using the least squares method to smooth out the annual observations with a logarithmically linear function, corresponding to the assumption of a uniform annual percentage growth of income. Thus the trend income is calculated from the following formula:

$$I = a \cdot t^b + \epsilon,$$

in which I = income, t = time, a is a constant, b the trend coefficient and ϵ a random factor.

Estimates have been made for incomes from basic farms, for the annual earnings of rural industrial workers and for the annual earnings of agricultural workers. As regards basic farmers in the central and southern Swedish plainlands, trends have been calculated for 11 income concepts, namely the total consumption of the large family, total income according to three methods in the three income categories of large family, primary family and farmer, and finally for the farmer's labour return.[3]

The three total income concepts for the large family are identical with total income concepts A–C described above. The total income of the primary family is calculated by subtracting labour return for adult relatives over 16, calculated according to agricultural wages, from the total income of the large family. The farmer's total income is calculated by subtracting the estimated labour return to all family members except the farmer from the total income of the large family.

Table E2, covering the period 1954–66, gives the annual observation with and without trend adjustment for each of the 13 income groups.

THE DISTRIBUTION OF INCOME, CALCULATED USING DATA FROM JEU

Income data for 1957–62 from JEU have been analyzed to see whether the distribution of income between farmers during individual years is the result of coincidence or of permanent inequalities of income. The study includes the four production areas which go to make up the plainlands of central and southern Sweden. The only 10–20 and 20–30 hectare acreage groups have been taken into account.[4] The distribution of income has been calculated on the basis of the total income of the large family minus capital profits but including family allowances etc. Altogether 804 farming families are included in the study.

The distribution of income has been estimated for two periods, namely the three-year period 1960–62 and the six-year period 1957–62. The average income of the individual family has been calculated for each of these periods. Calculations have only been made with regard to families with incomes accounted in JEU for each year of the three-year and six-year periods, respectively. Minimum and maximum values, medians, quartiles, group means and dispersions have been calculated for these average incomes in each period, area and acreage group. The results are given in Table E3.

THE DISTRIBUTION OF INCOME AND WEALTH ACCORDING TO INCOME TAX RETURNS

The distribution of income and wealth among farmers has been studied by a special analysis of the SCB's sample survey of farmers' income tax returns.

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[3] Similar estimates have also been made with regard to other acreage groups and national regions. The results have been filed at the Institute for Economics and Statistics of the Agricultural College, 750 07 UPPSALA 7.

[4] The analyses have been made using punch-card-material provided by Nils-Ivar Isaksson, whose studies of various factors affecting the distribution of income have been published in *Jordbruksekonomiska meddelanden* (The Journal of Agricultural Economics), No. 5, 1966 and elsewhere.

The analysis covered data for 1963, 1965 and 1966. Only certain data for 1966 are covered in this appendix.[5]

Income has been measured in terms of the combined incomes of husband and wife minus any deficit in the source of income. Wealth has been measured in terms of the difference between the total assets and liabilities of husband and wife. Production area, acreage group and age have been used as classification variables. The analysis of income and wealth has been applied to a total population calculated from the sample.

The analysis involved calculating the distribution of incomes in each acreage group on the same lines as in the study of income distribution based on data from JEU, as well as determining the frequency distribution of farmers between a number of acreage, age, income and wealth groups. The distribution rates for 1966 are given in Table E4. Frequency distribution between income classes is given in Table E5 and between certain combinations of income and wealth classes in Table E6. Table E7, finally, gives mean and total figures for incomes and wealth of farmers by age groups and size of farm.

INCOME AND WEALTH ACCORDING TO SAVINGS SURVEYS BY THE INSTITUTE OF ECONOMIC RESEARCH

Sample studies have been made by the National Institute of Economic Research of savings by different income groups in 1955, 1957 and 1958. These studies have been published in *Konjunkturinstitutets meddelanden* (Reports from the National Institute of Economic Research) B 25, B 26, B 32 and B 33. Summaries of data from these studies which are of relevance to the subjects dealt with in this book will be found in Table E8 concerning saving and disposable income and in E9 concerning wealth. There are certain discrepancies between the definitions of concepts applied to the different years, so that comparisons between them are hazardous. On the other hand comparisons can be made between different income groups in the same year. Table E10 shows the percentage distribution of wealth in certain groups according to the survey for 1957. The percentages are relatively unreliable owing to the small sample used.

[5] »Assessed incomes, expenditure, net receipts, assets and liabilities of farmers» (*Statistiska meddelanden* (Statistical Reports) J 1965:17, J 1967:18 and J 1968:10. The results for 1963 and 1965, tables of raw data given here regarding 1966 and the programme for the analysis have been filed at the Institute for Economics and Statistics of the Agricultural College, 750 07 Uppsala 7.

Table E 1. *Income, consumption and saving of farmers on the plains of southern and central Sweden, 1954–66*

Year	Consumption Sw.kr.	Tax Sw.kr.	Saving in Sw.kr. A	Saving in Sw.kr. B	Childrens allowances etc. Sw.kr.	Total income in Sw.kr. JEU	Total income in Sw.kr. A	Total income in Sw.kr. B	Total income in Sw.kr. C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Acreage group 5–10 hectares arable									
1954	8 651	1 399	621	627	468	9 524	9 056	10 203	10 209
1955	8 516	1 399	−153	−107	428	9 881	9 453	9 334	9 380
1956	9 599	1 607	−20	1 480	421	12 077	11 656	10 765	12 265
1957	9 482	1 980	−15	−1 006	458	10 775	10 317	10 989	9 998
1958	9 512	1 861	658	−507	513	11 536	11 023	11 518	10 353
1959	9 927	1 407	−133	−244	526	9 918	9 392	10 675	10 564
1960	10 457	1 691	2 543	1 148	614	12 720	12 106	14 077	12 682
1961	11 326	2 179	−1 119	−483	582	12 708	12 126	11 804	12 440
1962	11 907	2 295	1 470	−29	653	13 782	13 129	15 019	13 520
1963	12 293	2 260	5 503	2 722	660	14 349	13 689	19 396	16 615
1964	13 335	2 616	8 552	8 187	632	16 703	16 071	23 871	23 506
1965	14 371	3 374	7 637	8 264	695	18 350	17 655	24 687	25 314
1966	14 981	4 080	4 678	447	792	18 088	17 296	22 947	18 716
Mean	11 104	2 165	2 325	1 577	572	13 109	12 536	15 022	14 274
Acreage group 10–20 hectares arable									
1954	11 385	2 070	858	1 552	424	13 258	12 834	13 889	14 583
1955	10 898	2 070	−1 023	−58	440	13 073	12 633	11 505	12 470
1956	11 798	2 222	46	2 604	382	15 636	15 254	13 684	16 242
1957	11 411	2 578	−966	−704	355	13 448	13 093	12 668	12 930
1958	11 917	2 559	1 244	−873	527	14 591	14 064	15 193	13 076
1959	12 323	2 134	1 751	1 510	583	13 781	13 198	15 625	15 384
1960	13 331	2 268	5 153	2 815	700	17 284	16 584	20 052	17 714
1961	13 918	2 995	−114	615	638	16 683	16 045	16 161	16 890
1962	14 544	3 381	3 842	2 019	765	19 102	18 337	21 002	19 179
1963	15 632	3 350	6 230	5 559	734	19 822	19 088	24 478	23 807
1964	16 981	3 672	12 922	14 920	861	23 937	23 076	32 714	34 712
1965	18 296	5 039	13 177	15 105	1 006	26 789	25 783	35 506	37 434
1966	19 159	5 972	1 720	2 211	1 041	24 879	23 838	25 810	26 301
Mean	13 969	3 101	3 449	3 637	650	17 868	17 217	19 868	20 056
Acreage group 20–30 hectares arable									
1954	13 198	2 930	2 992	2 120	456	15 830	15 374	18 664	17 792
1955	13 152	2 930	−707	−540	526	15 730	15 204	14 849	15 016
1956	13 702	3 254	−480	3 296	431	18 873	18 442	16 045	19 821
1957	13 801	3 392	−2 879	−2 227	465	15 193	14 728	13 849	14 501
1958	14 509	3 075	1 001	−2 759	624	16 118	15 494	17 961	14 201
1959	14 475	2 660	479	1 541	640	15 691	15 051	16 974	18 036
1960	15 340	2 690	5 692	3 437	754	19 863	19 109	22 968	20 713
1961	16 476	3 652	1 120	−217	735	18 589	17 854	20 513	19 176
1962	17 070	4 181	5 525	2 195	804	22 184	21 380	25 972	22 642
1963	18 316	4 028	8 766	6 812	813	22 875	22 062	30 297	28 343
1964	19 757	4 395	21 377	20 622	886	29 528	28 642	44 643	43 888
1965	21 950	5 852	17 142	20 217	1 138	32 102	30 964	43 806	46 881
1966	23 118	7 190	1 383	1 583	1 201	28 194	26 993	30 490	30 690
Mean	16 528	3 864	4 724	4 314	729	20 828	20 100	24 387	23 977

Table E 1 (cont.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Acreage group 30–50 hectares arable									
1954	16 342	3 472	4 072	2 178	486	18 710	18 224	23 400	21 506
1955	15 423	3 472	−1 626	−2 809	111	15 941	15 830	17 158	15 975
1956	16 204	3 840	−329	3 644	397	21 527	21 130	19 318	23 291
1957	15 745	3 720	−167	−2 766	344	16 766	16 422	18 954	16 355
1958	16 275	3 795	3 735	−3 530	546	18 318	17 772	23 259	15 994
1959	16 182	3 425	6 314	3 555	526	19 046	18 520	25 395	22 636
1960	17 819	3 759	9 092	5 446	758	24 950	24 192	29 912	26 266
1961	19 047	4 776	−2 569	322	723	22 326	21 603	20 531	23 422
1962	19 492	5 288	5 889	4 196	929	27 315	26 386	29 740	28 047
1963	21 005	5 042	12 045	11 730	951	29 206	28 255	37 141	36 826
1964	22 522	5 659	28 165	29 527	986	37 967	36 981	55 360	56 722
1965	24 606	7 761	26 733	31 250	1 242	42 161	40 919	57 858	62 375
1966	26 030	8 614	648	6 146	1 265	35 662	34 397	34 027	39 525
Mean	18 976	4 817	7 077	6 838	713	25 377	24 664	30 158	29 918

Note: The concept of income, methods of calculation and sources are given in Appendix E, pp. 197 ff.

Table E2. *Income of basic farmers, industrial workers and farm workers, 1954–66*

Year	Basic farmers on plains of southern and central Sweden										Annual wage of industrial worker in rural area (Sw.kr.)	Annual wage of farm worker (Sw.kr.)
	Consumption (Sw.kr.)	Large family's total income (Sw.kr.)			Primary family's total income (Sw.kr.)			Farmer's total income (Sw.kr.)			Farmer's labour income (Sw.kr.)	
		A	B	C	A	B	C	A	B	C		
Observed data												
1954	11 385	12 834	13 889	14 583	10 862	11 917	12 611	9 229	10 284	10 978	5 948	9 050	6 738
1955	10 898	12 633	11 505	12 470	10 602	9 474	10 439	8 876	7 748	8 713	5 212	9 751	7 386
1956	11 798	15 254	13 684	16 242	13 108	11 538	14 096	11 239	9 669	12 227	7 401	10 460	7 851
1957	11 411	13 093	12 668	12 930	10 979	10 554	10 816	8 922	8 497	8 759	4 784	10 991	8 338
1958	11 917	14 064	15 193	13 076	12 243	13 372	11 255	9 924	11 053	8 936	5 589	11 345	8 825
1959	12 323	13 198	15 625	15 384	11 448	13 875	13 634	9 085	11 512	11 271	4 760	11 643	8 939
1960	13 331	16 584	20 052	17 714	14 706	18 174	15 836	11 791	15 259	12 921	6 871	12 366	9 747
1961	13 918	16 045	16 161	16 890	14 051	14 167	14 896	10 647	10 763	11 492	5 136	13 443	10 551
1962	14 544	18 337	21 002	19 179	16 256	18 921	17 098	12 558	15 223	13 400	6 855	14 687	11 819
1963	15 632	19 088	24 478	23 807	16 877	22 267	21 596	12 644	18 034	17 363	6 794	16 001	12 902
1964	16 981	23 076	32 714	34 712	20 993	30 631	32 629	16 521	26 159	28 157	9 460	17 302	13 848
1965	18 296	25 783	35 506	37 434	23 475	33 198	35 126	18 689	28 412	30 340	9 662	18 931	14 911
1966	19 159	23 838	25 810	26 301	21 532	23 504	23 995	16 202	18 174	18 665	5 234	20 553	16 839
Value according to trend													
1954	10 328	11 709	11 185	11 536	9 837	9 346	9 716	8 300	7 793	8 148	5 342	8 844	6 612
1955	10 830	12 424	12 179	12 511	10 509	10 272	10 625	8 784	8 543	8 879	5 486	9 449	7 114
1956	11 356	13 183	13 261	13 568	11 226	11 291	11 620	9 297	9 365	9 676	5 634	10 095	7 655
1957	11 908	13 989	14 440	14 715	11 993	12 410	12 707	9 839	10 267	10 544	5 786	10 785	8 237
1958	12 487	14 844	15 723	15 958	12 812	13 641	13 896	10 413	11 255	11 490	5 942	11 523	8 864
1959	13 093	15 751	17 120	17 307	13 688	14 993	15 197	11 020	12 338	12 521	6 102	12 311	9 538
1960	13 730	16 713	18 642	18 769	14 623	16 480	16 619	11 663	13 526	13 645	6 266	13 153	10 263
1961	14 397	17 735	20 299	20 355	15 621	18 114	18 175	12 343	14 828	14 870	6 435	14 052	11 043
1962	15 096	18 818	22 103	22 075	16 688	19 910	19 876	13 063	16 255	16 204	6 608	15 013	11 883
1963	15 829	19 968	24 067	23 940	17 828	21 884	21 736	13 824	17 820	17 658	6 786	16 039	12 787
1964	16 599	21 188	26 206	25 963	19 046	24 054	23 770	14 631	19 535	19 243	6 969	17 136	13 759
1965	17 405	22 483	28 536	28 157	20 347	26 439	25 995	15 484	21 415	20 970	7 157	18 308	14 805
1966	18 251	23 857	31 072	30 536	21 737	29 060	28 428	16 387	23 477	22 852	7 349	19 560	15 931

Note: The concept of income, methods of calculation and sources are given in Appendix E, pp. 197 ff.

Table E3. *Range of income among farmers according to JEU, 1957–62*

Acreage group, period and region	No. of families	Total income of large family excl. capital income (Sw.kr.) Lowest value	Lower quartile	Median	Upper quartile	Highest value	Mean	Dispersion
10–20 hectares arable								
1960–62[a]								
Gss	108	5 549	17 114	21 193	25 978	44 742	21 949	7 244
Gmb	123	5 922	13 901	17 536	22 606	42 532	18 787	7 222
Gns	98	3 128	12 307	15 169	18 682	42 903	16 298	6 361
Ss	111	4 284	10 691	14 024	16 739	31 033	14 213	4 744
Slb	440	3 128	12 909	16 636	21 533	44 742	17 855	7 080
1957–62[b]								
Gss	89	4 441	15 170	19 342	23 028	42 322	19 657	6 616
Gmb	84	5 162	12 033	16 308	20 111	39 135	16 744	6 387
Gns	72	3 944	10 220	13 100	15 781	39 350	14 134	5 712
Ss	75	5 049	9 417	12 171	14 714	25 348	12 689	4 180
Slb	320	3 944	11 560	15 008	19 520	42 322	16 017	6 422
20–30 hectares arable								
1960–62[a]								
Gss	75	6 958	18 091	25 085	30 226	39 515	24 609	7 774
Gmb	87	5 533	16 134	19 934	26 908	57 414	21 444	8 237
Gns	109	3 962	15 882	18 601	22 067	43 072	19 090	6 129
Ss	93	3 477	12 819	16 739	20 309	38 245	17 089	5 712
Slb	364	3 477	15 124	19 090	25 028	57 414	20 279	7 421
1957–62[b]								
Gss	50	6 718	18 343	23 786	29 539	34 931	23 264	6 951
Gmb	52	7 536	15 187	18 787	25 267	33 966	19 787	6 837
Gns	64	5 013	14 048	16 751	20 431	34 915	17 425	4 817
Ss	54	4 695	12 217	13 916	16 547	32 246	14 497	4 944
Slb	220	4 695	14 037	17 391	22 713	34 931	18 592	6 644

[a] Based on individual data concerning the family's mean income for 1960–62 (three years).

[b] Based on individual data concerning the family's mean income for 1957–62 (six years).

Abbreviations for regions: Gss = southern plains of Götaland, Gmb = central districts of Götaland, Gns = northern plains of Götaland, Ss = plains of Svealand, Slb = plains of southern and central Sweden.

Source and methods of calculation: See Appendix E, pp. 199 f.

Table E4. *Range of income among farmers according to tax returns, 1966*

Acreage group (hectares arable)	Combined income of husband and wife (Sw.kr.)					
	Lowest value	Lower quartile	Median	Upper quartile	Highest value	Mean
2–5	– 10 476	7 721	12 611	19 296	100 396	14 711
5–10	– 25 103	8 538	12 677	18 478	96 072	14 583
10–20	– 10 608	11 430	15 967	21 536	182 513	17 769
20–30	– 23 577	12 917	18 818	24 968	115 764	20 048
30–50	– 68 975	15 716	22 300	29 996	157 731	24 346
50–100	– 87 250	19 392	28 536	39 777	403 605	32 373
over 100	– 205 064	24 988	42 075	68 984	1 072 609	53 835

Source and method of calculation: See Appendix E, pp. 199 f.

Table E5. *Distribution of farmers by income, age and size of farm, 1966*

Age (years)	Income (Sw.kr)	Acreage group (hectares arable)							
		2–5	5–10	10–20	20–30	30–50	50–100	over 100	Total
		Number of farmers							
Under 50	Under 5 000	(333)	988	(544)	(242)	254	(121)	(45)	2 527
	5 000–10 000	1 293	2 655	2 159	996	379	(103)	(18)	7 603
	10 000–15 000	1 703	4 156	4 258	1 507	851	275	(47)	12 797
	15 000–20 000	2 391	3 809	4 427	2 171	1 260	373	(46)	14 477
	Over 20 000	4 252	5 141	6 422	4 456	4 321	2 553	787	27 932
	Totals	9 972	16 749	17 810	9 372	7 065	3 425	943	65 336
50–59	Under 5 000	(1 096)	1 205	(519)	(195)	(168)	(54)	(17)	3 254
	5 000–10 000	2 346	3 789	1 639	510	(142)	(80)	(6)	8 512
	10 000–15 000	2 615	4 898	3 629	984	488	(82)	(18)	12 714
	15 000–20 000	2 881	2 873	4 033	1 078	592	(141)	(27)	11 625
	Over 20 000	3 210	3 342	3 755	1 958	1 874	1 236	399	15 774
	Totals	12 148	16 107	13 575	4 725	3 264	1 593	467	51 879
60–66	Under 5 000	1 228	1 069	(253)	(102)	(49)	(22)	(12)	2 735
	5 000–10 000	2 199	3 379	1 395	(271)	(106)	(38)	(2)	7 390
	10 000–15 000	2 520	2 894	2 109	(318)	(160)	(46)	(9)	8 056
	15 000–20 000	(1 121)	1 355	1 674	(420)	239	(64)	(6)	4 879
	Over 20 000	(831)	957	1 641	966	650	358	120	5 523
	Totals	7 899	9 654	7 072	2 077	1 204	528	149	28 583
Over 66	Under 5 000	1 960	1 635	593	(154)	(40)	(53)	(39)	4 474
	5 000–10 000	3 625	2 436	736	(143)	(76)	(14)	(6)	7 036
	10 000–15 000	3 205	2 687	774	(271)	(68)	(56)	(10)	7 071
	15 000–20 000	(833)	1 015	577	(144)	(62)	(24)	(14)	2 669
	Over 20 000	(828)	1 104	888	(390)	319	(138)	175	3 842
	Totals	10 451	8 877	3 568	1 102	565	285	244	25 092
All	Under 5 000	4 617	4 897	1 909	693	511	250	113	12 990
	5 000–10 000	9 463	12 259	5 929	1 920	703	235	(32)	30 541
	10 000–15 000	10 043	14 635	10 770	3 080	1 567	459	84	40 638
	15 000–20 000	7 226	9 052	10 711	3 813	2 153	602	93	33 650
	Over 20 000	9 121	10 544	12 706	7 770	7 164	4 285	1 481	53 071
	Totals	40 470	51 387	42 025	17 276	12 098	5 831	1 803	170 890

Note: Unreliable figures (sample of less than 30) are given in brackets. The concepts of income and sources are given in Appendix E, pp. 199 f.

Table E6. *Distribution of farmers by income, wealth, age and size of farm, 1966*

Income and wealth (Sw.kr.)	Age (years)	Acreage size (hectares arable) 2–5	5–10	10–20	20–30	30–50	50–100	over 100	T
		No. of farmers							
Under 7 000 and 20 000 respectively	Under 50	(370)	(450)	(206)	(158)	(58)	(40)	(15)	
	50–60	(801)	(359)	(134)	(10)	(32)	(4)	(4)	
	60–66	(516)	(591)	(14)	(18)	(6)	(0)	(5)	
	Over 66	(1 141)	(213)	(10)	(30)	(2)	(4)	(11)	
	Totals	2 828	1 613	(364)	(216)	(98)	(48)	(35)	
Under 9 000 and 40 000 respectively	Under 50	(815)	1 451	720	(409)	(168)	(76)	(19)	
	50–60	1 908	1 911	(470)	(128)	(50)	(16)	(4)	
	60–66	1 782	1 632	(282)	(68)	(45)	(0)	(5)	
	Over 66	2 927	1 430	(72)	(62)	(6)	(8)	(12)	
	Totals	7 432	6 424	1 544	667	269	(100)	(40)	
Under 10 000 and 60 000 respectively	Under 50	1 455	2 737	1 702	752	344	(82)	(21)	
	50–60	2 716	3 102	867	(272)	(78)	(20)	(4)	
	60–66	2 618	3 281	678	(113)	(53)	(1)	(5)	
	Over 66	4 548	2 463	(436)	(78)	(12)	(12)	(14)	
	Totals	11 337	11 583	3 683	1 215	487	(115)	(44)	
Under 15 000 and 60 000 100 000	Under 50	3 124	7 057	6 098	2 271	1 188	329	62	
	50–60	5 474	8 712	4 272	1 087	458	(74)	(10)	
	60–66	5 340	6 540	2 563	(395)	(147)	(27)	(8)	
	Over 66	7 996	5 782	1 522	(287)	(34)	(28)	(16)	
	Totals	21 934	28 091	14 455	4 040	1 827	458	96	
Over 15 000 or over 100 000 respectively	Under 50	6 848	9 692	11 712	7 101	5 877	3 096	881	
	50–60	6 674	7 395	9 303	3 638	2 806	1 519	457	
	60–66	2 559	3 114	4 509	1 682	1 057	501	141	
	Over 66	2 455	3 095	2 046	815	531	257	228	
	Totals	18 536	23 296	27 570	13 236	10 271	5 373	1 707	
All farmers	Under 50	9 972	16 749	17 810	9 372	7 065	3 425	943	
	50–60	12 148	16 107	13 575	4 725	3 264	1 593	467	
	60–66	7 899	9 654	7 072	2 077	1 204	528	149	
	Over 66	10 451	8 877	3 568	1 102	565	285	244	
	Totals	40 470	51 387	42 025	17 276	12 098	5 831	1 803	1

Note: Unreliable figures (sample of less than 30) are given in brackets. The concepts of income and wealth and sources are given in Appendix E, pp. 199 f.

Table E.7. *Farmers' taxable income and wealth, means and totals for different ages and sizes of farm, 1966*

	Age (years)	Acreage group (hectares arable) 2–5	5–10	10–20	20–30	30–50	50–100	over 100	Total
Mean per farmer		Sw.kr. per farmer							
Income	Under 50	19 515	17 648	18 741	20 672	24 603	32 970	49 622	20 681
Wealth	»	44 849	60 039	75 496	89 998	103 912	186 786	521 256	84 028
Income	50–59	15 890	14 588	17 842	19 580	23 973	33 169	57 120	17 743
Wealth	»	48 953	72 112	105 616	121 428	163 464	252 826	670 849	96 634
Income	60–66	12 551	11 762	16 574	19 597	22 664	32 392	53 201	14 796
Wealth	»	50 705	70 609	118 706	144 195	172 052	276 818	774 987	94 110
Income	Over 66	10 387	11 860	15 016	17 593	26 880	20 716	64 213	12 895
Wealth	»	57 971	79 300	106 671	160 419	297 867	367 477	1 293 086	97 869
Income	All	14 711	14 583	17 769	20 048	24 429	32 373	53 835	17 661
Wealth	ages	50 613	68 821	95 144	109 602	135 818	221 812	685 421	91 573
Total value per age group		Millions of Sw.kr.							
Income	Under 50	195	296	334	194	174	113	47	1 353
	50–59	193	235	242	93	78	53	27	921
	60–66	99	114	117	41	27	17	8	423
	Over 66	109	105	54	19	15	6	16	324
	Total	595	750	747	347	294	189	98	3 020
Wealth	Under 50	447	989	1 345	843	734	640	492	5 490
	50–59	595	1 162	1 434	574	534	403	313	5 015
	60–66	401	682	839	299	207	146	115	2 689
	Over 66	606	704	381	178	168	105	316	2 458
	Total	2 049	3 537	3 999	1 894	1 643	1 294	1 236	15 652

Note: The concepts of income and wealth and sources are given in Appendix E, pp. 199 f.

Table E8. *Saving and disposable income, from the Savings Studies by the National Institute of Economic Research*

	Units with income chiefly from		
		Employment	
	Agriculture	Workers	Salaried employees
Saving	*Sw.kr.*		
1955	1 994	451	1 123
1957	2 470	436	2 108
1958	1 712	656	1 148
Disposable income			
1955	7 828	8 367	13 847
1957	10 518	8 210	13 772
1958	9 451	9 598	12 943

Source: See Appendix E, p. 200.

Table E9. *Wealth, from the Savings Studies by the National Institute of Economic Research*

	Units with income chiefly from				
			Employment		
Years	Agriculture	Other enterprise	Workers	Salaried employees	Basic farmers according to JEU
	1000's of Sw.kr.				
1955	66.5	109.8	10.2	35.9	79.6
1957	71.2	67.1	13.8		81.0
1958	70.0	66.7	16.4		82.4

Note: The figures for different years are not comparable owing to changes in the definitions.

Source: See Appendix E, p. 200.

Table E10. *Distribution of wealth, from the Savings, Studies by the National Institute of Economic Research, 1957*

	Wealth					
	Less than 5 000 Sw.kr.	5 000–20 000 Sw.kr.	20 000–50 000 Sw.kr.	50 000–100 000 Sw.kr.	100 000 Sw.kr. or more	Total
Units with income chiefly from	*Per cent*					
agriculture	5	13	30	33	19	100
other enterprise	12	17	24	31	16	100
employment	57	22	15	4	2	100
total	52	20	16	8	4	100

Source: See Appendix E, p. 200.

APPENDIX F

PRODUCTIVE CAPACITY AND FACTOR REQUIREMENTS FOR EMERGENCY SITUATIONS

BY ODD GULBRANDSEN

This appendix gives the methods of calculation for the estimates concerning emergency food supplies on which the reasoning in Chapter 7 is based. The account falls into four sections:

1. Consumption estimates
2. Estimate of stocks
3. Factor requirements in emergency agriculture
4. Estimate of land reserves.

It should be emphasized that the estimates are illustrative examples of a cheap solution of emergency food supplies rather than as indication of the preparedness that would be most suitable for the national economy.

CONSUMPTION ESTIMATES

The estimate of peacetime consumption in 1980 given in Table 23 (p. 115) is based on an assumed population increase of 8.5 per cent, from 7.9 millions in 1967 to 8.57 millions in 1980, and a rise in disposable income of 3.5 per cent per capita and year. Consumption of calories and individual foodstuffs has been calculated with the aid of income elasticities derived from FAO surveys[1] and from studies at the Institute for Economics and Statistics of the Agriculture College.[2] The total elasticity of demand with regard to changes of income, certain allowances being made for the effect of demand on prices and the resultant substitution, is −1.5 for butter, −0.3 for bread grain and potatoes, −0.1 for calories and fats, 0 for milk, 0.1 for sugar and beef, 0.2 for eggs and all meat, and 1.0 for broilers and other foodstuffs. The low elasticities of butter and beef express an anticipated heavy substitution of demand in favour of other fat and meat products. Margarine consumption has been taken as the difference between consumption of fats and consumption of butter, pork consumption as the difference between all meat consumption and beef and broiler consumption combined.

In estimating the volume of necessary consumption in the event of an emergency in 1980 it has been decided to retain a high consumption of milk, pork and broilers on account of their value as calory sources as well as the low additional price of the protein content of these products (above the unit value of

[1] *Agricultural Commodities* – Projections for 1975 and 1985, CCP 67/3, Rome 1966, Vol. II, p. 124.

[2] *Makroekonomisk prognosmodell för den svenska jordbrukssektorn baserad på multipla regressionsekvationer* (Macroeconomic Prediction Model for the Swedish Agricultural Sector Based on Multiple Regression), mimeograph 1968.

their calory content). Beef consumption is reduced to a level that can be catered for by domestic production when the calves bread in combined dairy and beef production are fattened to heifers. Given this scheme of things, the requisite daily quota of 40 g animal protein can be provided with about half the peacetime rate of egg consumption. Fish consumption is also expected to be reduced by half in view of the difficulties attending ocean fishing in the event of an emergency. Imports of fruit, vegetables and edible oils are expected to cease entirely. Since edible oils cost far more to store than bread grain and sugar, supplies of these oils from stores during an emergency have been put at half the rate of peacetime imports.

These cuts in consumption would reduce calory consumption by over 10 per cent. The balance is redressed by increased consumption of bread and potatoes. The volumes of these products have been gauged to meet total protein and calory requirements. Since increased bread consumption is expected to increase the demand for edible fats, it is assumed that the fat content of milk will be reduced and supplies of double cream limited. This will make it possible to produce more butter. To maintain or even increase the volume of milk consumption despite a fall in dairy output, the quantity of skim milk used in pig farming can be restricted. This will call for additional supplies of alternative forms of animal protein for pig farming, e.g. by improved utilization of protein waste in the food processing industry and from private households. It may also prove necessary to lay up stocks of protein feed.

The estimates of the calory and protein content of food consumption have been based on available data concerning the nutritive content of individual food products.

ESTIMATE OF STOCKS

Annual removals from stores and the total size of food stores are shown in Tables 23 and F 1. For purposes of comparison the latter table includes present emergency stores. It also contains details concerning stores of oil concentrates and commercial fertilizers. Storage requirements for oil concentrates have been calculated as the difference between the amount required for the dairy and beef production planned and the volume occurring as a by-product of domestic output of oil plants. Stores of commercial fertilizer correspond to one-third the annual requirements of nitrogen and phosphoric acid and the entire annual requirement of potash. It is assumed that the residual nitrogen requirement can be met by domestic production. It is assumed that the quantity of phosphorous fertilizers can be reduced during an emergency without greatly inhibiting production, since the negative consequences of the reduction would be slight in the short run.

Table F 1 also shows the costs of the planned stores of various products. Storage costs comprise rent for storage premises, depreciation of stores and interest charges. It is assumed that the stores are purchased at the world market prices current in 1966/67.

FACTOR REQUIREMENTS IN EMERGENCY AGRICULTURE

In estimating factor requirements for domestic production, the first step was to calculate the need of plant products (crop volume). This is expressed in crop units and has been calculated with the aid of certain coefficients for the number

of crop units required per product unit.[3] The calculations indicated that 6.4 billion crop units, corresponding to two-thirds of the crop volume in normal weather conditions during the mid-1960's, would be required.

It is assumed that the crop volume can be reduced to these dimensions by de-cultivating the least productive acreage. Estimates in this respect have been based on a grading of different agricultural areas in order of productivity, using data concerning crop yield and labour requirements per hectare in different parts of the country (according to the estimates described in Appendix G) and acreage figures (1961 agricultural census). Acreage and labour requirements have been calculated with the help of these figures and the above-mentioned estimate of the crop volume required. The result is that the crop volume in question requires about 2 million hectares as against some 3.3 million in 1963. The amount of labour required will of course depend very largely on the entrepreneurial structure of agriculture. Given the structure in 1963, just under 200 000 man-years would be required as against 320 000 in 1963.

Labour requirements in a more optimal structure comprising 15 000 units with an average of 150 hectares each, have been estimated at 60 000 men. The capital requirements of these units, expressed in terms of replacement value in 1960 prices, have been estimated at Sw.kr. 9 billion, using figures from Hjelm's study of optimal enterprises (*Statens Offentliga Utredningar* 1963:66, Supplement 1). This sum includes Sw.kr. 0.3 billion working assets, calculated as 25 per cent of labour costs and overheads. The figures used in the estimates of labour and capital requirements are given in Table F2. Expressed in 1966 prices which as regards capital goods and livestock are about 30 per cent higher than 1960, capital requirements amount to Sw.kr. 12 billion.

In estimating capital costs, allowance has been made for an annual depreciation of 10 per cent on machinery and 2.5 per cent on livestock, buildings and plant, together with interest charges of 6 per cent based on half the replacement value. Maintenance costs have been calculated at 3 per cent of the replacement cost for machinery and 1/2 per cent for building and plant. The value of 2.25 million hectares of undeveloped land has been put at Sw.kr. 250 per hectare. The cost of supplies and services purchased has been schematically put at Sw.kr. 500 per hectare. Labour costs are based on the incomes of industrial workers (Sw.kr. 21 000 per man-year in 1966). On these assumptions, the total annual cost in 1966 prices would be Sw.kr. 3.8 billion approximately (see Table F1).

ESTIMATE OF LAND RESERVES

The main text indicates an alternative of a land reserve of 1/2 million hectares, estimated to yield the same crop as 300 000 hectares arable. This presupposes a yield of about 2 400 crop units per hectare arable on what, given a cultivated area of 2 million hectares, is marginal land (Svealand plains) and that the yield of this reserve, in spite of a certain amount of fertilization (provided for in the estimates of fertilizer stocks), cannot exceed 1 500 crop units per hectare, i.e. 40 per cent less yield than on cultivated land in the marginal area.

In calculating labour and capital requirements for land to be held in reserve, it has been assumed that this land in the event of an emergency will be used primarily to provide grazing and hay for young cattle and dairy herds. This

[3] The following requirements are assumed: beef 11, pork and poultry 6, eggs and margarine 4, milk 1 and potatoes 0.4 crop units per kg.

means that part of the production of roughage will be transferred in an emergency to the reserve land, so that land cultivated in peacetime is released for increased vegetable production. Livestock will be put out on reserve land during the grazing season. Schoolchildren or other causal labour can be employed to mind the cattle. Since the total output of roughage need not be increased, the greater requirements entailed by this production will be confined to certain additional transport costs for that part of the hay crop derived from reserve land. This makes it desirable for the land kept in reserve to be located near the consumption centres of surviving agricultural regions.

Resources are of course also required for vegetable production on the 300 000 hectares arable released through the transfer of animal production to reserve land. If the number of grazing animals is assumed to be 300 000 and assuming also that one person can mind between 20 and 30 animals, between 10 000 and 15 000 persons would be required for the purpose. The additional labour required for transporting roughage 20 km further than in peacetime can be put at 2 000 men during hay-making. The increased production of vegetable crops would require between 10 000 and 15 000 men during the cultivation period. Thus altogether 30 000 persons would be needed during the summer months over and above the normal agricultural labour force to exploit a land reserve of 1/2 million hectares during an emergency.

Table F1. *Storage costs in 1966/67 prices*

	World market price cif	Storage costs: Buildings and turnover	Storage costs: Total incl. 6 % interest	Emergency stores: At present	Emergency stores: »Optimal»
	Öre per kg			*Millions of kg*	
Sugar	45	3	6	50	900
Bread grain	30	5	7	300	1 600
Edible oils	153	13	22	20	120
Oil concentrates	66	4	8	65	400
Commercial fertilizer					
nitrogenous, in N	140	4	12		100
phosphorous, in P_2O_5	100	4	18		100
potash, in K	50	2	5		250
Total				*Millions of Sw.kr.*	
Purchase cost				184	1 698
Storage cost				33	259

Sources: Jordbruksekonomiska meddelanden (The Journal of Agricultural Economics). Working data from National Agriculture Marketing Board.

Table F 2. *Labour and capital required for agriculture in an emergency*

	No. of units 1000's	Capital required in 1960 prices Sw.kr./unit	Labour consumption hour/unit
	Hectares		
Grain and oil seed	1 100	1 300	25
Potatoes	50	1 900	100
Roughage	1 100	800	30
Soil implements	2 250	1 600	2
	Animals		
Dairy cows	600	3 100	50
Beef animals	400	1 400	20
Breeding sows	150	1 600	40
Slaughter pigs	2 400	80	1
Broilers	18 000	3	0.2
Laying hens	4 000	20	0.7
		Billions of Sw.kr.	*Millions of hours*
Total		9	123

Source: See Appendix F, p. 211.

Table F 3. *Annual costs for emergency agriculture, 1966 prices*

	Volume	Price factor	Cost
	Billions of Sw.kr.	*Per cent*	*Billions of Sw.kr.*
Depreciation and maintenance			
Machinery for crops	3.2	13	0.42
Land improvement	4.8	3	0.14
Animals and buildings	4.0	3	0.12
Interest			
Real capital	6	6	0.36
Undeveloped land	5.6	6	0.34
	Millions of hectares	*Sw.kr.*	
Supplies and services	2.25	500	1.13
	1000's	*Sw.kr.*	
Labour, annual workers	60	21 000	1.26
Total			3.77

Methods of calculation: See Appendix F, p. 211..

APPENDIX G

SUPPLY ELASTICITIES IN AGRICULTURE

BY ODD GULBRANDSEN

This appendix falls into three sections:

1. Time series studies of supply elasticities in agriculture
2. Cross-sectional studies of supply elasticities in agriculture
3. Methods for determining the effect on supply of considerable changes in prices and productivity.

The conclusions of these studies are presented in Chapter 8.

TIME SERIES STUDIES

Supply elasticities have been estimated for the period 1938/39 – 1964/65. Elasticity has been obtained by a regression calculation of a logarithmically linear relation of the form $Q = A \cdot P^e \cdot F^a \cdot N^b \cdot S^c \cdot \epsilon$, in which

Q = volume of production
P = producer price
F = factor prices
N = net productivity
S = crop variation
e = supply elasticity
A, a, b and c = constants
ϵ = a random factor

The volume of production consists of net production, i.e. gross production minus feed imports by the sector, in 1964/65 prices.

The data for the regression calculations are given in Table G1. The estimates were based on six different equations and are given in Table G2. The first four imply the consecutive insertion of several independent variables, factor prices being inserted as the last variable. Owing to a strong correlation between net productivity and factor prices (R=0.95), the coefficients of elasticity change considerably when factor prices are inserted. For this reason some additional approaches were tried.

In the fifth regression equation labour and interest are excluded from the factor prices (=the second factor price index), since the prices and volumes used for these factors of production may be misleading with respect to the actual alternative values. In the sixth equation net productivity has been divided by the factor price, a statistical technique for eliminating multicollinearity. None of these approaches gives, however, as satisfactory a result in terms of either their descriptive power (R^2) or of the signs and magnitudes of the coefficients anticipated on theoretical grounds as does the fourth approach.

If all farms are classified in order of profitability, their production is cumulated and profitability is related to cumulated production, the resultant graph shows the relation between profitability and production for the agricultural sector as a whole. In the absence of information on the profitability of each farm, the approximative method has been chosen of grouping farms of different sizes in different parts of the country. This has been done using JEU material for 8 regions and 2–4 acreage groups, making 27 groups in all.

Obviously the variations of average profitability between this number of groups is only a partial reflection of the total variation occurring between two hundred thousand enterprises. In order to arrive at some conception of the extent to which the variation between all farms has been under-estimated in the available material, a study has been made of variation in the factor which, apart from size of farm, has the greatest effect on profitability, namely crop yield. The basic material used consists of standard yields for about 400 areas according to SCB's estimates (known for purposes of crop damage compensation as reimbursement areas). These standard yields, which are given for individual crops, have been weighted together into an average yield per area of all products (16) together. These standard yields have been expressed in three ways, in current prices, at uniform price support and in crop units.[1]

The areas have been graded in order of standard yields and their total acreages cumulated. The present study relates to conditions in 1964. In Diagram G 1 the yields per hectare in crop units according to crop statistics and to JEU are compared. As the diagram shows, the two sources agree fairly well as regards both the 27 groups and a weighted average for each of the 8 areas in JEU.[2] This leads one to conclude that the JEU material can be used approximatively to describe regional variations of crop yield and consequently variations of profitability.

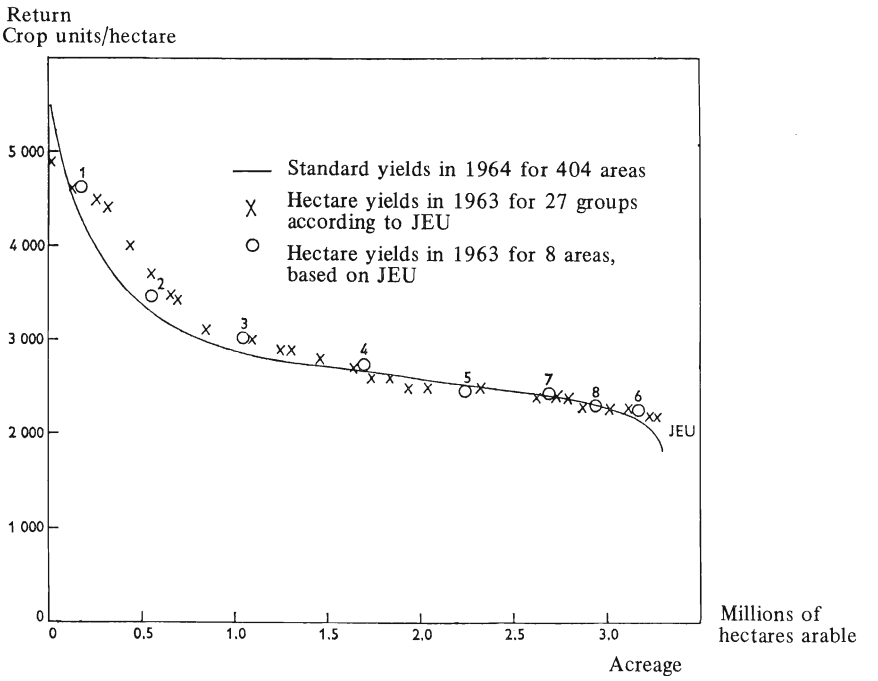
Four criteria of profitability have been calculated, three of which refer to labour returns calculated by different methods, while the fourth relates costs to receipts. The difference between the three first criteria are due to the valuation of capital costs. The first two criteria refer to labour return in a profitability estimate with the farm valued at its opportunity cost, while the third refers to labour return at the current market value of the farm. In calculating the opportunity cost, land has been valued at forest land prices and the other assets incorporated in the farm, buildings and plant, at replacement cost. Anticipated capital return consists of interest on the forest land value and half the replacement value of the other assets; the same rate of interest has been applied as in JEU. Forest land value has been inserted in labour return criterion 1 at current value according to JEU for each farm group, while a uniform national forest land value has been used in criterion 2. There is, however, little difference between these two criteria.

The fourth criterion of profitability is a cost-receipts relation in which production costs, including capital expenditure calculated according to opportunity cost

[1] Acreages according to the SCB acreage inventory have been taken as weighted averages. Current prices are given in *Statistiska meddelanden* (Statistical Reports) J 1965:8, prices at uniform price support are taken from Appendix L and the number of crop units per kg crop from *Sveriges Officiella Statistik,* Jordbruk och boskapsskötsel (Agriculture) 1960.

[2] Lack of space forbids the inclusion of the standard yields and acreages of the 404 areas. Data can be obtained by request from the author.

Diagram G 1. *Relation between factor returns and the size (acreage) of the agricultural sector*



and labour costs according to agricultural wages, are related to the value of net production.

The size of the agricultural sector has been measured in net production, acreage and the number of man-years. Net production has been defined here as receipts for animal and vegetable products minus the purchase costs of feed and seed. (Only in the case of seed costs has the raw material value, estimated at half, been deducted.) The number of man-years has been obtained by dividing the total labour return expectation relating to farming operations by a cost per man-year based on agricultural wage rates at an annual labour input of 1 920 hours.

The correlation analyses refer to regressions with the yield and profitability criteria as dependent variables and the cumulated volume of production and factor input respectively as independent variables. A second order functional relationship was chosen for the regression, since if the various observations are plotted individually in the diagram, the main concentrations form a definite curve (e.g. Diagram 3 in the main text and Diagram G1).

The relation between the above-mentioned cost-receipts ratio and the cumulated volume of production gives an expression for the output curve and can be used to calculate the supply elasticities. This relation is also curvilinear, though its form is the reverse of a supply curve with constant supply elasticity, i.e. the curve obtained by logarithmically linear fit. This means that supply elasticity according to cross-sectional data falls as the volume of production in the agricultural sector rises.

Lack of space makes it impossible to include all the results here. The individual observations given in Table G3 are confined to regional and national averages. The figures refer to 1954 and 1963. The regression solutions for the supply func-

tions and certain other relations are given in Table G4. Since the elasticities change successively throughout the observation interval, supply elasticities are given for two portions of the curve, namely the end and the middle of the curve (accounted along the cost-receipts ratio axis). The elasticities are given in Table G4.

The results obtained using the JEU material represent the reaction pattern for existing farms. The reaction pattern for newly established farms is equally interesting on a long-term basis, and estimates have therefore been made for optimal farms, referring to one-man farms without woodland.[3] The data and results of these estimates, referring to 1960 prices, are also given in Tables G3 and G4.

ESTIMATES OF SHIFTS IN THE SUPPLY CURVE

A schematic picture of shifts in the supply curve can be obtained by comparing three periods which have been relatively free from »abnormal» circumstances such as an emergency or several years of exceedingly good or bad weather conditions. Diagram 16 in the main text is based on observations of three such periods, one pre-war consisting of the years 1938/39 and 1939/40, one from the 1950's, namely 1951/52 – 1955/56 and one from the 1960's, the period 1961/62 – – 1965/66. Table G5 contains production price and productivity indices for these periods.

To assess the influence of weather conditions on period averages, Table G5 also shows indices based on normalized net production figures. For the purposes of normalization, a deviation of 1 per cent in the harvest conditions factor in any one year from the average for the entire period has been assumed to alter net production by 0.17 per cent, corresponding to the coefficient of the harvest conditions factors in Table G2, approach 4. As can be seen from Table G5, production rises somewhat more steeply between the 1930's and the 1950's after such a correction than it would otherwise have been the case, while between the 1950's and 1960's it would stagnate instead of rise.

The method of moving coordinates is applied to determine shifts of the supply curves calculated in the cross-sectional studies. The output curve has the form

$$Q = b_1 + b_2 P + b_3 P^2. \qquad (1)$$

Q = net production
P = cost-receipts relation.

Assume that a change in factor prices moves the coordinates of the curve along the cost-receipts relation axis and that a change in productivity moves the coordinates of the curve along the net production axis. The following symbols are introduced

d_Q = change in productivity expressed as a percentage/100
d_P = change in factor prices expressed as a percentage/100.

After moving the coordinates of (1) the new supply curve is obtained

[3] L. Hjelm, Det svenska lantbrukets effektiviseringsvägar (Methods for the Rationalization of Swedish Agriculture). *Statens Offentliga Utredningar* 1963:66, alternative R3000, T60, P60 without woodland and, in the case of upper Norrland, without poultry as well. The labour return quoted in this study has been adjusted for capitalization effects on the lines already stated.

Table G1. *Prices, inputs and outputs in agriculture, 1938/39 – 1965/66*

Production year (1.9.–31.8.)	Net production			Capital		Production factors					
	Volume 1950/51 = 100 (1)	Nominal price 1938/39 = 100 (2)	Real price 1950/51 = 100 (3)	Volume billions of Sw.kr. 1964/65 prices (4)	Rate of interest (5)	Volume 1938/39 = 100 (6)	Nominal price 1938/39 = 100 (7)	Real price 1950/51 = 100 all factors (8)	Real price 1950/51 = 100 excl. labour and interest (9)	Net productivity 1950/51 = 100 (10)	Level of conditions 3 = normal harvest (11)
1938/39	86	100	83	24.9	4.00	100	100	79	84	85	3.4
1939/40	86	113	86	25.0	4.50	100	110	80	86	85	3.1
1940/41	76	142	95	24.6	4.92	99	123	78	84	76	2.3
1941/42	66	165	100	24.4	4.50	98	124	72	81	66	2.0
1942/43	78	164	96	24.7	4.50	98	132	74	90	79	2.8
1943/44	87	166	98	25.2	4.50	99	135	76	91	87	2.9
1944/45	83	165	98	25.4	4.21	98	140	79	99	83	3.0
1945/46	88	167	99	25.6	4.00	99	144	81	97	87	3.1
1946/47	75	172	100	25.7	4.00	99	151	83	94	74	3.2
1947/48	82	193	108	25.7	4.00	99	166	88	94	81	2.4
1948/49	93	192	105	26.1	4.00	98	171	89	96	93	3.1
1949/50	101	199	107	26.1	4.33	99	178	91	97	101	3.3
1950/51	100	207	100	26.3	4.50	98	218	100	100	100	3.2
1951/52	98	239	105	26.4	4.50	96	252	105	109	101	2.8
1952/53	102	255	109	26.5	4.50	95	261	106	100	106	3.0
1953/54	104	247	104	26.7	4.50	94	269	107	98	110	3.2
1954/55	100	249	104	26.7	4.83	91	288	114	98	108	3.0
1955/56	90	274	108	26.5	5.50	88	314	117	98	100	2.3
1956/57	100	272	103	26.3	5.78	86	333	120	99	114	2.9
1957/58	102	266	96	26.5	5.75	85	346	118	98	117	2.8
1958/59	95	277	99	26.7	6.25	84	363	123	98	112	2.8
1959/60	96	282	97	26.6	6.75	80	387	127	96	117	2.6
1960/61	97	291	98	26.3	6.75	81	414	132	99	118	3.2
1961/62	104	285	92	26.5	6.75	79	442	135	100	130	3.4
1962/63	102	304	90	26.5	6.25	76	465	137	101	132	3.1
1963/64	95	323	98	26.4	5.50	74	479	137	99	127	3.0
1964/65	100	341	99	26.1	6.25	71	524	145	100	140	3.1
1965/66	101	350	96	25.7	6.75	67	566	146	97	[illegible]	[illegible]

$$Q - Q \cdot d_Q = b_1 + b_2(P - P \cdot d_P) + b_3(P - P \cdot d_P)^2 \quad (2)$$

$$Q = [b_1 + b_2 \cdot P(1 - d_P) + b_3 \cdot P^2(1 - d_P)^2]/(1 - d_Q). \quad (3)$$

If coefficients are inserted in equation (3) according to the first supply equation in Table G4 and d_Q and d_P are put at 0.55 and 0.35 respectively, the price will have to fall by 17 per cent in order for current production to fall by 30 per cent (the current figures for Q and P have been estimated at Sw.kr. 5 243 million and 2.27, the new figures after the move and the fall in production are Sw.kr. 3 670 million and 1.87).

It is desirable to check the plausibility of the results of the supply analysis by estimating profitability. If the volume of production is reduced by 30 per cent and prices are cut by 17 per cent, the value of production will fall by 42 per cent (according to the estimate 0.7 x 0.83 = 0.58).[4] Given the above fall in production and a 55 per cent rise in productivity, factor volume will fall by 55 per cent (0.7/1.55 = 0.45), while a 35 per cent rise in factor prices will cause factor costs to fall by 39 per cent (0.45 x 1.35 = 0.61). Profitability, expressed as the value of production in relation to factor costs, will then fall by 5 per cent (0.58/0.61 = 0.95). Using the indices in Table G5 for the period 1961/62– – 1965/66 in relation to the period 1951/52 – 1955/56, profitability, as expressed above, is estimated to have fallen between these two periods by 11 per cent (acoording to the estimate 1.00 x 0.90/(0.79 x 1.28) = 0.89). But production is unchanged. Since greater pressure on profitability is required to reduce production than is necessary to maintain it, it is doubtful whether the price reduction indicated by the supply analysis is sufficient to bring about such a fall in production as has been assumed.

[4] For the sake of simplicity the percentage changes ($100d$) have been expressed instead as relations (ν) according to the formula $\nu = 1 + d$. Thus if $d = -0.3$, $\nu = 0.7$.

Sources: Own estimates using material supplied by the Swedish Agricultural Research Institute, the National Agricultural Marketing Board and the Central Bureau of Statistics. Columns 1, 2, 6 and 7 refer to chain indices. In estimating real prices, the consumer price index for a production year has been used as a deflator, prior to 1949 chained with a price index for total consumption according to the Industrial Institute for Economic and Social Research.

The volume of capital in column 4 includes assets in the form of farm property (excl. forest), livestock, machinery and implements. The volume of property is based on the taxable agricultural value of farm property in 1964, converted to the market value using a factor of 1.59. This volume was then adjusted backwards in time with the aid of total building investment according to the state agricultural building trials and an assumed annual depreciation of 1 per cent p.a. The volume of livestock was obtained by weighting together the number of animals according to the livestock inventories of the Central Bureau of Statistics with the 1964 livestock prices. The volume of machinery and implements until 1959 was obtained from estimates by the National Agricultural Marketing Board and subsequent to that year by adding annual investments according to the Swedish Agricultural Research Institute and deducting 10 per cent depreciation.

Net productivity in column 10 has been calculated using formula (24) in Appendix A. The level of conditions in column 11 is taken from *Sveriges Officiella Statistik*, Årsväxten (Crops, Acreage and Production).

Table G2. *Supply elasticities based on time-series data, 1938/39–1964/65*

	Condition					
	1[a]	2[a]	3	4	5	6
Regression constant ($_e$log)	7.2759	3.7648	3.9526	4.7368	3.7731	3.0488
Coefficients for regression on production volume of						
1. Real producer price	0.25	0.57	0.39	0.41	0.34	0.53
2. Condition factor		0.60	0.29	0.17	0.28	0.67
3. Net productivity			0.45	0.87	0.43	
4. Factor prices				−0.36		
5. Ditto excl. labour and interest					0.08	
6. Net productivity/factor prices						−0.34
Descriptive power (R^2)	0.02	0.42	0.88	0.91	0.88	0.45

[a] Conditions 1 and 2 must be considered unrealistic because no allowance is made for the development of productivity or, in the case of 1, for variations in the harvest.

Table G3. *Profitability and farm output in specific areas*

	Götaland				Svealand				
	southern plains	central districts	forest districts	northern plain	plain lands	forest districts	Lower Norrland	Upper Norrland	A S
JEU 1963									
Weighted average									
Labour return Sw.kr./hour									
1	5.45	4.18	1.74	2.66	2.05	0.57	1.19	0.85	
2	5.48	4.17	1.76	2.67	2.03	0.56	1.15	0.82	
3	4.64	4.26	2.23	2.95	2.55	1.19	2.13	1.70	
Costs/receipts ratio	1.10	1.28	1.63	1.48	1.51	1.95	1.77	2.05	
Crop units per hectare	4 580	3 708	3 016	2 737	2 466	2 255	2 400	2 322	2
Net production Sw.kr./hectare	2 415.02	2 047.95	1 644.71	1 465.91	1 170.48	1 216.37	1 594.86	1 420.48	1
Labour input, hours/hectare	173.07	185.81	209.83	145.06	115.76	177.77	234.22	257.35	
Group totals									
Arable acreage, 1000's	373	343	676	474	732	271	223	204	3
Crop units, millions	1 703	1 293	2 001	1 313	1 818	614	536	475	9
Net production millions of Sw.kr.	901	703	1 111	694	857	329	356	290	5
Man-years, 1000's	34	33	74	36	44	25	27	27	3
HJELM 1960									
Labour return, Sw.kr./hour									
1	19.22	10.34	7.12	10.86	9.28	6.27	4.59	3.82	
2	11.78	6.64	4.46	7.28	6.20	3.53	3.50	2.75	

Note: Labour return 1=assets valued at opportunity cost, 2=assets valued at uniform value for forest land (200 Sw.kr. per hectare), 3=assets valued at market value.

Sources: See Appendix G, p. 215.

Table G 4. *Supply functions and the relation between productive capacity and yield*

Dependent variable	Independent variable	Year	Group observed	No. of observations	Regression constant	Regression coefficient for simple term	Regression coefficient for square term	Multiple R^2	Supply elasticity at middle of curve	Supply elasticity at end of curve
Net production millions of Sw.kr.	Costs/receipt ratio	1963	All [a]	27	−8 231	10 699	−2 102	0.98	2.41	0.61
			5–50 ha [b]	8	−8 729	9 725	−1 416	0.97	3.57	1.64
			5–10 »	8	−3 111	1 297	965	0.95	4.56	2.85
			10–20 »	8	2 729	−8 377	5 553	0.96	5.96	4.06
			20–30 »	6	−8 705	8 295	37	0.98	5.95	3.17
			30–50 »	5	13 501	−29 074	16 503	0.88	5.64	5.47
		1954	All [a]	27	−10 526	15 089	−3 887	0.99	2.94	0.68
			5–50 ha [b]	8	−15 887	21 435	−5 732	0.98	3.86	0.78
			5–10 »	8	−9 717	9 554	−1 017	0.88	6.08	2.78
			10–20 »	8	−18 887	25 143	−6 733	0.96	5.54	1.79
			20–30 »	6	15	−6 922	7 447	0.94	7.91	5.01
			30–50 »	5	−63 312	+110 904	−46 220	0.97	11.66	3.71
Acreage	Net production per hectare	1963	5–50 ha [b]	8	9 304 440	−7 193	1,4	0.97		
		1954	5–50 ha [b]	8	19 878 000	−25 790	8,4	0.98		
Net production millions of Sw.kr.	Labour return, Sw.kr. per hectare	1963	5–50 ha [b]	8	6 304	−1 953	164	0.98		
		1954	5–50 ha [b]	8	5 196	−1 669	−52	0.99		
		1960	Hjelm	8	8 168	−816	21	0.96		

[a] Each of 27 regional and acreage groups constitutes an observation in the calculations.

[b] Averages of the four acreage groups 5–10, 10–20, 20–30 and 30–50 hectares, weighted together with the number of farms in each acreage group, constitute observations, one for each region.

Source and methods of calculation: See Appendix G, p. 215.

Table G 5. *Indexes for production, productivity and prices for the 1930's, 1950's and 1960's*

Index 1951/52–1955/56=100

Period	Normalised net production	Un-normalised net production	Un-normalised net productivity	Factor input	Real producer price	Real factor price
1938/39–1939/40	83	85	81	105	80	72
1951/52–1955/56	100	100	100	100	100	100
1961/62–1965/66	100	102	129	79	90	128

Source: The index figures are based on means of the data in Table G1.

APPENDIX H

THE EFFECT OF PRICES ON INCOME

BY ODD GULBRANDSEN

This appendix describes estimates of the long-term effects of changes in agricultural prices on farmers' incomes. The estimates also take into account changes in factor prices, in volumes of production and in productivity. The conclusions drawn from the estimates are presented in Chapter 9.

The material consists mainly of data from the income tax return survey.[1] Changes over time are based on the years 1954 and 1965. The forecast year is 1976. The estimates cover proprietor farmers in the plainlands of central and southern Sweden (Slb) in all the acreage groups included in the income tax return statistics. In view of the effect of changes in structure of farms on the conclusions drawn from the estimates, national means and total financial results have been calculated, the figures for different acreage groups being weighted together with the national distribution of farm units.[2]

For purposes of weighting the 1956 agricultural census has been consulted for the number of farms in 1954 and the 1965 acreage inventory for the number of farms in 1965. The number of farms in each acreage class in 1976 has been forecast as a function of price movement, using the formula

$A_{76} = A_{65} - (0.5 - d)(A_{54} - A_{65})$, provided that $A_{76} \leqslant 0$, where

A = number of farms in a given acreage group
d = percentage annual change in the producer price level, indices refer to years.

The formula is an example of the possible effects of price level on farm structure. It has been introduced as a quantitative illustration of an idea in the absence of empirical data concerning the relation. The relation is also inadequate in principle, since it does not allow for changes of mean acreage within each acreage group. These changes can be particularly important in wide-ranging groups. Nor is any allowance made for changes in factor prices. But these deficiencies should not affect the empirical results to any significant extent.

Incomes in 1976 have been calculated on the assumption that the percentage change in the volumes of net sales, processing and labour recorded during the

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[1] Farmers' assessed incomes, expenditure, net receipts, assets and liabilities in 1965. *Statistiska meddelanden* (Statistical Reports) J 1967:18.

[2] This is a permissible approximation in view of the generally small differences between the Slb acreage group means and those of the country as a whole. The weighting method has the advantage of leaving the estimates relatively unaffected by the difficulties of eliminating forestry economics and the effects of regional support in Norrland.

period 1954–65 will be repeated during the period 1965–76.[3]

Labour productivity has been calculated as value added in fixed prices divided by the volume of labour. This criterion approximates most closely to the expression of net labour productivity according to formula (8), Appendix A, since the value added is calculated after deduction of real capital costs which, as regards the group means on which the calculations are based, correspond on the whole to depreciation and maintenance costs.

It is assumed in the estimates that incomes in 1976 will be affected by the following factors: losses due to a fall in the price of the estimated volume of net sales in 1976, profits due to a fall in the price of the volume of means of production (other than feed, seed and livestock) purchased in 1976, losses due to increased wages for hired labour in 1976, profits due to increased processing volume and losses due to increased interest charges on debts contracted in financing continued mechanization. The estimates indicate that labour consumption in many acreage groups will decline to such an extent as to eliminate hired labour and also reduce the labour input of the farming family. Incomes have been quoted per hour of family labour input so as to avoid special assumptions concerning incomes earned during the free time accruing to the family. Value added has been calculated as well per hour of total labour input.

A number of alternative estimates have been made with a view to studying the effects of falling product prices. One series of alternative comprised a uniform reduction in the real prices of animal and vegetable products by 1/2 per cent at a time from 0 to 2 per cent. Another comprises the same intervals but with different rates of reduction for animal and vegetable products, the assumption here being that vegetable prices fall twice as fast as the average and animal prices at one-third the average rate. A difference of this kind between the movements in vegetable and animal prices has in fact occurred, between 1954 and 1965, and there is reason to expect that it will continue.

Two alternative assumptions have been made regarding changes in the prices of purchased means of production, one involving the same fall in real prices as between 1954 and 1965, the other involving constant real prices. Two alternative assumptions have also been made concerning wages, namely a rise in real wages identical with that occurring between 1954 and 1965, and an annual increase of 4 per cent, i.e. approximately the same increase as the long-term survey forecast for industrial wages.

The volume of labour has been obtained by dividing labour costs by agricultur wage rates. Wage costs have been used as a measure of the cost of hired labour and agricultural labour costs according to JEU (calculated according to the principles

[3] The volume of net sales is calculated as sales of animal and vegetable products minus purchases of feed, seed and livestock in 1965 prices. By adding net receipts from farm property, interest charges and wage costs give a figure for value added referring to all farming operations, including forestry. Value added is, however, assumed for the sake of simplicity to consist of four components, two with a plus sign, namely sales of vegetable products and sales of animal products minus purchases of livestock, and two with a minus sign, namely purchases of feed and seed together with a residual item comprising the net of other receipts and expenses. Four indices, for animal products, vegetable products, feed and the residual item respectively, have been used to convert value added to the volume of value added in 1965 prices. The residual item index includes the prices of machinery, buildings, supplies and services weighted in the same proportions as the cash expenditure on these factors of production calculated for Sib as a whole. These indices are based on chain indices calculated from material from the Institute for Agricultural Research.

described in Appendix E) as a measure of the labour costs of the family. The difference between family labour costs in agriculture in the 2–5 hectare and the 5–10 hectare groups has been assumed equal to the difference between their respective incomes from gainful employment outside agriculture. Family labour costs in agriculture in acreage groups over 50 hectares have been assumed equal to those of the 30–50 hectare group.

Increase in indebtedness has been calculated at the same rate per hour saved of working time as during the period 1954–65. Indebtedness in 1954 has been assumed equal to that in 1952 (according to *Sveriges Offentliga Statistik,* Jordbrukarnas tillgångar och skulder den 13 december 1952 (Assets and Liabilities of farmers as on the 31st December 1952, Stockholm 1955). Two alternative real rates of interest have been studied, namely 5 per cent and 0 per cent. Amortizations are assumed to be financed by the depreciation included in the purchase and maintenance of buildings and stock. This is a permissible approximation, since the estimates refer to group means and not to individual cases. Moreover indebtedness is on average either below or slightly above the level of first mortgage loans, so that amortizations on new loans should be small.

The level of income has probably been over-estimated, since it was not possibl to include new stock (about 10 per cent of other stock expenses) in the estimate: This implies an over-estimate of 10 per cent. On the other hand, the level of income has been under-estimated owing to the low valuation of payments in kind. This error also amounts to about 10 per cent, though it is probably greater with regard to small farms and less with regard to large ones. Thus the errors affecting the income level on which the percentage magnitudes of the change figures are based are probably small.

Since limitations of space make it impossible to include all the alternatives calculated, only those which are particularly relevant to the questions raised in Chapter 9 are given here. Tables H1 and H2 give in figures the conditions described previously. Table H3 contains a comparison of the absolute income levels of certain alternatives in 1965 and 1976, while Table H4 compares annual percentage changes in value added and incomes between 1965 and 1976 for the alternatives which have been adjudged of interest.

The method of calculation has been checked by applying it to the period from which most of the conditions for the calculations have been taken, i.e. 1954–65. Three calculations are given in Table H5 in addition to the actual development for purposes of comparison. The first of these represents the calculation series for uniform price reduction, in which the alternative of an annual reduction of 1/2 per cent corresponds most closely to the actual price movement. The second calculation represents the calculation series for non-uniform price reduction and refers to the result of an annual reduction of vegetable product prices by 1 per cent and of animal product prices by 1/3 per cent. The third calculation is directly related to historical developments as regards component price movements. The incomplete agreement in this third instance (cf. table) is mainly due to the ignorance of the actual interest rate, which may have differed from that applied in the estimate. Even a 1/2 per cent increase in the interest rate, assumed in the estimates to be 5 per cent, would largely suffice to explain the differences between actual and estimated incomes.

Table H1. *Changes in farming economy on the plains of southern and central Sweden, based on income tax returns, 1954–65*

Size hectares arable	Real changes 1954–65					Growth of indebtedness per working hour saved	Volumes in 1954, 1965 prices			
	Net sales	Value added	Labour input	Labour productivity	Labour income per hour		Net sales	Value added	Income from farm	Labour input
	Per cent p.a.					*Sw.kr.*	*Sw.kr.*			*Hours*
2–5	−0.7	−2.3	−3.0	0.7	0.3	1.54	5 489	5 220	1 681	3 078
5–10	1.2	0.1	−2.8	3.0	3.0	7.45	10 917	9 157	7 759	3 561
10–20	2.6	0.7	−2.5	3.3	2.8	16.10	19 500	15 293	12 157	4 249
20–30	2.3	0.7	−3.1	3.9	2.2	23.12	30 824	22 237	15 727	5 101
30–50	1.7	0.1	−4.2	4.5	1.2	21.79	47 608	32 307	20 782	6 423
50–100	1.5	−0.1	−5.8	6.0	0.5	18.09	81 626	53 374	27 257	10 357
over 100	2.4	0.9	−5.8	7.0	0.1	16.69	184 305	129 476	48 312	25 141
Mean	3.6	1.7	−2.6	4.1	3.0	—	16 873	13 026	9 573	4 102
							Millions of Sw.kr.			*Millions of hours*
Total	0.6	−1.3	−5.5	4.1	3.0	—	4 524	3 492	2 470	1 100

Sources and methods of calculation: Price index for adjusting 1954 values to 1965 prices – for vegetable products 119, animal products and livestock 151, feed and seed 130, other expenditure 141. The corresponding consumer price index is 147. Agricultural wages in 1954 and 1965 were 4.91 and 7.57 Sw.kr. per hour respectively. For further details see Appendix H, pp. 222 ff.

Table H2. *Data and assumptions for projections of farm income – wages, in est and farm structure – 1976*

Size hectares arable	Wage expenditure 1965	Wage expenditure 1976 Historical trend	Wage expenditure 1976 With a wage increase of 4 % p.a.	Interest charges 1965	Interest charges 1976 at a rate of 5 %	Distribution by farm s 1965	Distribution by farm s 1976 with a pr reduction of 0,5 % p.a.	Distribution by farm s 1976 with a pr reduction of 1,5 % p.a.
	Sw.kr. per farm unit					*Per cent*		
2–5	342	265	231	388	436	26	0	0
5–10	640	0	0	834	1 092	30	21	0
10–20	1 469	0	0	1 821	2 445	23	27	16
20–30	3 100	0	0	3 350	4 554	11	22	34
30–50	5 999	0	0	5 495	7 143	7	18	30
50–100	16 714	0	0	9 727	12 080	3	9	16
over 100	74 942	51 841	45 089	25 036	30 572	1	3	4

Source and methods of calculation: See Appendix H, pp. 222 ff.

Table H3. *Value added and income of farm owners on plains of southern and central Sweden, 1965 and 1976*

Size hectares arable	Value added 1965	Value added 1976 with a price reduction of 0,5 % p.a. alt. a	Value added 1976 with a price reduction of 1,5 % p.a. alt. a o. b	Value added 1976 with a price reduction of 1,5 % p.a. alt. c	Value added 1976 with a price reduction of 1,5 % p.a. alt. d	Income 1965	Income 1976 with a price red 0.5 % p.a.	Income 1976 with a price red 1,5 % p.a. alt. a	Income 1976 with a price red 1,5 % p.a. alt. b
	Sw.kr. per farm unit					*Sw.kr. per hour*			
2–5	4 036	3 207	2 941	2 715	2 608	1.50	1.60	1.40	1.50
5–10	9 276	9 301	8 495	8 173	8 212	3.10	4.20	3.80	3.80
10–20	16 524	18 032	16 073	14 877	15 617	4.40	6.20	5.40	5.40
20–30	23 874	25 775	22 879	21 232	22 452	5.50	7.50	6.50	6.50
30–50	32 802	33 533	29 580	27 298	26 286	6.60	8.90	7.60	7.60
50–100	52 770	52 361	46 193	42 392	37 697	8.30	13.90	11.70	11.70
over 100	142 236	157 059	139 188	129 106	109 427	13.30	25.50	19.40	21.70
Mean	15 659	22 237	28 754	26 600	25 608	3.75	6.60	7.40	7.50

Source and methods of calculation: Alternative a concerns historical trends for factor prices and 5 per cent interest on new loans, *alternative b* the same as *a* but with a wage increase of 4 per cent p.a., *alternative c* a wage increase of 4 per cent p.a., constant real prices for other expenditure and a real interest of 0 per cent on new loans, *alternative d* the same as *b* but the price reduction of 1.5 per cent p.a. comprises 3 per cent p.a. for vegetable products and 1 per cent p.a. for animal products. For other details see Appendix H, pp. 222 ff.

Table H4. *Percentage changes of value added and family income of farm owners on the plains of southern and central Sweden, 1965–76*

Size hectares arable	Annual change in the farm's value added per working hour with a price reduction of				Annual change in family income per hour with a price reduction of				
	0,5 % p.a.	1,5 % p.a.			0,5 % p.a.	1,5 % p.a.			
	alt. a	alt. a o. b	alt. c	alt. d	alt. a	alt. a	alt. b	alt. c	alt. d
2–5	1.0	0.2	−0.5	−0.9	0.5	−0.6	−0.4	−1.2	−1.8
5–10	2.9	2.0	1.7	1.7	2.9	2,0	2.0	1.9	1.6
10–20	3.4	2.3	1.6	2.1	3.2	1,9	1.9	1.5	1.6
20–30	3.9	2.8	2.1	2.6	2.9	1.6	1.6	1.4	1.4
30–50	4.6	3.4	2.6	2.3	2.8	1.3	1.3	1.0	−0.2
50–100	6.1	4.9	4.1	2.9	4.8	3.1	3.1	2.7	0.5
over 100	7.1	5.9	5.2	3.6	6.1	3.5	4.5	3.8	−1.3
Mean	6.0	7.9	7.1	6.9	5.3	6.4	6.5	6.1	5.0

Source and methods of calculation: For the conditions underlying the calculations for alternatives *a–d* see Table H3. For other details see Appendix H, pp.222 ff.

Table H5. *Check of the calculated effect of prices on agricultural income*

Size hectares arable	Income from farm property					Annual change in family's income per hour			
		1965							
	1954	observed alt. a	calculated alt. b	calculated alt. c	calculated alt. d	alternative a	alternative b	alternative c	alternative d
	Sw.kr. per farm unit					Per cent			
2–5	3 013	2 249	2 116	2 109	2 244	0.3	−0.2	−0.3	0.3
5–10	5 013	5 307	4 871	4 876	5 147	3.0	2.2	2.2	2.7
10–20	7 956	9 003	8 567	8 577	9 126	2.8	2.3	2.4	2.9
20–30	10 560	11 853	11 868	11 803	12 433	2.2	2.2	2.1	2.6
30–50	13 916	14 495	15 468	15 026	15 117	1.2	1.8	1.5	1.6
50–100	18 460	17 911	21 302	19 981	18 818	0.5	2.1	1.5	0.9
over 100	30 916	28 747	39 954	35 883	31 264	0.1	3.1	2.1	0.8
Mean	6 268	7 339	7 387	7 261	7 479	3.0	3.0	2.8	3.1

Sources and methods of calculation: Alternative a concerns observed income deflated to 1954 prices on the basis of the consumer price index (factor 0.68), *alternative b* income calculated with a reduction of 0.5 per cent p.a. for product prices and feed, a reduction of 0.4 per cent p.a. for prices of purchased means of production and 5 per cent interest on new loans, *alternative c* the same as *b* but with a non-uniform reduction of product prices, i.e. 1 per cent p.a. for vegetable products and 1/3rd per cent p.a. for animal products, *alternative d* the same as *c* but with the actual price reductions, i.e. 1.9 per cent p.a. for vegetable products, −0.2 per cent p.a. for animal products and 1.1 per cent p.a. for feed. For other details see Appendix H, pp. 222 ff.

APPENDIX J

OPTIMAL PRICE POLICY FOR AGRICULTURE AT PRODUCTION CAPACITY RESTRICTION

By KARL GÖRAN MÄLER

THREE-SECTOR MODEL WITHOUT INTERMEDIARY PRODUCTS

Our task here will be to determine the prices which should be put on agricultural products to ensure the »optimal» attainment of a pre-determined emergency capacity. Emergency capacity is here taken to mean a peacetime allocation of resources to agriculture which makes it possible to attain the volume of production desired in the event of an emergency. This implies a restriction on adjustment to world market prices. This appendix sets out to examine the effect of such a restriction in greater detail.

We shall assume that all enterprises, agricultural and industrial, are profit maximizing and price-takers, i.e. unable to determine their own selling or purchasing prices.[1] We shall also assume (to begin with) that the production functions of these enterprises are of the ordinary neo-classical type. This means that the profit maximum is subject to the usual marginal conditions, i.e. the value of the marginal productivity of a factor is equal to the factor price.

We can start by considering a very simple economy producing three commodities, one industrial and two agricultural. We shall assume the production functions to be

$$f_i(K_i, L_i) - q_i = 0 \quad i = 1, 2, 3, \tag{1}$$

in which K_i and L_i are input of real capital and labour respectively in the production of commodity i. Commodity 3 is assumed to be the industrial commodity, commodities 1 and 2 the agricultural commodities.

The total factor requirements in the economy are assumed to be given and constant, $\bar{K}$ and $\bar{L}$.

$$\bar{K} - \sum_{i=1}^{3} K_i \geq 0 \tag{2}$$

$$\bar{L} - \sum_{i=1}^{3} L_i \geq 0. \tag{3}$$

Let C_i be the quantity of commocity i used for domestic consumption. If the economy can sell all three products on the world market at given and constant prices p_1, the equation for equilibrium in foreign trade can be written

[1] This assumption is immaterial to the deduction of the following optimal conditions. On the other hand it is of fundamental importance for the conclusions drawn regarding agricultural policy.

$$\sum_{i=1}^{3} p_i(q_i - C_i) = 0. \tag{4}$$

The emergency objective can be specified as follows. First, an estimate is made of the quantity of agricultural products needed for consumption during the emergency, after which the proportions of this quantity to be stored and produced domestically are calculated.[2] This done we have also determined which of the two commodities most urgently needs to be produced in order to attain the consumption planned during an emergency. If we assume that there is every possibility of reallocation between the two agricultural products, while reallocation of the factors of production between industry and agriculture is subject to considerable limitations (in the short run a realistic assumption), the emergency objective specifies the minimum of factors of production required in agriculture. On the other hand, the objective does not imply any requirement concerning the peacetime product mix in agriculture. If * stands for variables in an emergency, the emergency objective can be formulated

$$f_1(K_1^*, L_1^*) - q_1^* \geqslant 0 \tag{5}$$

$$f_2(K_2^*, L_2^*) - q_2^* \geqslant 0 \tag{6}$$

$$\sum_{j=1}^{2} K_j - \sum_{k=1}^{2} K_j^* \geqslant 0 \tag{7}$$

$$\sum_{j=1}^{2} L_j - \sum_{j=1}^{2} L_j^* \geqslant 0. \tag{8}$$

q_1^* and q_2^* denote the output of the two agricultural products desired in an emergency and are therefore constants. Equations (7) and (8) indicate that total stocks of real capital and total labour input in agriculture must be the same in peacetime as in an emergency. This implies that the size of capital stocks and labour input in industry are unaffected by a transition from peacetime to emergency.

Assume now that the objective of society is to maximize a welfare function

$$W = W(C_1, C_2, C_3) \tag{9}$$

with peacetime consumption of the three products as argument, i.e. to find the best peacetime allocation.[3]

The problem now is to maximize welfare function W with the equations and dissimilarities (1) – (8) as subsidiary conditions. To this end we shall assume that all functions are sufficiently differentiable and that they are such that there exists an unequivocal global maximum. We shall also assume that all dissimilarities are binding, i.e. that we have equality at the optimal point.

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[2] Optimal stores ought in principle to be calculated simultaneously with optimum output of the various products. We shall, however, disregard stores so as to simplify the analysis. This forces us to assume in subsequent models that agriculture only uses such intermediary products as can be produced within the country. This is far from realistic in the case of Sweden (e.g. oil is a sine qua non of motorized agriculture).

[3] We assume that $\partial W/\partial C_i > 0 \quad i = 1, 2, 3.$

For the sake of simplicity we designate $f_i(K_i^*, L_i^*) = f_i^*$ $i = 1, 2, 3$ and similarly for the derivates.

We can now solve the maximum problem by forming the Lagrange function.[4]

$$\phi = W + \sum_{i=1}^{3} \lambda_i (f_i - q_i) + \mu_1 \left(\bar{K} - \sum_{i=1}^{3} K_i \right) + \delta_1 \left(\bar{L} - \sum_{i=1}^{3} L_i \right)$$
$$+ \eta \sum_{i=1}^{3} p_i (q_i - C_i) + \sum_{j=1}^{2} \alpha_j (f_j^* - q_j^*) + \mu_2 \left(\sum_{j=1}^{2} K_j - \sum_{j=1}^{2} K_j^* \right) + \delta_2 \left(\sum_{j=1}^{2} L_j - \sum_{j=1}^{2} L_j^* \right)$$

and set its partial derivates equal to zero, assuming that all dissimilarities are binding, i.e. that both equalities and inequalities are satisfied at the maximum point.

$$\frac{\partial \phi}{\partial C_i} = \frac{\partial W}{\partial C_i} - \eta p_i = 0 \quad i = 1, 2, 3$$

$$\frac{\partial \phi}{\partial q_i} = -\lambda_i + \eta p_i = 0 \quad i = 1, 2, 3$$

$$\frac{\partial \phi}{\partial K_3} = \lambda_3 \frac{\partial f_3}{\partial K} - \mu_1 = 0$$

$$\frac{\partial \phi}{\partial L_3} = \lambda_3 \frac{\partial f_3}{\partial L} - \delta_1 = 0$$

$$\frac{\partial \phi}{\partial K_j} = \lambda_j \frac{\partial f_j}{\partial K} - \mu_1 + \mu_2 = 0 \quad j = 1, 2$$

$$\frac{\partial \phi}{\partial L_j} = \lambda_j \frac{\partial f_j}{\partial L} - \delta_1 + \delta_2 = 0 \quad j = 1, 2$$

$$\frac{\partial \phi}{\partial K_j^*} = \alpha_j \frac{\partial f_j^*}{\partial K} - \mu_2 = 0 \quad j = 1, 2$$

$$\frac{\partial \phi}{\partial L_j^*} = \alpha_j \frac{\partial f_j^*}{\partial L} - \delta_2 = 0 \quad j = 1, 2.$$

We now know that the multipliers associated with inequalities, i.e. μ_j, δ_j, α_j, are non-negative. From the first two equations we see that the other multipliers are also non-negative.

Together with the subsidiary conditions we have 26 equations in 26 unknowns. We assume that this system has an unequivocal solution. As a result of our earlier assumptions, we know that this solution corresponds to a global maximum of W under subsidiary conditions (1) – (8). We can now rewrite these optimum conditions as follows (we choose W so that $\eta = 1$).

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[4] See Hestenes, *Calculus of Variations and Optimal Control Theory*, Chapter 1, Sec. 10.

$$\frac{\partial W}{\partial C_i} = p_i \quad i = 1, 2, 3 \tag{10}$$

$$p_2 \frac{\partial f_2}{\partial K} = \mu_1 \tag{11}$$

$$p_2 \frac{\partial f_2}{\partial L} = \delta_1 \tag{12}$$

$$p_j \frac{\partial f_j}{\partial K} = \mu_1 - \mu_2 \quad j = 1, 2 \tag{13}$$

$$p_j \frac{\partial f_j}{\partial L} = \delta_1 - \delta_2 \quad j = 1, 2 \tag{14}$$

$$\alpha_j \frac{\partial f_j^*}{\partial K} = \mu_2 \quad j = 1, 2 \tag{15}$$

$$\alpha_j \frac{\partial f_j^*}{\partial L} = \delta_2 \quad j = 1, 2. \tag{16}$$

Equation (10) shows that the marginal utility of consumption of each product must be equal to its world market price. If we assume the welfare function to be of Pareto character and, consequently, based on individual utility functions, (10) shows that the consumers have to be confronted by world market prices. We have thus demonstrated the desirability of a low price line.[5]

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[5] This can be shown stringently if we write the welfare function

$W = W(U_1, \ldots, U_n)$ in which

U_s is the i-th individual's utility function

$U_s = U_s(C_{1s}, C_{2s}, C_{3s})$;

C_{is} is the s-th consumer's consumption of the i-th product. Since W is of the Pareto type, $\partial W/\partial U_s > 0$. Thus the sum of the individual consumer's consumption of each product must be equal to total consumption.

$$C_i - \sum_{s=1}^{n} C_{is} = 0, \quad i = 1, 2, 3.$$

If we now maximize W with the same subsidiary conditions as previously and the above equation, we obtain

$$\frac{1}{\eta} \frac{\partial W}{\partial U_s} \frac{\partial U_s}{\partial C_{is}} = p_i, \quad s = 1, 2, \cdots, n, \quad i = 1, 2, 3$$

which means that at the optimum the individual consumers must have adapted their consumption in such a way that their marginal substitution ratio between any two products is equal to the relation between the world market prices of those products.

Equations (11) – (14) can be interpreted as maximum profit conditions. We see that optimality requires all enterprises to be confronted by world market prices in peacetime, i.e. a low price line is also desirable for producers. Our analysis involved only one enterprise producing each commodity, but it is very easy to show that exactly the same type of optimum conditions are obtained with a random number of enterprises in each sector.

Equations (13) – (14) also show that the use of capital in agriculture has to be subsidized by μ_2 to make the price confronting farmers $\mu_1 - \mu_2$, and that the use of labour has to be subsidized by δ_2 to make the demand price of labour $\delta_1 - \delta_2$. (The prices the factor owners receive, output prices, must on the other hand be identical in agriculture and industry, which in turn requires complete mobility of the factors of production. Since the general product mix in agriculture will be different in peacetime from in an emergency, the marginal substitution ratios of capital and labour will differ in these two situations, i.e.

$$\frac{\partial f_j^*/\partial K}{\partial f_j^*/\partial L} \neq \frac{\partial f_j/\partial K}{\partial f_j/\partial L}$$

which implies that

$$\frac{\mu_2}{\delta_2} \neq \frac{\mu_1 - \mu_2}{\delta_1 - \delta_2}$$

or

$$\frac{\mu_2}{\mu_1} \neq \frac{\delta_2}{\delta_1}.$$

This implies that the use of capital is not generally to be subsidized on the same scale as the use of labour. The practical implication of this is that the subsidization of the factors of production cannot be replaced by a subsidy proportional to value added or a subsidy in the form of price subsidy.

We can also interpret the maximum conditions by rewriting equations (13) and (14) as

$$p_j \frac{\partial f_j}{\partial K} + \alpha_j \frac{\partial f_j^*}{\partial K} = \mu_1$$

and equations (14) and (15) as

$$p_j \frac{\partial f_j}{\partial L} + \alpha_j \frac{\partial f_j^*}{\partial L} = \delta_1.$$

The left side is interpreted as the social marginal productivity of each factor in agriculture. $\alpha_j(\partial f_j/\partial K)$ refers to the increased receipts resulting from the fulfilment of the emergency objective. If more factors are allocated to agriculture, the emergency objective will no longer be binding and $\alpha_j = 0$. α_j can thus be regarded as a shadow price for agricultural products during an emergency. At the optimum, the social marginal productivity of each factor must be equal in all uses, i.e. equal to μ_1.

Another consequence of the discrepancy of factor price relations between agriculture and industry is that the allocation of factors at the optimum will not be represented by a point on the transformation surface between the two agricultural products and the industrial product. Thus it is possible at the optimum for the output of, say, industrial products to be increased while the output of agricultural products remains unchanged by a reallocation of the factors of production. But a reallocation of this kind would be inconsistent with the emergency objective.

In practice it is presumably impossible to attain the »right» protection of agriculture, since this requires a knowledge of the production functions within the three sectors and of the total supply of factors of production. A trial and error process would probably also involve considerable difficulties, owing to the problems involved in measuring the potential reallocation gains for individual factors resulting from an incorrect dimensioning of protection. The most reasonable solution would therefore seem to be to base agricultural protection on value added, i.e. make it relatively equal for both labour and capital. In this simple model, protection of such a kind is equivalent to price protection, e.g. by means of price subsidies. On the other hand, tariffs, to take one example, disturb price relations for consumers and thus conflict with equation (10).

In our formulation of optimality and the emergency objective, however, we have not specified any positive weight for industrial production during an emergency, the object being to prevent our first model becoming too complicated.

INTERMEDIARY PRODUCTS – NEO-CLASSICAL PRODUCTION FUNCTION

As we now proceed to consider the occurrence of flows in the form of intermediary goods between industry and agriculture, we are obliged to introduce some form of valuation of industrial production during an emergency, otherwise a very large proportion of industrial production would be used as input in the agricultural sector.[6] Thus we define our welfare function

$$W = W(C_1, C_2, C_3, q^*_{c3}), \tag{17}$$

in which q^*_{c3} stands for the net production of the industrial commodity during an emergency, i.e. after the quantities used as input have been deducted. Thus we have two objectives regarding production during an emergency, one absolute, regarding agricultural production, and one which says that, subject to this absolute objective, we should produce as much of the industrial commodity as possible.

Another problem associated with intermediary products concerns the definition of capital stocks. In our previous model we were able to take for granted the existence of some factor of production which we could call real capital. We now have to distinguish between real capital and other inputs. Are agricultural purchases of tractors to be classed as capital or intermediary products? A dynamic model probably affords the only possible means of exact discussion but here we shall content ourselves with the following reasonable but vague classification. A commodity of such durability that stocks of it in agriculture cannot

[6] This would also have been desirable in the earlier model, but for the sake of simplicity we disregarded industrial production during an emergency.

change during an emergency is classed as real capital. This means that commodities such as oil and commercial fertilizer are not classed as real capital, since they can be rapidly reallocated. On the other hand, buildings, machinery etc., which take a long time to reallocate, are classed as real capital. This definition of real capital enables us to retain our previous statement of the emergency objective, equations (5) – (8).

Another problem in this context is that we make use of a static model with given total supplies of labour and real capital. In fact capital intensity grows successively, partly as a result of new investments. We cannot draw inferences from our model concerning the »optimal» prices of these new supplies of real capital or how they should be allocated without first formulating a dynamic model with an intertemporal preference function.

We shall introduce intermediary goods on two alternative assumptions. The first assumption is that intermediary products are incorporated in the production function in the same way as labour and real capital (i.e. intermediary products and labour and capital can be substituted). The second assumption is that intermediary products are only used in fixed proportions to output of the various commodities.

Let q_{ij} be the quantity of product j used as input in the production of product i. Assume now that the production functions can be written

$$q_i = f_i(K_i, L_i, q_{i1}, q_{i2}, q_{i3}) \quad i = 1, 2, 3. \tag{18}$$

If q_{ci} is the quantity of product i remaining for export or domestic consumption after the quantities used as input have been deducted, the following relations must apply by definition

$$q_i - \sum_{j=1}^{3} q_{ji} - q_{ci} = 0 \quad i = 1, 2, 3. \tag{19}$$

The equation for the balance of current payments will now be

$$\sum_{i=1}^{3} p_i(q_{ci} - C_i) = 0. \tag{20}$$

We can now form the Lagrange function in the same way as before.[7]

$$\begin{aligned}\phi = W &+ \sum_{i=1}^{3} \lambda_i(f_i - q_i) + \sum_{i=1}^{3} \gamma_i \left(q_i - \sum_{j=1}^{3} q_{ij} - q_{ci} \right) + \mu_1 \left(\bar{K} - \sum_{i=1}^{3} K_i \right) + \delta_1 \left(\bar{L} - \sum_{i=1}^{3} L_i \right) \\ &+ \eta \sum_{i=1}^{3} p_i(q_{ci} - C_i) + \mu_2 \left(\sum_{j=1}^{2} K_j - \sum_{j=1}^{2} K_j^* \right) + \delta_2 \left(\sum_{j=1}^{2} L_j - \sum_{j=1}^{2} L_j^* \right) + \mu_3 \left(\bar{K} - \sum_{i=1}^{3} K_i^* \right) \\ &+ \delta_3 \left(\bar{L} - \sum_{i=1}^{3} L_i^* \right) + \sum_{i=1}^{3} \alpha_i(f_i^* - q_i^*) + \sum_{i=1}^{3} \beta_i \left(q_i^* - \sum_{j=1}^{3} q_{ji}^* - q_{ci}^* \right).\end{aligned}$$

[7] We shall assume from now on that the differences between the restrictions are satisfied by similarities. This implies, as previously, the corresponding multipliers are non-negative.

Here as previously, f_i^* means the value of the function calculated using the emergency variables as argument. Note that the emergency objective is formulated here as a net production requirement for the two agricultural products, q_{c1}^* and q_{c2}^*, and that the preferences for emergency industrial production have also been expressed in terms of net production q_{c3}^*.

We assume as previously that the welfare function has a global maximum and that this maximum can be characterized by the equations obtained when the partial derivatives of the Lagrange function are set equal to zero. If we derive ϕ partially and make the derivatives equal to zero, we obtain, after a number of simplifications, the following equations (of which (21), (23) – (26), (31) and (32) are formally the same as equations (10) – (16) in the previous model).

$$\frac{\partial W}{\partial C_i} = p_i \quad i = 1, 2, 3 \tag{21}$$

$$p_i \frac{\partial f_i}{\partial q_{ij}} = p_j \quad i = 1, 2, 3;\ j = 1, 2, 3 \tag{22}$$

$$p_3 \frac{\partial f_3}{\partial K} = \mu_1 \tag{23}$$

$$p_3 \frac{\partial f_3}{\partial L} = \delta_1 \tag{24}$$

$$p_j \frac{\partial f_j}{\partial K} = \mu_1 - \mu_2 \quad j = 1, 2 \tag{25}$$

$$p_j \frac{\partial f_j}{\partial L} = \delta_1 - \delta_2 \quad j = 1, 2 \tag{26}$$

$$\frac{\partial W}{\partial q_{c3}^*} = \alpha_3 \tag{27}$$

$$\alpha_i \frac{\partial f_i^*}{\partial q_{ij}} = \alpha_j \quad i = 1, 2, 3;\ j = 1, 2, 3 \tag{28}$$

$$\alpha_3 \frac{\partial f_1^*}{\partial K} = \mu_3 \tag{29}$$

$$\alpha_3 \frac{\partial f_3^*}{\partial L} = \delta_3 \tag{30}$$

$$\alpha_j \frac{\partial f_j^*}{\partial K} = \mu_3 + \mu_2 \quad j = 1, 2 \tag{31}$$

$$\alpha_j \frac{\partial f_j^*}{\partial L} = \delta_3 + \delta_2 \quad j = 1, 2. \tag{32}$$

Since the input of the factors of production labour and capital in industry is to remain unchanged by the transition from peacetime to emergency, the ratio of μ_1 to δ_1 will be equal to the ratio of μ_3 to δ_3.

We see that in this alternative too, agriculture will have a support which differentiates between the use of capital and labour. Consequently giving support in the form of price increments is at variance with the optimality conditions. But assume that μ_2/μ_1 is approximately equal to δ_2/δ_1 (as is the case if the agricultural product mix is approximately the same in peacetime and during an emergency), so that support could comprise a given percentage of the value added in agriculture. Will support in the form of price increments then be a feasible alternative? (Consumers must still be confronted by world market prices, so that a »high» price policy with import duties is undesirable in view of the optimal conditions.) Assume that

$$k = \frac{\mu_2}{\mu_1} = \frac{\delta_2}{\delta_1}.$$

We then see from equations (25) and (26) that the prices of agricultural out put will be $p_j/(1-k)$. From equation (22) with $i=1, 2$ we see that the prices of primary products used in agriculture will be $p_i/(1-k)$, i.e. the prices of agricultural input will have to be increased as well as the prices of agricultural output. At the same time we see from equations (22), (23) and (24) that industry must sell its output and purchase its input at world market prices. This means (if method of price increments to farmers is to be used) that agricultural purchases of intermediary prices will have to be taxed.

Thus, if price manipulations are considered an appropriate means of supporting agriculture, the manipulation will have to apply to all the commodities bought and sold by agriculture, while industry on the other hand must be able to sell and buy commodities (agricultural commodities included) at world market prices and consumers must be able to purchase freely at world market prices.

It would appear to be a simpler administrative proposition for support to be given directly in the form of income increments proportional to value added. Another alternative, of course, is to tax industry's use of capital and labour and leave agriculture intact, or the combine taxation of the industrial value added with a subsidization of agriculture.

INTERMEDIARY PRODUCTS – FIXED COEFFICIENTS

We shall now turn to consider conditions in the alternative where intermediary products are only used in certain fixed proportions to the total production of each commodity. We shall, however, assume that there exists a product (product 5) which is traded internationally and cannot be produced domestically (which means in principle that it is not profitable under any circumstances for this commodity to be produced at home) and we shall also assume that there exists an industrial commodity (product 4) which is produced at home but cannot be exported (e.g. services). As earlier, we shall assume that the emergency objective applies to the two agricultural products (products 1 and 2). The welfare function is now written

$$W = W(C_1, C_2, C_3, C_4, C_5, q^*_{c3}, q^*_{c4}). \tag{33}$$

Since consumption of product 4, C_4, is equal to net production, q_{c4}, we shall use these two designations alternatively. We now have to evaluate production of product 4 during an emergency.

We assume that the production functions can be written as earlier

$$q_i = f_i(K_i, L_i) \quad i = 1, 2, 3, 4. \tag{34}$$

Let a_{ij} be the quantity of product j required to produce one unit of product i. We assume that all a_{ij} are fixed. We also assume that product 5 (i.e. the product not produced at home) is not used as input in domestic production. The purpose of this assumption is to avoid making the model unnecessarily complicated: for if product 5 were used as input we would be forced to introduce stores of product 5 into the model to make production possible during an emergency, or else to assume that there were alternative processes for domestic production in which product 5 was not required as input.

The following relation must now apply

$$q_i - \sum_{j=1}^{4} a_{ji} q_j - q_{ci} = 0 \quad i = 1, 2, 3, 4. \tag{35}$$

The equation for the balance of current payments now becomes

$$\sum_{i=1}^{3} p_i(q_{ci} - C_i) - p_5 C_5 = 0. \tag{36}$$

We can now form the Lagrange function for our maximum problem.[8]

$$\begin{aligned}\phi = W &+ \sum_{i=1}^{4} \lambda_i(f_i - q_i) + \sum_{i=1}^{4} \gamma_i \left(q_i - \sum_{j=1}^{4} a_{ji} q_j - q_{ci} \right) + \mu_1 \left(\bar{K} - \sum_{i=1}^{4} K_i \right) + \delta_1 \left(\bar{L} - \sum_{i=1}^{4} L_i \right) \\ &+ \eta \left\{ \sum_{i=1}^{3} p_i(q_{ci} - C_i) - p_5 C_5 \right\} + \mu_2 \left(\sum_{j=1}^{2} K_j - \sum_{j=1}^{2} K_j^* \right) + \delta_2 \left(\sum_{j=1}^{2} L_j - \sum_{j=1}^{2} L_j^* \right) \\ &+ \mu_3 \left(\bar{K} - \sum_{i=1}^{4} K_i^* \right) + \delta_3 \left(\bar{L} - \sum_{i=1}^{4} L_i^* \right) + \sum_{i=1}^{4} \alpha_i(f_i^* - q_i^*) + \sum_{i=1}^{4} \beta_i \left(q_i^* - \sum_{j=1}^{4} a_{ji} q_j^* - q_{ci}^* \right).\end{aligned}$$

As earlier, we shall assume the partial derivatives of ϕ to be equal to zero, and after simplification (again we select W so that $\eta = 1$ and, in order to obtain greater symmetry, y_4 is retermed p_4):

$$\frac{\partial W}{\partial C_i} = p_i \quad i = 1, 2, 3, 4, 5 \tag{37}$$

$$\left(p_i - \sum_{j=1}^{4} a_{ij} p_j \right) \frac{\partial f_i}{\partial K} = \mu_1 \quad i = 3, 4 \tag{38}$$

[8] See p. 234, n. 7.

$$\left(p_i - \sum_{j=1}^{4} a_{ij} p_j\right) \frac{\partial f_i}{\partial L} = \delta_1 \quad i = 3, 4 \tag{39}$$

$$\left(p_j - \sum_{i=1}^{4} a_{ji} p_i\right) \frac{\partial f_j}{\partial K} = \mu_1 - \mu_2 \quad j = 1, 2 \tag{40}$$

$$\left(p_j - \sum_{i=1}^{4} a_{ji} p_i\right) \frac{\partial f_j}{\partial L} = \delta_1 - \delta_2 \quad j = 1, 2 \tag{41}$$

$$\frac{\partial W}{\partial q_{ci}^*} = \beta_i \quad i = 3, 4 \tag{42}$$

$$\left(\beta_i - \sum_{j=1}^{4} a_{ij} \beta_j\right) \frac{\partial f_i^*}{\partial K} = \mu_3 \quad i = 3, 4 \tag{43}$$

$$\left(\beta_i - \sum_{j=1}^{4} a_{ij} \beta_j\right) \frac{\partial f_i^*}{\partial L} = \delta_3 \quad i = 3, 4 \tag{44}$$

$$\left(\beta_j - \sum_{i=1}^{4} a_{ji} \beta_i\right) \frac{\partial f_j^*}{\partial K} = \mu_2 + \mu_3 \quad j = 1, 2 \tag{45}$$

$$\left(\beta_j - \sum_{i=1}^{4} a_{ji} \beta_i\right) \frac{\partial f_j^*}{\partial L} = \delta_2 + \delta_3 \quad j = 1, 2. \tag{46}$$

We see that the conclusions drawn earlier still apply. Support to agriculture should take the form of a non-proportional subsidization of capital and labour. If support takes the form of price subsidies, the use of primary products in agriculture will still have to be taxed. The factors of production allocated to industry will be allocated efficiently, and the same applies to agriculture, while allocation between agriculture and industry on the other hand will not generally satisfy the marginal conditions for »efficient» production.

LIMITED REALLOCATION OPPORTUNITIES IN AGRICULTURE

So far we have assumed that the factors of production in agriculture can be reallocated between the two agricultural products without any limitations. If product 1 is animal production and product 2 is vegetable production, there ought not to be much difficulty in changing from product 1 to product 2 (slaughtering the herd and putting land down to bread grain instead of feed grain). On the other hand, it would probably take quite a long time to change from product 2 to product 1. The occurrence of time lags in changes of agricultural production should be taken into account when defining the emergency objective. If we assume that lags exist in both directions, our emergency objective is bound to entail producing the same quantities of the two products in peacetime as we wish to produce in an emergency. But if a lag is supposed to exist in one direction only, peacetime production does not necessarily have to be the same as emergency production. The nature of peacetime production compared with production during an emergency will depend on how the emergency objective is defined.

Three alternatives are conceivable. We shall make all three subject to a restriction concerning factor input in the production of product 1 to equations (5)–(8). This additional restriction can now be formulated in one of the following three ways (on the basis of the model on pp. 228 ff.

$$K_1 - K_1^* \geqslant 0, \quad L_1 - L_1^* \geqslant 0 \tag{47}$$

$$q_1 - q_1^* \geqslant 0 \tag{48}$$

$$K_1 - K_1^* \geqslant 0. \tag{49}$$

The first restriction is that we must allocate at least as many factors of production for the production of product 1 in peacetime as are required during an emergency. If this restriction is binding, peacetime production will of course correspond to production during an emergency.

The second restriction is that we must allocate sufficient factors of production in peacetime to enable us to produce at least as much of product 1 as we wish to produce in an emergency. It is possible to show that, if this restriction is binding, emergency and peacetime production will again be identical.

The conclusion for price policy of these two alternative restrictions (which is also the conclusion if the emergency objective is formulated so as to require agricultural production to be the same during peacetime and during an emergency) is that farming enterprises should receive a subsidy proportional to the value added of each branch of production but not necessarily of the same magnitude for both products. In terms of producer prices this implies non-uniform price subsidy for agricultural products. It is readily apparent that subsidies should not be the same for all products, for the object of subsidization is to induce farms to produce the quantities desired. There is no reason why these prices should be proportional to world market prices.

The third restriction is that at least as much capital should be allocated to the production of product 1 as is required in an emergency. We shall study this case more closely.

Let restriction (49) receive the Lagrange multiplier ϵ. The optimal conditions will then be

$$\frac{\partial W}{\partial C_i} = p_i \quad i = 1, 2, 3$$

$$p_1 \frac{\partial f_1}{\partial K} = \mu_1 - \mu_2 - \varepsilon$$

$$p_1 \frac{\partial f_1}{\partial L} = \delta_1 - \delta_2$$

$$p_2 \frac{\partial f_2}{\partial K} = \mu_1 - \mu_2$$

$$p_2 \frac{\partial f_2}{\partial L} = \delta_1 - \delta_2$$

$$p_3 \frac{\partial f_3}{\partial K} = \mu_1$$

$$p_3 \frac{\partial f_3}{\partial L} = \delta_1$$

$$\alpha_1 \frac{\partial f_1^*}{\partial K} = \mu_2 + \varepsilon$$

$$\alpha_1 \frac{\partial f_1^*}{\partial L} = \delta_2$$

$$\alpha_2 \frac{\partial f_2^*}{\partial K} = \mu_2$$

$$\alpha_2 \frac{\partial f_2^*}{\partial L} = \delta_2.$$

Thus, in contrast to what was found previously, the costs of capital in peacetime must be subsidized more in the production of product 1 than in the production of product 2, which is a very reasonable conclusion. Theoretically, support should still not take the form of price subsidies. If we accept the previous assumption of approximate equality between μ_2/μ_1 and δ_2/δ_1, we conclude that support to agriculture can take the form of a uniform price subsidy in both agricultural products coupled with a capital subsidy of the production of product 1.

Finally, we shall consider another problem concerning the possibilities of reallocation. Our definition of the emergency objective is based on the assumption that labour and capital cannot be reallocated quickly enough between agriculture and industry in an emergency. This may be too extreme an assumption in the case of labour. We shall therefore replace it with the following: a certain proportion, θ, of the labour needed in an emergency must be employed in agriculture in peacetime. Clearly our previous definition implied that $\theta = 1$. Concerning capital we shall assume as previously that there is no possibility of reallocation between agriculture and industry in an emergency.

We shall now analyze our second model with this definition of the emergency objective. The only change in the model occurs in equation (8) which is replaced by

$$\sum_{j=1}^{2} L_j - \theta \sum_{j=1}^{2} L_j^* \geqslant 0 \quad 0 \leqslant \theta \leqslant 1. \tag{8'}$$

The only change in the optimal conditions occurs in equation (32)

$$\alpha_j \frac{\partial f_j^*}{\partial L} = \delta_j + \theta \delta_2 \quad j = 1, 2. \tag{32'}$$

If $\theta = 0$, equation (8') is no longer binding and $\delta_2 = 0$.[9] On the other hand $\mu_2 \geqslant 0$ still holds good. Thus in this case all support to agriculture must go to

[9] This corresponds to the case where no emergency objective has been applied to the peacetime allocation of labour. Thus with this objective equation (8') would disappear.

capital. But as long as equation (8′) is binding the new definition will not entail any change of principle in the conclusions we have drawn. Small θ, however, will increase the possibilities of equation (8′) not being binding. Moreover since δ_2 can be taken as a continual function of θ, small θ will make δ_2 small, even if equation (8′) remains binding, so that in cases like these support must focus on capital.

THE EMERGENCY OBJECTIVE IN TERMS OF NUTRITIVE VALUES

In the debate on agricultural policy, reference is often made to the concept of degree of self-sufficiency, which measures the relation between the calory content of peacetime agricultural production and the calory output desired in an emergency. In this section we shall attempt to define the emergency objective as a requirement for the production during an emergency of sufficient quantities of various nutritive substances such as proteins and calories.

Let us assume that we are only interested in two nutritive substances, proteins and calories, and that we have specified the desired consumption of these substances in an emergency as S_1 and S_2. Let b_{ij} be the quantity of the j-th nutritive substance present in agricultural product i. On the basis of model 1 we can then formulate the emergency objective in the following inequalities

$$b_{11} q_1^* + b_{21} q_2^* \geqslant S_1$$

$$b_{12} q_1^* + b_{22} q_2^* \geqslant S_2$$

$$f_j^* - q_j^* \geqslant 0 \quad j = 1, 2$$

$$\sum_{j=1}^{2} K_j - \sum_{j=1}^{2} K_j^* \geqslant 0$$

$$\sum_{j=1}^{2} L_j - \sum_{j=1}^{2} L_j^* \geqslant 0.$$

We can now carry out almost the same analysis as in model 1, as a result of which we have the following optimal conditions

$$\frac{\partial W}{\partial C_i} = p_i \quad i = 1, 2, 3$$

$$p_1 \frac{\partial f_3}{\partial K} = \mu_1$$

$$p_1 \frac{\partial f_3}{\partial L} = \delta_1$$

$$p_j \frac{\partial f_j}{\partial K} = \mu_1 - \mu_2 \quad j = 1, 2$$

$$p_j \frac{\partial p_j}{\partial L} = \delta_1 - \delta_2 \quad j = 1, 2$$

$$(\alpha_1 b_{j1} + \alpha_2 b_{j2}) \frac{\partial f_j^*}{\partial K} = \mu_2 \quad j = 1, 2$$

$$(\alpha_1 b_{j1} + \alpha_2 b_{j2}) \frac{\partial f_j^*}{\partial L} = \delta_2 \quad j = 1, 2.$$

We see that the only difference from model 1 lies in the determination of δ_2 and μ_2, i.e. the size of the subsidization of labour and capital, respectively. Thus all the conclusions previously drawn still apply. We can, however, draw certain (intuitively self-evident) conclusions regarding the product mix in an emergency. If for example b_{11} and b_{12} are very small, the marginal productivity of capital and labour in the production of product 1 must obviously be very large in an emergency, which implies that output of product 1 is small in an emergency. In peacetime on the other hand, allocation between the two agricultural products is determined by world market prices.

SUMMARY

The conclusions we have reached are naturally based on our definition of the emergency objective. This definition would, however, appear to be the most plausible of all the conceivable alternatives. In all the models we have considered, the optimal conditions have generally entailed basing support to the agricultural sector on use of the factors of production labour and capital and not supporting both factors on the same scale. In practical terms it is probably impossible to distinguish between support to labour and support to real capital, and support should therefore be made proportional to value added. In this case, however, support will be equivalent to a subsidy via producer prices. Another common principle has been that consumers should be confronted by world market prices, which rules out support by means of tariffs.

Support via prices is, however, complicated by the use in farming of intermediary products. In this case farmers should receive a uniform price subsidy on sales, irrespective of whether they sell to consumers, other farmers or industry. At the same time farmers' purchases of intermediary products, irrespective of their origin, should be taxed at the same percentage rate as the price subsidy (i.e. all prices confronting the farmer should be raised uniformly, while all prices in industry should be world market prices or, in the absence of world trade in a product, marginal cost prices).

APPENDIX K

METHODS AND COSTS OF AGRICULTURAL SUPPORT

BY ASSAR LINDBECK

Assume that the state wishes to increase farmers' total incomes by a certain sum. Several alternative methods may be considered to this end. The choice of method will presumably depend on the side-effects the various alternatives are likely to have. In this appendix we shall confine our attention to the effects on government expenditure.

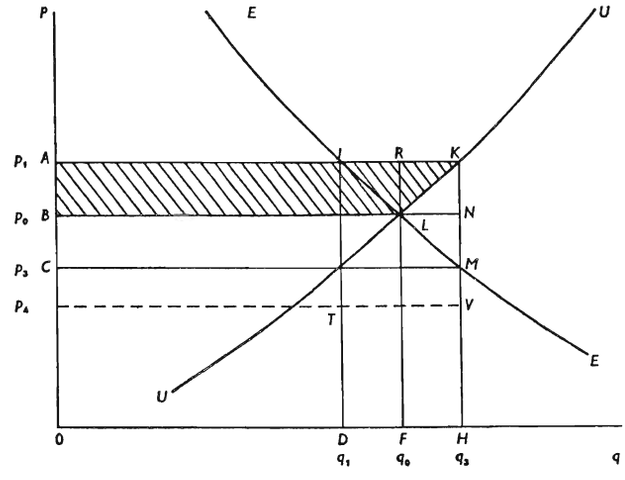
We shall study four different support systems, namely (a) price controls (a high price policy), (b) subsidies (a low price policy), (c) direct cash subsidies, and (d) production controls (e.g. a soil bank). Diagram K 1 provides a suitable point of departure for our analysis.

Diagram K 1 shows on its vertical axis the price (p) and on its horizontal axis the quantity (q) of a particular agricultural product. Curve EE denotes demand while curve UU denotes supply of the product in question. In the absence of state intervention in price formation, the short-term equilibrium price (i.e. with given capital stocks) would be p_0 and the equilibrium price (i.e. with given capital stocks would be p_0 and the equilibrium quantity q_0. Farmers' receipts on the product in question would be $p_0 q_0$.

a. CONTROLLED PRICE (HIGH PRICE POLICY)

Assume that the state wishes to raise farmers' receipts to $p_1 q_1$, i.e. by $\Delta Y^a = p_1 q_3 - p_0 q_0$, by increasing prices. Since the supply curve in free competition

Diagram K 1. *Prices and incomes with alternative types of support*



consists of the total marginal cost curves of all enterprises, the increase in farmers' net incomes (profit) will be equal to the shaded area *BAKL* in Diagram K 1; we shall refer to this increase as ΔY_n. The controlled price would produce an excess supply of $(q_3 - q_1)$ which can be stored, exported, given away to other countries or even destroyed. Domestic consumption will be q. Out of the farmers' total receipts for the product in question, consumers will pay *OAJD* and the state the remainder, i.e. *DJKL.*

b. PRICE SUBSIDY (LOW PRICE POLICY)

Assume instead that the state wishes to guarantee farmers the same rise in income by means of price subsidies at equilibrium prices, i.e. without creating any surplus output. The consumers now pay the price p_3 (for the quantity q_3), while the farmers are paid the price p_1. Price subsidies per unit amount to $(p_1 - p_3)$. (The farmers can be said to be confronted by a demand curve passing through point K although the households' actual demand curve is *EE*.) The farmers' receipts and net incomes are the same as in case (a), above, since price and quantity sold remain the same. The consumers pay the sum of *OCMH* while the state pays the remainder, i.e. *CAKM.*

c. CASH SUBSIDY

The third case is a cash subsidy to an amount corresponding to the shaded area *BAKL* in Diagram K 1. (Price and production in this case will be p_0 and q_0 respectively in the short run, i.e. with given capital stocks.)

In cases (a) and (b) the *sum* of the state's and the consumers' total expenditure on the subsidization of agricultural incomes will be equal, *BARL* + *FRKH.* Case (c) will cost them less, namely *BAKL*, since this case does not involve any rise in production, together with the costs this would entail. The relative magnitude of the costs incurred by the state in case (a) (price controls), case (b) (price subsidization) and case (c) (cash subsidies) will depend on three circumstances, namely the elasticity of demand and supply and the scale of support (and with it of the rise in prices). These relations are best illustrated algebraically, following on from Diagram K 1.

Assume that the state raises the producer price by 100 α per cent through price control or a price subsidy. If the state expenditures connected with these policies are denoted ΔG_a and ΔG_b respectively, and the state expenditure in the case of a cash subsidy denoted ΔG_c, we obtain the following relationship, where e_d and e_s refer to the elasticity of demand and supply respectively, both assumed constant in the relevant interval, and both defined as positive numbers.

$$\Delta G_a = p_0(1+\alpha) \cdot q_0 \alpha(e_e + e_u) = p_0 q_0 \alpha(1+\alpha)(e_e + e_u)$$

$$\Delta G_b = p_0 \alpha \left(1 + \frac{e_u}{e_e}\right) q_0(1+\alpha e_u) = p_0 q_0 \alpha(1+\alpha e_u)\left(\frac{e_e + e_u}{e_e}\right)$$

$$\Delta G_c = \Delta Y_n = p_0 \alpha q_0 + \tfrac{1}{2} p_0 \alpha \cdot q_0 \alpha e_u{}^1 = p_0 q_0 \alpha(1 + \tfrac{1}{2}\alpha e_u).$$

Clearly

$$\Delta G_b > \Delta G_c. \quad \text{Similarly} \quad \Delta G_b > \Delta G_a \quad \text{if} \quad p_0 q_0 \alpha(1+\alpha)(e_e+e_u) < p_0 q_0 \alpha(1+\alpha e_u)\left(\frac{e_e+e_u}{e_e}\right)$$

$$\text{i.e. if} \quad e_e < \frac{1+\alpha e_u}{1+\alpha}. \tag{1}$$

If the elasticity of the demand curve is one, the condition will clearly be $e_d < 1$. If the elasticity of the demand curve is small, we have the approximate condition

$$e_e < \frac{1}{1+\alpha}.$$

If the price rise is small the condition $e_d < 1$ will apply approximately. If for instance prices rise by five per cent, the condition will be

$$e_e < \frac{1+0{,}05\, e_u}{1{,}05}.$$

The diagram shows that the condition in question will be approximately $e_d < 1$ in the event of a slight rise in prices. This is because a slight rise in prices will make the *consumers'* expenditure at point J larger than at point M if the price elasticity of demand is less than one (since the elasticity shows by how many per cent demand changes in response to a price change of one per cent). Since farmers' incomes comprise the sum total of payments by the state and the consumers, case (a) (given slight changes in prices) will therefore be cheaper for the state than case (b) if the price elasticity of demand is less than one. If the price elasticity of demand is greater than one, the contrary applies, and if price elasticity is equal to one the cost to the state will be the same in either case.

Thus if the state prefers the support programme involving the least state expenditure – regardless of other effects – price controls are to be preferred to price subsidies in the case of a product with low price elasticity of demand (e.g. grain and potatoes), while price subsidies are preferable to price controls as regards products with large price elasticity (e.g. butter). Cash subsidies are always cheaper for the state than price subsidies. But price controls are cheaper still in cases of low elasticity of supply and demand.[2]

In our analysis so far, we have disregarded the question of what is to be done with the surplus $q_3 - q_1$ accompanying the high price policy. If it is stored (as in the USA) this will entail storage costs to the state over and above $DJKH$, so that the price elasticity of demand will have to be rather less than $(1+\alpha e_s)/(1+\alpha)$ (or in the event of a slight rise in prices approximately under one) in order for the high price policy to cost the state less than the low price policy.

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[2] Obviously the condition for $\Delta G_a < \Delta G_c$ is that $(1+\alpha)(e_e+e_u) < (1+\frac{1}{2}\alpha e_u)$

$$e_e < \frac{1-e_u(1+\frac{1}{2}\alpha)}{1+\alpha}.$$

With small price changes, when $\alpha \simeq 0$, the condition will be approximately $e_e + e_u < 1$. If $e_u = 0$ it will be $e_e < 1/(1+\alpha)$.

A somewhat different problem arises if the surplus is sold abroad. Assume that the export price is below the domestic price, say at p_4 in Diagram K 1. This means that $DTVH$ can be earned abroad. If the farmers themselves have to sustain the loss on exports, their receipts (and profits) will be $TJKV$ less than in the previous instance (a). If on the other hand the state purchases the surplus and sells it abroad, the farmers' situation will resemble that in case (a) and the cost to the state will be reduced by $DTVH$.

NUMERICAL EXAMPLES

The following example will serve further to elucidate the importance of the size of elasticity of supply and demand. Assume that for a given agricultural product $e_d = 0.5$ and $e_s = 0.2$. Assume also that we are considering giving farmers a certain net income by using price controls to raise the market price by 10 per cent. Formula (1) shows that in this case price controls are cheaper for the state than price subsidies (since $(1+0.1 \times 0.2)/(1+0.1) = 0.93 > 0.5$). Consequently, elasticity of demand in the case must be greater than 0.93 in order for a price subsidy to be cheaper for the state. If the elasticity of output had been 0.6 instead, a price subsidy would have been cheaper if the elasticity of demand is greater than 0.96 (since $(1+0.1 \times 0.6)/(1+0.1) = 0.96$). Thus so long as we are not dealing with very large price changes, the condition $e_d < 1$ can be accepted as a good approximation. (If prices rise by 50 per cent and the elasticity of supply is 0.2, the condition will be that $e_d < (1+0.5 \times 0.2)/1.5 = 0.73$).

It is interesting to see how much farmers' incomes would rise at given values for e_d and e_s. If $e_d = 0.5$ and $e_s = 0.2$, a 10 per cent rise in prices would increase farmers' net incomes by $\Delta Y_n = p_0 q_0 \alpha(1+1/2\alpha e_s) = 0.101\ p_0 q_0$.

Let us now define the relation between the farmers' increased income (ΔY_n) and the costs the state would incur thereby in the three cases the relation is expressed by the ratios, the »multipliers», m_a, m_b, m_c

$$m_a = \frac{\Delta Y_n}{\Delta G_a} = \frac{1 + \frac{1}{2}\alpha e_u}{(1+\alpha)(e_e + e_u)}; \quad m_b = \frac{\Delta Y_n}{\Delta G_b} = \frac{1 + \frac{1}{2}\alpha e_u}{(1+\alpha e_u)\left(\frac{e_e + e_u}{e_e}\right)}; \quad m_c = \frac{\Delta Y_n}{\Delta G_c} = 1.$$

In the above numerical example the »multiplier» will be

$$m_a = \frac{1 + \frac{1}{2} \cdot 0{,}1 \cdot 0{,}2}{1{,}1 \cdot (0{,}5 + 0{,}2)} = 1{,}31.$$

The same increase in farmers' net incomes obtained by means of price subsidies gives us the »multiplier»

$$m_b = \frac{\Delta Y_n}{\Delta G_b} = 0{,}71.$$

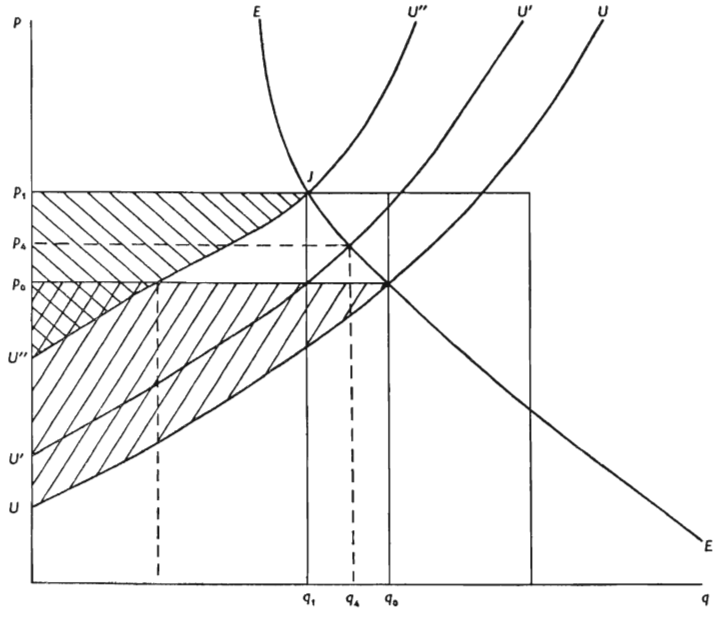
»Multiplier» m_c, as we have already remarked, is always equal to one.

d. PRODUCTION CONTROLS (E.G: A SOIL BANK)

Another way of increasing farmers' net incomes is to limit agricultural output by a mandatory reduction of cultivated acreage. Assume that an area corresponding to output $(q_0 - q_1)$ is taken out of cultivation. If closures are mainly confined to inferior land, the percentage reduction in acreage will be greater than the percentage fall in output. But the price rise resulting from the reduction of acreage will stimulate increased production on the land that is still cultivated. If for the sake of simplicity we assume that the supply elasticity of each price is the same as before, the supply curve can be said to shift to the left, e.g. to $U'U'$ in Diagram K2.

Thus, instead of the »planned» reduction to q_1 we only succeed in reducing output to q_4. The price will be p_4. In order to raise the price to p_1, acreage will have to be reduced to an extent corresponding to a shift of the supply function to $U''U''$. In this case farmers' net receipts will change by $p_1q_1 - p_0q_0$, i.e. by $(1+\alpha)p_0q_0\ (1-\alpha e_d) - p_0q_0 = p_0q_0[(1+\alpha)(1-\alpha e_d)-1]$. Thus farmers' net receipts will rise if $(1+\alpha)(1-\alpha e_d) > 1$, i.e. if $e_d < 1/(1+\alpha)$. The net profit will be changed by the difference between the $NO-SV$ shaded area in the $NV-SO$ shaded area (if fixed costs are the same in both cases).

Diagram K2. *Prices and incomes when output is restricted*



APPENDIX L

PRICES, CONSUMPTION, PRODUCTION AND USE OF RESOURCES WITH ALTERNATIVE PRICE SYSTEMS

BY ODD GULBRANDSEN

In this appendix a comparative static method will be used to determine the agricultural prices resulting from different price systems. The method will also be used to show how the different prices affect consumption, production, foreign trade and the use of factors of production. A numerical analysis will be made of prices according to the principle of uniform price support and of EEC prices. The appendix also includes an account of various attempts to determine mathematically the long-term development of world market prices, as well as tables showing the price indices on which Diagrams 2 and 15 in the main text are based.

NUMERICAL ANALYSIS OF DIFFERENT PRICE SYSTEMS

The numerical analyses comprise four principal stages, (1) determination of the product prices occurring in different price systems, (2) calculation of the consumption resulting from these prices, (3) calculation of production at different prices and (4) calculation of the factor requirements, value and nutritive content of consumption and production at the alternative prices under consideration.

(1) Prices are estimated on the basis of import prices (world market prices cif), which in the absence of controls are assumed to determine domestic wholesale prices. Producer prices with free price formation are assumed to lie under these wholesale prices by an öre margin representing value added, transport and distribution costs at the collection stage. Uncontrolled consumer prices are assumed to lie below current consumer prices by an öre margin equal to import duties (including any compensation charges). In cases where the import duties clearly have not been effective, however, the margin has been made equal to the difference between current domestic retail prices and import prices. These methods for determining producer and consumer prices are based on the simplified assumption – simplified for methodological reasons – that the margin between the above price stages is not affected by the control system.

The figures for the öre margin at the collection stage are taken from available printed sources (in the case of milk from Swedish Dairy Operation Statistics and in the case of sugar from government bills regarding sugar controls), from personal information (the National Agricultural Marketing Board and the Swedish Oil Seed Growers' Association), and from comparisons of retail and producer prices (according to the National Agricultural Marketing Board's statistics concerning grain, meat, eggs and potatoes). Import duties are taken from Jordbruksekonomiska meddelanden.

Estimates regarding milk and oil seeds are complicated by the fact that processing results in several products. For the sake of simplicity, milk production is divided into three products only, consumer milk (including milk used in cream production), cheese and butter in the proportions occurring during the year to which the estimate applies. Oil and flour are assumed to be produced from oil seeds in the same proportions as apply to winter rape seed. Finally, estimates of sugar beet prices call for knowledge of their sugar content.

The öre margins at the collection stage are given in Table L 1 together with the above-mentioned calculation factors. World market prices, domestic retail and producer prices, deduced world market producer prices and import duties are shown in Table L 2. These figures, referring to 1960/61 and 1964/65 – 1966/67, have also been used to calculate border protection and price support in Table 26 in the main text.

Prices at uniform price support have been estimated for two eventualities, namely support on the same average level as before and the lower level of support calculated to preserve the production capacity required for purposes of emergency. The level of support is indicated by the value of production at current producer prices in relation to the value of production at world market producer prices. Uniform price support must be accompanied by a tax on purchases of supplies, levied at the same rate as the price support. To maintain farmers' receipts through support, agricultural products must then be given a price subsidy sufficiently larger than the average current price support to counterbalance the tax they have to pay. If the cost of supplies is a per cent of the value of production, price increments will have to be made $a/(1-a/100)$ per cent larger than the current level of support. In the calculations described here, the cost of supplies has been put at 20 per cent of the value of production, so that price subsidies at the same rate of price support will be 25 per cent higher than the current rate of support. Thus, producer prices at uniform price support at the same level as previously are calculated as world market producer prices plus a uniform percentage price increment on all products. Producer prices at the lower level of support in the emergency programme are calculated by reducing producer prices at a uniform support rate by a certain percentage, 15 per cent in the present calculations.

In determining the consumer prices resulting from uniform price support, a distinction is drawn between two more cases, high price policy and low price policy. In the case of a high price policy, consumer prices are reduced by the difference in öre between current import duties and the duties required to maintain the new producer prices. In estimating the consumer prices accompanying a low price policy, allowance is made for the increase in turnover tax which is required over and above the proceeds of supply taxation in order to cover the cost of price support. Thus, consumer prices with a low price policy are current consumer prices minus current import duties plus the increase in turnover tax.

Most of the EEC prices quoted here are taken from material furnished by the National Agricultural Marketing Board. The difference forecast by the Board between EEC prices and Swedish producer prices in 1967/68 has been added to current producer prices to obtain EEC prices comparable to the estimates made here. The price differences are shown in Table L 2.

Table L 3 shows the average level of support for certain years, 1960/61 and 1964/65 – 1966/67, together with the value of production and consumption at world market and domestic prices. Conditions attaching to uniform price support

are only given for the emergency case. The estimates cover bread grain, sugar (sugar beet), edible oils (oil seeds), potatoes, milk (including cheese and butter on the consumption side), beef (including veal, horsemeat and lamb), pork, poultry and eggs.

(2) Consumption in the various price systems is calculated on the basis of current consumption and subject to certain assumptions regarding price elasticities. Apart from specific elasticities, certain cross elasticities have also been taken into account. Consumption is calculated using the formula:

$$D_{i,1} = D_{i,0} \cdot \left[\frac{p_{j,1}}{p_{i,0}}\right]^{-e_i} \cdot \left[\frac{p_{j,1}}{p_{j,0}}\right]^{e_j};$$

D = volume of consumption
p = consumer price
e = elasticity
i = product no.
j = competing product no.
1 = price system no.
0 = current situation.

The elasticities are set out in Table L 1. Consumer prices and consumption have been calculated for five different price situations: current prices, EEC prices and three cases of uniform price support (high price policy with unchanged support, and high and low price policy respectively with the level of support adjudged sufficient for preparedness). These estimates form the basis of Tables 28 and 29 in the main text.

(3) Production with different price systems is calculated in several stages. The first stage is to calculate the qualitative effects of changes in price relations on the basis of hypothetical supply elasticities. The price relation of a product is expressed in terms of its price in relation to the price of feed grain. The price of feed grain has been selected as numeraire because feed grain competes with other crops on the arable side, in addition to which it affects the profitability of most animal products. A large change in the price relation of a product is assumed to result in the termination of production (in the calculations given here, production is assumed to cease following a 30 per cent relative price fall). Production is calculated using the formula

$$S_{k,1} = S_{k,0} \cdot \left[\frac{p_{k,1}/p_{k,0}}{p_{f,1}/p_{f,0}}\right]^{u_k}$$

S = volume of production
p = producer price
u = output elasticity
k = product no.
f = feed price subscript
1 = price system no.
0 = current situation.

The second step in calculating production is to adapt to total production. The output volumes of individual products calculated according to the production formula. Total production is measured in terms of total crop output ex-

pressed in crop units. But the volume of crop output depends on total receipts in the new price system. Changes in the prices and output volumes of individual products can cause receipts to deviate from total receipts in the current price system. Adjustment to total production proceeds in four stages.

First, the estimated volumes of production are adjusted by an equal percentage so that their combined volume in crop units corresponds to current crop output. The total value of the new volumes of production is then calculated in prices applying in the new system. The difference between this value and the value of current total production can be interpreted as a price change per crop unit, since crop output is the same in both cases. This price change is assumed to affect total crop output according to a certain price elasticity. In this way total production of the individual products is also changed. The third stage, then, is to adjust the volumes of the individual products again proportionally to make their crop unit volume agree with the new crop output. Another proportional adjustment is made in order to calculate the production volumes of individual products in the preparedness programme, so that their total crop unit volume is equal to the crop output required in an emergency (according to Appendix F).

Output elasticities and coefficients of crop unit content and – for animal products – crop unit requirements per kg. product – are shown in Table L 1.

(4) The total nutritive content of production and consumption has been calculated on the basis of calory, animal protein and total protein content per kg. product. The total volumes of production and consumption in different price situations have been calculated by weighting together the volumes of the various products with uniform weights consisting of current prices.

Differences between production and consumption, i.e. balances of resources, have been calculated for individual products and totally. Since consumption in certain cases involves processed products, while the estimates of production refer to raw materials, conversion coefficients showing the quantity of output per kg. input (see Table L 1) have been used in the estimates of resource balances. Dairy products are subject to the additional complication that foreign trade can refer to more than one product. In the present estimates, foreign trade in dairy products has been expressed in terms of butter for the sake of simplicity.

METHODS FOR DETERMINING LONG-TERM PRICES

One disadvantage of allowing world market prices to influence domestic agricultural prices directly is thought to lie in the violent fluctuations of world market prices, which impairs the dependability and with it the efficiency of production planning. The most efficient procedure ought therefore to be to »import» long-term price movements on the world market and exclude short-term fluctuations. But it is difficult to determine long-term prices objectively. In the following a number of mathematical methods of smoothing price fluctuations are compared.

Table L4 shows the annual variation of the prices of certain important agricultural products on the world market. This variation has been measured as the standard deviation of prices in individual years from the average price over a longer period of years. Of the eight products analyzed for the period 1951–64, sugar showed the greatest variation in price, with a standard deviation equal to about 35 per cent of the average price, which is two or three times the standard deviation of other products.

World market prices have been measured in two ways in this study, quotations from leading exchanges or exporters and average unit values for world exports. There is often a considerable difference between the annual variations of these two price indices. Sugar stands out particularly in this respect too, the standard deviation of its export unit value being only half that of its quoted price. Considerable discrepancies were also observed in the case of wheat, eggs and pork. This is because large sectors of world trade in products registering such discrepancies are controlled by agreements in which prices are successively changed, while prices on the »free» market can vary considerably.

The traditional method of determining long-term prices is to calculate moving averages. The disadvantage of this method, however, is that the averages refer to years in the middle of the successions of years and not to the end of the period studied. The lag may be considerable since periods of seven years or more sometimes have to be used to eliminate short-term effects. This is particularly inconvenient if prices show a rising or falling trend throughout the period, in which case the moving averages give excessively low or high prices in relation to the actual trend.

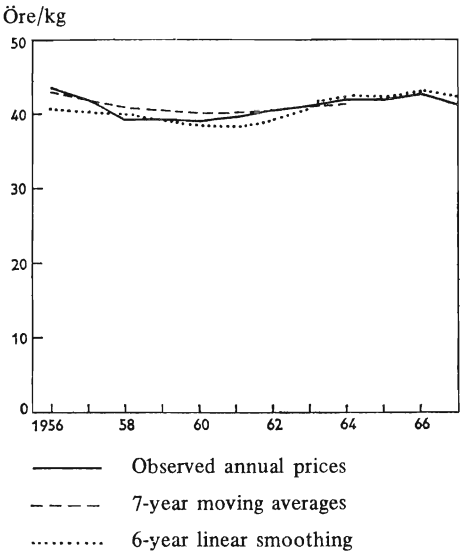
The need here is for a method of smoothing that gives an even price trend in the same way as the moving averages but at the same time capable of supplying an actual figure for the long-term price. One method is to adjust mathematical functions to an annual series of prices and use the estimate for current prices, i.e. prices during the last known year, as long-term prices. If the estimate is to be based on a large number of years, functions have to be selected that permit other than linear trends, i.e. functions of the second degree or more. The preparatory experiments that have been conducted with these suggest that there is considerable difficulty involved in choosing objectively a function that is not too rigid but at the same time not too flexible to thwart the object of smoothing.

If instead one chooses to smooth shorter periods of years, the obvious course is to use the simplest form of curve, a straight line, making moving linear smoothings according to the least square method for a limited number of years. The estimate for the year in question, i.e. the last year included in the smoothing, is an expression of the long-term price that year. The advantage of the method is its sensitivity to the position of the observations at the end of the sequence, which makes for prompt changes of trend. But there still remains the problem of objectively choosing the length of the sequence, for the smoothing effect has to be balanced against the risk of obtaining an excessively rigid estimate, which is particularly detrimental in cases where trends change. On the other hand, smoothings of short sequences can cause isolated deviations at the end of the sequence to exert undue influence on the slope of the regression line.

To cast empirical light on these problems, 6, 8 and 10 year moving linear smoothings have been made of 8 of the more important agricultural products on the world market. The data used consists of price quotations for the period 1951–67. The long-term price has been measured with the correctly timed moving seven-year average (not the delayed average the disadvantages of which were discussed above). Since the first year for comparison is the sixth in the period (=the shortest period for linear smoothing) and the last is the fourth from the end (owing to the years lost through the formation of averages), the number of years compared will be at least 8 less than the period covered by the data. To check the accuracy of the linear smoothings, a standard deviation has been calculated using the formula

$$S = \sqrt{\frac{\sum (p_u - p_m)^2}{n-1}},$$

Diagram L1. *Price trends for wheat, 1956–67*



For methods of calculation see Appendix L, pp. 251 ff.
The calculations are based on recorded prices cif British port for Manitoba 2.

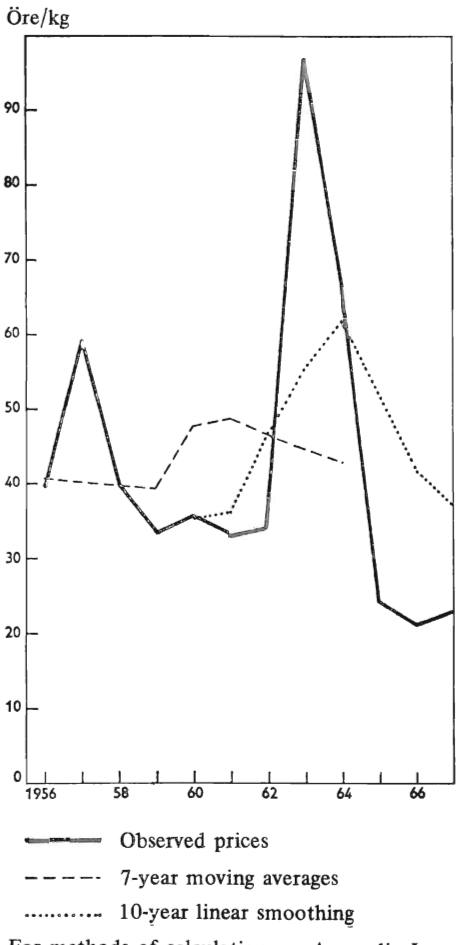
in which p_u = estimated price according to linear smoothing, p_m = the moving average and n = the number of years which can be compared. The empirical expressions of these measurements are summarized in Table L5.

The results show that the period for linear smoothing giving the least deviation varies considerably from one product to another. The longer smoothing periods give the smallest deviations in the case of products with large short-term fluctuations, e.g. sugar. If, on the other hand, the price movement is relatively even, it is the shorter smoothing periods that give the smallest deviation. In cases such as these, e.g. wheat, it is doubtful whether even the moving seven-year average can provide a better expression of long-term trends than the quoted price. This is shown in Diagram L1 with reference to wheat.

The question now arises what practical procedure is to be followed to apply the long-term prices thus calculated to the determination of domestic prices. If the average level of prices is not to be increased, import duties and import subsidies will have to be introduced corresponding to the difference between the current world market price and the long-term price.

It is relevant here to investigate the total stabilization effect that can be attained in the level of domestic prices. One way of measuring this effects is to estimate the fall in the value of variations in the producer's receipts and the consumer's food expenditure that price smoothing according to the above methods could achieve compared with an entirely unprotected market. If varying import

Diagram L2. *Price trends for sugar, 1956–67*



For methods of calculation see Appendix L, pp. 251 ff. The calculations are based on recorded prices for crude sugar fob Carribean ports.

duties and import subsidies are used to ensure that domestic prices always agree with the »ideal» long-term price, price rises resulting from duties and price reductions resulting from import subsidies ought to cancel out in the long run. The values of price rises and price reductions have been obtained by weighting together the differences between current price and estimated long-term price and, in the present case, the total volumes of the 8 products under consideration.

The result of the value estimates is given in Table L6. These estimates show that the correctly timed seven-year moving averages are relatively close to the »ideal». The linear smoothings on the other hand show quite considerable deviations from the ideal and would during the period under consideration have resulted in

a reduction of the average level of prices in relation to the unsmoothed prices. The shortest smoothing period gives the best result, but prices based on a price smoothing using this period will still give too low an average price level for the years that have been studied.

But the linear smoothing method is undoubtedly superior to the method of applying the most recently known moving average as a trend estimate, which as we have seen can lag considerably. This is made clear by the lower half of Table L6, where the result of the method using the latest seven-year moving average is compared with the linear smoothing methods. Thus the six-year linear smoothing would have given quite a fair average result for the period 1959–67, while the moving average for the last seven years would have severely underestimated the long-term level of prices.

In practice one must clearly compare the effects of several smoothing methods in order to determine the long-term price. Smoothing is of doubtful advantage when annual variations are small, e.g. less than 10 per cent. If the variations are greater, several linear smoothing methods with relatively short periods should be tested. With very large short-term fluctuations, these methods frequently tend to give excessive annual price variations. This is shown by Diagram L2 regarding sugar. For years of this kind one might consider retaining the trend estimate for the preceding year or choose for purposes of smoothing periods in which the short-term variations are fairly evenly distributed in time.

PRICE INDEX CALCULATIONS

The index figures on which Diagrams 2 and 15 in the main text are based are to be found in Tables L7 and L8 respectively.

Table L1. *Coefficients used to calculate prices with alternative systems for farm prices*

Product	Price elasticities: Demand: own elasticity	Price elasticities: Demand: cross elasticity	Price elasticities: Elasticity of supply	Content per kg product of: Crop units	Content per kg product of: Kcal	Content per kg product of: Animal protein g	Content per kg product of: Total protein g	Input for processing: Product	Input for processing: Amount kg/kg	Margins in collection stage: 1960/61	Margins in collection stage: 1964/65	Margins in collection stage: 1965/67	Producer-price difference EEC-Sweden 1967 öre/kg
Wheat	0.0		0.7	1.5	2 700		65			2	2	2	1
Wheat-flour								Wheat	1.3				
Food potatoes	0.0		1.0	0.4	700		15			0[a]	0[a]	0[a]	−4
Sugar beet			0.5	0.15	540								−0.5
Sugar	0.5							Sugar beet	7.15	44	50	45	
Winter rape			1.5	2.0	3 850					14	16	16	2
Rapeseed oil													
Rapeseed flour													
Margarine	1.01	0.4[b]						Rapeseed	2.0				
Producer milk			0.3	1.0	690	35	35			9	10	10	−5
Consumer milk	0.36												
Cheese	0.80							Milk	7.5				
Butter	1.0	1.44[c]						Milk	21.0				
Beef	0.66	0.4[d]	0.5	11.0	1 900	150	150			−40	−40	−40	−74
Pork	0.03	0.25[e]	1.5	6.0	3 500	100	100			17	10	10	0
Eggs	0.2		1.0	4.0	1 400	110	110			70	80	90	−30
Broilers	0.7		1.0	6.0	1 200	120	120			200	270	270	−117
Feed grain										2	2	2	−4

[a] The world market price refers to the lowest producer price in either Holland, Denmark or Great Britain, so that for technical reasons the margin has been taken as 0. [b] With respect to the price of butter. [c] With respect to the price of margarine. [d] With respect to the price of pork. [e] With respect to the price of beef.

Addendum: Further is assumed that the production of 100 kg of milk also yields 5 kg beef. The average price of milk products is calculated using weights of 5.2 for consumer milk, 0.16 for cheese and 0.23 for butter.

Sources and methods of calculation: See Appendix L, pp. 248 ff.

Table L2. *Farm price and border protection in Sweden, 1960–67*

Product	Type of price[a]	1960/61 World market price	1960/61 Border protection	1960/61 Domestic price	1964/65 World market price	1964/65 Border protection	1964/65 Domestic price	1965/66 World market price	1965/66 Border protection	1965/66 Domestic price	1966/67 World market price	1966/67 Border protection	1966/67 Domestic price
		Öre per kg											
Wheat	a	28	—	46	28	—	54	28	—	55	30	—	56
Wheat	b	30	21	48	30	35	56	30	37	57	32	41	58
Sugar beet	a	1.5	—	7.3	0.6	—	9.5	0.4	—	10.4	0.1	—	11.4
Sugar	b	55	36	90	54	48	105	48	69	105	45	82	107
Rapeseed	a	52	—	79	59	—	89	60	—	73	59	—	85
Edible oils	b	143	102	245	159	88	247	157	100	257	153	115	268
Rapeseed flour	b	30	7	—	37	4	46	40	5	45	43	5	48
Food potatoes	a	17	—	20	19	—	26	20	—	32	18	—	30
Food potatoes	b	15	14	29	19	16	35	20	20	40	18	20	38
Producer milk	a	25	—	46	28	—	53	26	—	54	28	—	54
Consumer milk	b	39	22	61	41	33	74	37	36	73	40	38	78
Cheese	b	246	186	451	281	222	515	318	245	543	334	266	555
Butter	b	426	125	571	509	129	694	487	159	608	495	194	548
Beef	a	400	—	490	440	—	657	446	—	634	413	—	627
Beef	b	360	150	469	400	231	656	406	275	656	373	316	627
Pork	a	350	—	382	347	—	429	403	—	481	428	—	465
Pork	b	367	115	436	357	156	484	413	181	552	438	192	537
Eggs	a	219	—	335	164	—	322	175	—	348	155	—	352
Eggs	b	289	110	410	244	205	404	247	172	437	210	199	444
Broilers	a	226	—	540	300	—	500	300	—	500	300	—	500
Broilers	b	426	132	558	570	253	823	570	243	813	570	280	850
Feed grain	a	27	—	39	27	—	43	27	—	46	28	—	47
Feed grain	b	29	16	38	29	18	45	29	19	48	30	19	49
Oil cake	b	43	7	55	52	4	64	51	5	62	54	5	71

[a] a = producer price, b = wholesale price.

Sources and methods of calculation: See Appendix L, pp. 248 ff.

Table L3. *Some assumptions and the results of analyses of alternative price systems*

	1960/61	1964/65	1965/66	1966/67
	Millions of Sw.kr			
Value of production				
at world market level				
in producer prices	2 942	3 220	3 364	3 199
in wholesale prices	3 530	3 849	3 950	3 749
at current domestic level				
in wholesale prices	4 419	5 381	5 619	5 228
Value of consumption				
at world market level				
in wholesale prices	3 268	3 460	3 520	3 593
at current domestic level				
in wholesale prices	4 844	5 666	6 030	6 405
in consumer prices	7 295	9 059	9 570	9 949
With sales tax on sales value of all goods	35 000	54 000	54 000	58 000
Current size of border protection	1 576	2 206	2 510	2 812
Conditions with a low price policy and uniform price support in the emergency case				
Price support	1 196	1 659	1 756	1 829
Revenue from tax on supplies	478	664	703	732
Revenue from increased sales tax	718	995	1 053	1 097
Current conditions	*Per cent*			
Border protection	48	64	71	78
Price support	50	67	67	63
Conditions with a low price policy and uniform price support in the emergency case				
Price support and tax on supplies	38	56	56	52
Requisite increase in sales tax	2.0	1.8	2.0	1.9

Sources and methods of calculation: See Appendix L, pp. 248 ff.

Table L4. *Annual variations in world market prices of some major farm products, 1951–64*

Product	Recorded price			Mean export price		
		Standard deviation			Standard deviation	
	Mean öre/kg	öre/kg	percentage of mean	Mean öre/kg	öre/kg	percentage of mean
Wheat	44	6	15	35	3	9
Sugar	59	20	34	55	9	17
Groundnut oil	177	29	17	192	27	14
Butter	455	53	12	445	53	12
Cheese	264	27	10	362	23	6
Beef	240	28	11	265	37	14
Pork	363	40	11	357	18	5
Eggs	307	38	12	315	28	9

Note: Recorded prices – wheat, Manitoba 2 cif British port; sugar, crude sugar quotation on New York exchange plus freight charges to Malmö, converted into refined; groundnut oil from British West Africa to European ports; butter, eggs, beef and pork, Copenhagen quotations; cheese, Leeuwarden quotations.
Mean export price: export unit values according to FAO, *State of Food and Agriculture* 1965, Annex tables.
Note that the price levels are not necessarily comparable since qualities may differ and the price quotations for wheat, sugar and groundnut oil are import quotations.

Table L5. *Precision of regression lines as estimates of price trends*

Product	Standard deviation for trend estimates based on linear smoothing for			Mean price level 1958–64
	6 years 1956–64	8 years 1958–64	10 years 1960–64	
	Öre per kg			
Wheat	1.5	2.3	3.3	40
Sugar	17.1	12.8	15.0	49
Groundnut oil	9.4	10.0	12.1	154
Butter	32.5	35.6	42.3	444
Cheese	17.2	23.5	32.3	268
Beef	24.7	26.0	23.9	244
Pork	20.0	25.4	34.7	376
Eggs	15.1	17.3	19.9	241

Sources and methods of calculation: See Appendix L, pp. 251 f. The calculations are based on the following prices – wheat, Manitoba 2 cif British port; sugar, crude sugar fob Carribean ports; groundnut oil, cif Continental ports from Nigeria and Gambia; butter beef, pork and eggs, export quotations in Copenhagen; cheese, Leeuwarden quotation for Edamer.

Table L6. *Alternative methods of price smoothing*

Period	Trend estimated with	Reduction of variation due to price rise	Reduction of variation due to price fall	Net effect
		Millions of Sw.kr.		
1956–64	7-year moving averages	907	875	32
	6-year linear smoothings	420	818	–398
1958–64	7-year moving averages	842	633	209
	8-year linear smoothings	335	864	–529
1960–64	7-year moving averages	605	534	71
	10-year linear smoothings	200	929	–729
1959–67	Latest 7-years averages	751	1 909	–1 158
	6-year linear smoothings	584	711	–127
1961–67	Latest 7-years averages	533	1 855	–1 322
	8-year linear smoothings	450	814	–364
1963–67	Latest 7-years averages	237	1 749	–1 512
	10-years linear smoothings	268	931	–663

Sources and methods of calculation: The calculations are based on the same prices as in Table L5. Weights are consumption volumes for Sweden in 1964.

Table L7. *Relative prices in agriculture and manufacturing, 1948–70*

Year	World market prices		Wholesale prices			Relative prices		
				Swedish farm products			For Swedish products	
	Industrial goods (1)	Food and feed (2)	Industrial goods (3)	domestic (4)	on world market (5)	For world trade (6)	national (7)	international (8)
	Index 1948/52 = 100							
1952	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1953	101.0	95.6	114.3	121.1	111.0	94.6	105.9	97.0
1954	100.0	90.5	112.7	117.4	108.2	90.5	104.1	95.9
1955	100.0	86.2	118.6	124.7	106.4	86.2	105.1	89.7
1956	104.2	87.0	122.0	137.6	109.1	83.5	112.7	89.4
1957	107.4	88.7	124.8	135.7	107.3	82.6	108.7	86.0
1958	106.3	85.3	122.4	134.8	101.8	80.2	110.1	83.1
1959	105.3	84.4	120.5	137.6	108.2	80.2	114.1	89.8
1960	107.4	83.6	124.8	144.0	108.2	77.8	115.4	86.7
1961	108.5	82.7	127.9	143.1	103.6	76.2	111.8	81.0
1962	108.5	83.6	130.6	146.7	101.8	77.0	112.3	77.9
1963	108.5	92.2	133.3	165.1	120.1	85.0	123.8	90.1
1964	110.6	93.9	140.3	168.8	122.0	84.9	120.3	86.9
1965	113.8	93.1	144.9	175.2	120.1	81.7	120.8	82.9
1966	114.8	93.9	149.6	178.8	123.8	81.7	119.5	82.7
1967	114.8	93.9	150.7	177.9	122.0	81.7	118.0	80.9
1968*	113.8	91.3	151.5	181.6	112.8	80.2	119.8	74.4
1969*	114.8	95.6	159.3	187.1	119.2	83.2	117.4	74.8
1970*			169.7	193.5	126.6		114.0	74.5

*Prel. figures.

Sources and methods of calculation:

Column 1. World market prices for industrial goods based on the UN's index for average export unit values (UN *Statistical Yearbook*).

Column 2. World market prices for food and feed according to FAO's index for average export unit values for this commodity group (FAO *The State of Food and Agricuture)*.

Column 3. Wholesale price index for Swedish industrial goods based on the Central Bureau of Statistics' wholesale price index (*Allmän månadsstatistik* (Monthly Digest of Swedish Statistics)).

Column 4. Wholesale price index for Swedish farm products calculated in accordance with Table B1 in Appendix B.

Column 5. Index for world market prices for Swedish farm products calculated in accordance with Table B1 in Appendix B.

Column 6 = column 2/column 1 · 100, column 7 = column 4/column 3 · 100, and column 8 = column 5/column 3 · 100.

Table L 8. *Production, productivity, producer prices and factor prices in agriculture, 1938–70*

Index 1950/51=100

Period	Production (1)	Producer prices (2)	Productivity (3)	Factor prices (4)	Factor prices (4
1938/39	86.09	82.94	84.69	79.04	
1939/40	86.31	85.69	85.12	79.83	
1940/41	75.99	94.61	75.80	77.89	
1941/42	66.49	100.34	66.64	71.70	
1942/43	77.96	96.44	78.62	73.67	
1943/44	86.84	98.46	86.73	76.42	
1944/45	82.71	98.28	82.95	79.27	
1945/46	87.54	99.08	86.78	81.48	
1946/47	74.92	99.92	74.15	83.46	
1947/48	81.72	107.63	81.40	87.74	
1948/49	92.81	104.89	92.98	88.82	
1949/50	101.33	106.66	101.11	90.72	
1950/51	100.00	100.00	100.00	100.00	
1951/52	97.97	105.27	100.87	105.21	
1952/53	102.46	108.73	105.95	105.56	
1953/54	104.29	103.77	109.70	106.99	
1954/55	99.62	103.63	107.78	113.84	
1955/56	89.75	107.53	100.32	116.98	
1956/57	100.08	103.14	114.18	119.56	
1957/58	101.63	95.93	117.14	118.42	
1958/59	95.27	98.77	118.87	122.53	
1959/60	95.51	97.39	117.02	126.57	
1960/61	96.92	98.12	118.33	132.02	
1961/62	104.11	91.75	130.45	135.23	
1962/63	101.89	89.95	131.72	137.42	
1963/64	94.59	97.92	126.71	137.43	
1964/65	100.30	99.64	139.60	144.63	
1965/66	101.39	95.63	147.87	146.23	
1966/67	94.1	90.12	143.22	147.50	
1967/68	101.2	86.93	159.9	151.40	
1968/69*	105.7	86.2			
1969/70*	95.0	87.5			

* Prel. figures

Sources and method of calculation: The series are based on chain-index calculations of volumes as well as prices. The weights used as annual links in the index chains are the mean of prices (in volume indexes) or volumes (in price indexes) in the year in question and the following year. The basic data, provided mainly by the Agricultural Research Institute, concern information about 34 farm products and 68 means of production. The price indexes have been deflated with the consumer price index.

The series are as follows:

Column 1: Production index refers to the total volume of production minus the consumption of feed purchases from industry or imported.

Column 2: Producer price index – a chain index for all farm products.

Column 3: Productivity index calculated on the basis of formula (24) in Appendix A, production measured according to 1 being related to all costs except for feed.

Column 4: Factor price index – a chain index for all factor prices except feed prices.

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Agricultural policy is often considered a politically sensitive subject. The entire responsibility for the structural development of this branch of economic activity has been assumed in practice by the political decision makers. The political battle concerning the regulations through which the political authorities try to influence the economic and technical development of agriculture has been intensive. The policies finally adopted are characterized by compromises. Accordingly, the primary object of the debate has been what possibilities there are of guiding a necessary structural change within the framework of a very comprehensive regulation system.

The main emphasis of this book is put on the effects of price policies. The efficiency of Swedish agriculture is related to the prices in the world market. It can also be compared to the efficiency in other European countries. The discussions in the last few years concerning a common Nordic market for agricultural products have brought forward the possibilities of a further integration in the area of agricultural policy. More or less reasonable standards for judging the profitability and socio-economic costs of agriculture are subjects of thorough examination.

In spite of a rapid structural change, productivity and profitability are low in agriculture. The existing structure of firms, which means small land holdings and small numbers of animals for most units, does not permit an even approximately optimal utilization of capital and labor. It is claimed in this book that a far-reaching change of the structure of firms is the most effective means of increasing the productivity of Swedish agriculture.

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