

**ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT**

**DIRECTORATE FOR EDUCATION,
EMPLOYMENT,
LABOUR AND SOCIAL AFFAIRS**

EDUCATION COMMITTEE

RESTRICTED

Paris, drafted : 26-Oct-1994

OLIS : 27-Oct-1994

dist. : 04-Nov-1994

DEELSA/ED/CERI/CD(94)9

Or. Eng.

**GOVERNING BOARD
OF THE CENTRE FOR EDUCATIONAL RESEARCH AND INNOVATION**

INVESTMENT IN EDUCATION AND ECONOMIC GROWTH

MARKETS FOR LEARNING AND EDUCATIONAL SERVICES

**A MICRO EXPLANATION OF THE ROLE OF EDUCATION AND
DEVELOPMENT OF COMPETENCE IN MACROECONOMIC GROWTH**

017123

COMPLETE DOCUMENT AVAILABLE ON OLIS IN ITS ORIGINAL FORMAT

Note by the Secretariat

1. At its meeting in April 1992, the CERI Governing Board agreed to the proposal by the Secretariat [see CERI/CD(92)10] to initiate a study of issues and new approaches in the economics of education. The purpose of this study -- for which a substantial grant was made available to the Secretariat by the Swedish National Agency for Education -- was to examine, from different conceptual and empirical angles, the broad implications of the globalisation of economies and the development of more knowledge-intensive production and work-organisation systems. In particular, the implications for the organisation of educational production and services in Member countries, and for economic policy more generally, have been investigated.

2. Some 30 years ago, before the creation of CERI, the OECD played an instrumental role in developing the theory of human capital and launching the field of the economics of education which, during the 1960s, provided Member governments with a rationale to expand the system offering initial, formal education. Many studies on the economics of education and training have been conducted since the time when the OECD began to systematically explore the contribution of education to economic growth. Today, however, the links between education and the economy have not only become more complex but also, according to *The OECD Jobs Study* (OECD, Paris, June 1994), much more powerful than hitherto. The attached draft report by Professor Gunnar Eliasson explores these links and examines the possible implications for education and economic policies and further research. The study raises many important questions for educational policy in particular, such as the linkages between educational policy, labour market policy, and social insurance policy. An agenda for further research is also offered.

3. In the elaboration of this report, two meetings of education and economic experts were held, the first at the Industrial Institute for Economic and Social Research in Stockholm, and the second at the OECD in Paris. During these meetings the following experts were involved: Professors Gérard Ballot (France), John Bishop (United States), James Coleman (United States), Gunnar Eliasson (Sweden), Lisa Lynch (United States), Frank Stafford (United States) and Eric Wallin (Sweden). Professor Eliasson -- formerly Director of the Industrial Institute for Economic and Social Research, Sweden, and currently Professor of Industrial Economics at The Royal Institute of Technology (KTH), Stockholm -- has been the main author of the present report. The views expressed in this report are those of the author and do not necessarily reflect those of the Organisation or of the national authorities concerned.

4. A seminar to discuss the final draft was organised jointly by CERI and the US National Center on Education and the Economy in Washington, DC on 31st January, 1994. The meeting, attended by a selected group of policy experts from OECD countries as well as by representatives from the White House, the Department of Education, and the Department of Labor, examined the broad findings and conclusions presented in the draft report. The report was subsequently revised, taking into account the suggestions made at the Washington seminar.

5. Although the work in CERI on new developments in the economics of education is concluded with the attached report, this CERI Study offers a number of insights that should be further explored in the context of other OECD studies. The findings will be particularly important for the new CERI study on Life-cycle Alternatives in Education and Work (Study C7), the Education Committee's new and joint work with the ELSA Committee on Financing Lifelong Learning: Capacity, Incentive Structure and Distribution Effects (Activity 2.10), the Education Committee's new work (jointly with the ELSA and Industry Committees) on Flexible Enterprise: Human Resources Implications (Activity 2.8), and the ELSA Committee's work on Welfare in the Third Millennium (Activity 1.10). Moreover, recognising that more work needs to be undertaken in this important area, the Swedish National Agency for Education has offered a substantial grant to a group of Swedish and French researchers to continue their studies along the lines of the research programme presented in this report (see Appendix III). This can be seen as a demonstration of appreciation for the work initiated by CERI in this field. Furthermore, and based upon the results of this further work, the Swedish authorities have expressed an interest in hosting a CERI/OECD international exchange seminar in 1995. This could be an important CERI contribution to the follow-up to the OECD Jobs Study.

6. The Board is invited to:

- COMMENT on the attached report, particularly on how it can contribute to ongoing and new activities mentioned in para. 4 above, and on the relevance of the Research Agenda in Chapter 7 and Appendix III;
- AGREE to recommend that the attached report be submitted to the Employment, Labour and Social Affairs Committee for consideration of the implications for labour market policy and social insurance policy, and to Working Party No. 1 of the Department of Economic Affairs for consideration of the implications for economic policy;
- RECOMMEND that, after taking into account comments from the Governing Board, and any additional comments that may subsequently be received from Member countries, the attached report be derestricted for wider circulation under the responsibility of the Secretary General.

7. The Education Committee is invited to:

- COMMENT on the attached report, particularly on how it can contribute to ongoing and new activities mentioned in para. 4 above, and on the relevance of the policy issues raised in Chapter 6;
- AGREE to recommend that the attached report be submitted to the Employment, Labour and Social Affairs Committee for consideration of the implications for labour market policy and social insurance policy, and to Working Party No. 1 of the Department of Economic Affairs for consideration of the implications for economic policy.

Table of Contents

Executive summary 10

Box: An individual account for education, labour market search and social insurance 16

Chapter 1: THE NATURE, CREATION AND ALLOCATION OF ECONOMICALLY USEFUL KNOWLEDGE -- AN INTRODUCTION 19

1.1 The diversity of human capital and the multiple goals of education 19

 The ability to cope with change 19

 The development of competence depends critically on the individual 20

 Competence development is much more than school 20

 Educational output not well defined 20

 The labour market is a market for competence 21

 The many unexplored possibilities of the educational process 21

 Relevant policy hypotheses 21

 Micro-macro analysis and the dynamics of competence allocation
in economic growth 22

 Interaction of competence rents, economic organisation
and macroeconomic growth 22

Chapter 2: MODELLING COMPETENCE DEVELOPMENT AND ECONOMIC GROWTH -- THE IDENTIFICATION OF ECONOMIC COMPETENCE 23

2.1 Different theories of growth 23

 Neoclassical analysis 24

 The "new" growth theory 26

2.2 Micro-based macro analysis 26

2.3 Learning and the market process in the experimentally organised economy 28

 The experimentally organised economy 28

 The limits to learning 28

2.4 The agents of change 29

 The firm, or the employer 29

The individual in the imperfect markets for competence	30
The necessity of efficient insurance	30
2.5 The content of economically valuable knowledge	30
Competence capital and the organisation of a national economy	30
Heterogeneity and redundancy	31
The general learning problem	32
The recruitment problem	32
2.6 Competence, competition and economic growth	36
Competition causes business failure and local unpredictability	36
Connecting organisational competence back to competition and economic growth	36
2.7 The industrial knowledge base of a nation -- what is to come?	38
Selection mechanisms rule economic growth	38
The importance of universal education	38
The competence base of a nation and the very large business firms	41
2.8 Is radical technological transformation challenging mature industrial nations?	41
Where will technology and markets take us?	42
The educational system deprives simple production of human capital	43
The radical industrial transformation ahead	43
The burden on the individual of more change and higher labour market risks	44
<i>Figure 2.1a Labour productivity distributions over firms -- Swedish manufacturing, 1983 and 1990</i>	<i>33</i>
<i>Figure 2.1b Distributions over firms of rates of return over the market interest rate (the epsilon rents)</i>	<i>34</i>
<i>Figure 2.2 Illiteracy in the industrial and the developing world, 1982 and 1990</i>	<i>40</i>
<i>Table 2.1 The four fundamental investment categories of economic growth</i>	<i>35</i>
<i>Table 2.2 The intellectual structure of the firm</i>	<i>44</i>
<i>Box 2.1 Salter curve analysis of economic growth</i>	<i>33</i>
<i>Box 2.2 Technicalities of market imperfections, competence and technical change</i>	<i>37</i>

Chapter 3: INCENTIVE CONTRACTS, THE ORGANISATION OF THE FIRM, PRODUCTIVITY, AND THE MARKET ALLOCATION OF COMPETENCE	46
3.1 The mismatch problem and incentives to invest in competence	46
3.2 The efficient incentive contract	47
3.3 The firm as an insurance company: the internal insurance market	49
3.4 The firm as an educational (learning) organisation	50
3.5 The recruitment problem	51
3.6 Incentive contracts coping with asymmetric information	51
3.7 Overinvestment or underinvestment in competence accumulation; productive redundancy	52
3.8 Tradability in talent and certification of skills	53
Investments in tradable skills -- a private affair	53
Efficient training requires both competence and incentives	53
Certification and standard contracts conserve the work organisation	54
Does efficient signalling through grades and certification make the labour market more informed?	54
3.9 Receiver competence	55
3.10 Education as a cumulative process	55
The leverage of basic education: receiver competence	56
Labour market reorganisation in support of educational policy -- labour market deregulation	56
The rewards for competence	57
The content of education: the basic competencies	57
3.11 The problem of heterogeneity and underinvestment in equilibrium	58
3.12 The career	58
3.13 Organisational learning and the firm as a learning organisation	59
3.14 The self-employment contract	60
3.15 Main conclusions	61
 Chapter 4: THE PRODUCTION OF EDUCATIONAL SERVICES	 62
4.1 Does general education matter?	62
4.2 The selection issue: talent vs. education	64

4.3 The school and the job	65
Educational attainment and job performance	65
Education as filter	66
4.4 Productivity and income effects of schooling	67
Step I: Effects of school organisation on scholastic achievement	67
Step II: How does income depend on scholastic achievement?	67
Step III: What are the relationships between education and productivity?	69
Step IV: What is the relationship between formal education and the capacity to develop new competencies (to learn)?	70
4.5 Educational levels and recruitment practices	70
4.6 Is it possible to pre-sort according to competence characteristics?	71
Using tests for sorting	71
How are private and public gains affected by pre-sorting?	72
Concluding words on selection	73
4.7 Social capital and high school performance	73
Main reasons for poor school performance	73
Parental apathy	74
Family environment and length of schooling	74
Ethnic environment	75
Attitudes, student motivation, and the importance of high-quality parental inputs	76
4.8 Motivation and willingness to pay for education	77
Willingness to pay at different levels	77
Risks and limited financing	78
Does the individual or the government know best? Different theories, different assumptions and different policies	79
4.9 Educational production functions	80
4.10 Organisation and productivity	82
4.11 On-the-job competence development	83
4.12 Higher education	84
Is more higher education good for the economy?	84
Increasing returns to higher education	85
Chapter 5: ON-THE-JOB TRAINING, SELECTION AND THE LABOUR MARKET	86
5.1 Is manufacturing losing its competence base in once-advanced industrial nations?	86

5.2 Vocational training and labour market retraining	87
Four different labour training models	88
Firm insurance and internal education	89
Consequences of internal competence development	90
Human capital theory and imperfect labour markets	90
United States experience of education and labour market training	95
Experiences from Swedish labour market policy	96
Mobility in Sweden	96
Labour market training in Sweden	97
Small scale preferable	98
5.3 The problem of the disadvantaged	98
The disadvantaged need help very early	98
Selection effects and the two markets for labour training	99
5.4 Summing up on labour market policy	101
<i>Box 5.1 How change in labour market theory changes our understanding of education, the labour market and the firm</i>	92
<i>Table 5.1 Distribution of labour according to quality in the United States and Sweden</i>	103
<i>Table 5.2 The old Swedish policy model</i>	103
Chapter 6: WHAT CAN BE DONE? IS THERE STILL A POLICY ROLE FOR GOVERNMENT? ...	104
6.1 The economic welfare of a nation: labour market ability and insurance	105
6.2 The nature of human capital: a matter of tradability	106
6.3 Educational product specification	107
The standard-package student	107
Individual risk aversion causes educational myopia	108
Can policy play a role in supporting long-term decisions?	108
Social capital	108
The school agenda and human capital: are there basic competencies for all?	109
Competition improves product quality in business firms -- why not in school?	110
6.4 Incentives	110
Underinvestment in education is a matter of educational output	110
A different organisation of educational production may produce more competence	111
Wage-setting and the rents from educational investments	111

6.5 Educational production efficiency	111
Improving school as a path to the labour market	112
The efficient mix of public and private education	112
Paying for school	113
Financing school	113
Running school	113
Regulating school	114
Making schools innovative	114
6.6 Distributional considerations	115
6.7 The organisation of the labour market and the social insurance system	116
<i>Table 6.1 The educational policy map</i>	117
Chapter 7: WHAT DO WE NEED TO KNOW? THE RESEARCH AGENDA	118
7.1 A suggested research agenda: micro studies	119
A. Specifying the educational product	120
B. Incentives	121
C. The organisation and efficiency of educational production	122
7.2 Summarising the research agenda	123
Appendix I: Infrastructure knowledge capital confers economies of scale to other factors of production	125
Appendix II: Connecting organisational competence with total factor productivity growth	127
Appendix III: The research programme in detail	131
Bibliography	136
Subject index	155

Executive Summary

The industrial world is currently facing a radical transformation of its dominant production technology. Much of its manufacturing knowledge base is rapidly becoming economically obsolete. As workers and managers in the newly emerging market economies, not least in Eastern Europe, are learning to make the same things better and much more cheaply, it is becoming increasingly difficult for workers in the West to produce sufficiently high value-added information, goods and services, expressed in international currency, to cover their high wages. The changes occurring in the competitive circumstances of mature, industrialised countries are more fundamental than before, involving not only the relative performance among industrialised economies but also a rapidly growing part of the outside world. Large and small companies are responding by internationalising and seeking to gain economies of scale in international marketing, by focusing on product development and by outcontracting production. Some industrial economies are doing better than others in building new, high value-added production in smaller scale competence-intensive firms, notably the United States. With open international financial markets, investment capital is now moving much faster and in larger relative volumes into economies that are offering good opportunities for high returns and out of economies that are failing. The consequences of this transformation of industrial structures and intensified global competition are necessarily spilling over into the labour market. *The most important attractor for investment is a competent, diligent, flexible and not overpriced workforce.*

New technologies to replace the old industrial base and to sustain economic growth and employment at high wages are not being introduced fast enough. Because they require a different economic and social organisation and different, high-level competencies among workers, a massive reallocation and retraining of labour will be needed in order to restore rapid growth. This means that the manufacturing technology basis for high and growing relative wages for low-skilled labour, established some 150 years ago with the introduction of the large-scale factory, has disappeared. Since about the mid-1970s, the trend in industrialised countries has been towards relatively lower wages for unskilled workers, and evidence concerning the new technologies suggests that it will continue. The development of competence will therefore become even more important, and the economic and political stakes will rise accordingly.

The slow adjustment currently taking place in imperfect and regulated labour markets does not yet fully reflect this change in supply and demand for labour. Underpaid competent labour and overpaid low-skill labour are slowing the development and growth of competence, and causing increased and sustained unemployment among workers whose skills were shaped on the old knowledge base. On the other hand, large rents accrue to the few who have developed the needed competencies. International income distribution is now driven by very strong economic and technological forces that cannot be more than temporarily modified by policy or regulation. Income distribution is changing as high value-added production shifts away from raw materials, basic industries and large-scale factory organisation with low-skill production, towards small-scale, higher competence production, notably in the intersection of manufacturing and the private service sector. Raw material rents were fairly easy to redistribute through policy, but the same is not true for rents created by competence capital in small-scale production.

The emerging small scale, competence-intensive production where work efforts and compensation can be more easily and strongly linked in small firms, is not only stimulating self-employment and new firm creation but is also making the labour market more efficient in the sense of forcing the distribution of incomes closer to the distribution of productivities. Furthermore, small-scale production is more exposed to international competition than it was when integrated in the large-firm organisation. This means that the individual workers will be more exposed to the vagaries of international competition and will find themselves much more frequently than before in the state of unemployment. The increased exposure of individuals to competition will be putting heavy demands on both the competence of the individual and the capacity of the institutions of the labour market to help people get back to work. *Secondary trading in human capital will have to be made much more efficient*, and it will be a social and political concern to remove regulations and institutions that hinder the unavoidable turnover of labour to make the labour market emerge as an *efficient market for competence*, that both stimulates the individuals to develop their competence and allocates the existing competence base to its most efficient uses. Such policies are untraditional among mature industrial nations, notably in Europe.

As they, rather, attempt to avoid letting market forces perform the necessary reallocation of labour and/or wage adjustment to clear the labour market and to reduce unemployment, politicians are looking to education to solve the policy dilemma by upgrading competencies in the labour force. This new and unconventional type of policy has not been well researched, either theoretically or empirically, by economists. This study addresses the economic and social potential of educational policies aimed at saving the mature industrial economies from the spectre of jobless growth.

Education cannot, however, accomplish this alone. One reality of economic life is that competence development requires a well-functioning labour market where skills are effectively allocated and adequately remunerated. *Badly functioning labour markets*, typical of Europe, *will make the best educational system ineffective*. Individuals, furthermore, are notoriously myopic and risk-averse. This requires innovative developments in *social insurance markets* to make individuals overcome risk aversion, take on private educational investments, and to move -- the kind of developments that the current regulated and monopolised social insurance systems of governments will not be capable of promoting. Policies directed towards *competence development*, the *functioning of the labour market*, and the *organisation of the social insurance system* thus have to be enacted simultaneously to take the mature industrial economies, with a minimum of social hardship, beyond their current encounter with new competition in their home markets. Formulating these policies will require new policy competence which does not yet exist either in the policy or the academic community. Even more difficult to cope with is the fact that the needed policies will force change on the institutions controlling income distribution in which strong vested interests will resist change.

Competence is a scarce factor of production and the ultimate arbiter of the allocation of all resources in an economy. The production potential of an economy depends on its capacity to take decisions down into the places where the best competence to make decisions resides. The labour market and its institutions play a key role in that process.

The policy programme will not depend on conventional means and objectives. Evidence on the economics of institutions and dynamic economic systems analysis shows that policy cannot control the economic system as effectively as politicians sometimes appear to desire. Therefore, only reduced ambitions focussing on control of detailed outcomes will make successful policies possible, and policy will have to rely much more than before on reformed market institutions, that create the right incentives for

individuals and firms, that stimulate innovation and competition, and enhance the disciplining forces of markets. A market in acute need of such institutional reforms for enhanced performance is the labour market or, rather, *the market for competence*.

While competence capital advances economic growth, it will not be developed or efficiently allocated without a proper, market-based *incentive system*. Without a functioning labour market the benefits of improved education will not accrue either to the individual or to the economy.

The overall educational system has to be organised not only to produce the desired educational services but also to constantly improve them. This must be done even though there is no reliable way to specify the product prior to its use. It has to be left to the market (the customers of schools and the users of educational services) to determine the appropriate specification of the product. Without innovative product development, educational production will fail in meeting the mounting challenges ahead of mature economies, which are forced to radically restructure their competence bases. Only a sophisticated and pluralistic market for educational services open to experiments and new ideas, but above all based on the initiatives, efforts and responsibilities of individuals, will be up to that challenge. This notion is overwhelmingly supported by empirical evidence and is central to the arguments advanced here.

At least ten possible policy implications for further discussion can be derived from the conceptual and empirical analysis presented in the main body of this report:

First, educational policies will not work unless they are supported by the economic *incentives* that make it worthwhile *for individuals to invest in their own development of competence*. This means that the performance of the labour market and the social insurance system has to be improved to support educational reform. This is difficult, since it requires co-ordinating different political authorities, and overcoming vested interests with radically different views.

Second, educational policy has to rely *much* more on student effort and interest and *much* less on public money.

Third, the financing of education has to be shifted away from the educational institutions (the suppliers) to the individuals (the users) and the market. Financing incentives and control should remain with the individual through his working life, to inhibit moral hazard and minimise the underinvestment problem. An illustration of how this can be done is given in the box below. It is *not* advisable to vest almost all responsibility for the individual's education with public authorities, schools or employers.

Fourth, the length of time required to develop basic competencies means that strong incentives are needed to stimulate primary and secondary school students to build the basis for profitable continued education, since the monetary rewards of their investment are far off. *Education is cumulative throughout working life*, and the leverage on later competence development of early education is very large. It is thus extremely difficult to correct later a poor start. To achieve a good early start in education, a very strong tilting of *compensation* schedules in favour of *competence* has to be allowed and stimulated through adequate deregulation of the labour market to achieve *competitive* pressure to perform.

Fifth, in the future no individual can count on holding the same job and relying on the same competence for a lifetime. People will increasingly find themselves in the market looking for a new job, which will require new and updated competence and experience. Even though the competencies required

of newly hired workers are steadily increasing, no unreasonable demands will be put on workers on the job as long as they have acquired a *minimum of communication skills* at school. The acquisition of these minimum skills at school is difficult, but even here demands are reasonable for the not so talented students. Both labour markets and schools should be organised to serve all people. The increased demand for basic communication skills is, however, not well supplied by primary and secondary schools in industrial countries. Above all, an increasing number of students are graduating from high school without having acquired that minimum standard of communication skills required at recruitment and necessary for continued competence development on the job, thus forcing employers to supply supplementary education or, which is more common, not to employ them or to fire them. Thus, to prepare students for the conditions they will encounter in the labour market, primary and especially secondary education should be much more focused, and much more demanding on the student, perhaps covering a larger part of the scholastic year.

Sixth, the demands on competencies at recruitment are small compared to the demands placed on the individuals who have lost their job. If the basic competencies have not been constantly maintained and upgraded at work on their own initiative, the 35-year old workers in the market will face an almost impossible retraining problem. Therefore, compensation schemes in the labour market should be set up to facilitate frequent job changes and to stimulate and make obligatory individual development. Strong financial incentives and increasing risks of losing one's job or having to accept lower pay would seem to be the most effective way of ensuring that the necessary continuous training be followed. Or, put more positively, the labour market should be organised to effectively compensate those who actively pursue continuous education. It is not in the interest of society to allow collusive forces in the labour market to discourage that process. This is essentially a call for deregulation of the labour market -- for instance, by making jobs less secure for insiders and more accessible for outsiders, the young and the unemployed.

Seventh, other imperfections of the labour market would also have to be eliminated, notably restrictions on mobility and wage rigidities imposed by central bargaining agreements, so that individuals can more easily search out their comparative advantages and so that significant competence-based wage differentials be established.

Eighth, public support of formal schooling is already so large in OECD nations that improved school organisation and output, which might produce better education at lower cost, must be sought. This cannot be achieved unless new educational solutions are developed through market experimentation and selection.

Ninth, the institutions that provide the incentives for individuals to educate themselves and to seek jobs that suit them and that contribute maximum value to the economy at large must be appropriately organised. Paradoxically, perhaps, an improved incentive system requires significantly increased *freedom of contractual arrangements* in the market for educational services, the labour market, and the social insurance market than is currently available in most industrialised countries.

Tenth, there seems to be no clear economic case for *underinvestment* in education. It can be argued that underinvestment is not a matter of resource inputs in education but of the *quality and value of educational output*. Therefore, if educational service production and the labour market process are improved, the most credible economic case for underinvestment vanishes, leaving a *social* problem of underinvestment for that part of the population and workforce which has not been able to benefit from educational investment. This problem, which is social, has to be attended to very early at school, preferably

before. The *social capital* that students bring with them from the family appears to be important in this respect and related to school performance.

On the other hand, evidence is mounting of some *overinvestment*. For instance, a case can be established to demonstrate that by increasing subsidised higher education this may be performing a negative service to the economy, through filtering talented young people out of manufacturing production jobs into other types of production where their abilities are not appropriate and/or where industrial technological and management competence is not sufficient to use their competence efficiently, thus lowering overall productivity. Public subsidising of higher education should therefore be carefully analysed to minimise such negative allocation effects, and oblige students to take more personal responsibility for their job market and educational investment decisions.

The policy implications here are presented in the context of institutional change aimed at activating students, workers and employers through appropriately formulated incentives. It is argued that many significant decisions and a proportion of public resources should be removed from central authorities so that individuals take responsibility for their own development of competence, their labour market contracts and their social insurance arrangements. This requires deregulation and decentralisation in all three domains. There is no empirical support for elaborate policy instruments based on detailed quantitative forecasts and aimed at correcting foreseen and politically undesirable outcomes. There is no scientific basis for such precise and elaborate policy ambitions. There is, however, strong evidence to suggest that if reforms aimed at conducting policy through the institutions of more efficient markets are not enacted, the mature industrialised economies will not be capable of reorganising themselves for the new demands of technology and competition beyond the year 2000. This will mean that individuals and firms will be increasingly subjected to the arbitrary outcomes of dynamic market processes. For firms these are the rules of the game. For individuals this is not socially and politically acceptable. Hence, it is critical for the success of the policy model outlined here that the *social insurance system* of countries functions effectively in covering growing labour market risks and in being credible to individuals now increasingly at risk. This requires radical product innovation in the social insurance market, something which is difficult to achieve in countries where a dominant part of the social insurance system is operated as a public monopoly.

The overall policy implication that can therefore be drawn is that policy has to be formulated so that the problem of education, the labour market and social insurance is addressed and solved in one coherent context and in such a manner that the importance of individual effort and incentive is recognised. An example of how this can be done is found in the box below.

However, lack of sufficient information in these three policy areas makes it difficult today to formulate precise policies to ensure fewer labour market risks for the individual. Therefore, the following issues would have to be further analysed and clarified:

- identification of the *basic competencies* or minimum communication skills that will prepare students for the job market;
- clarification of the interdependence of *educational* and *labour market* performance;
- distinction between the relative importance of education as a *sorting (filter)* device and as an *investment* in human capital.

The proposed research agenda in Chapter 7 focuses on these three principal questions. They must be studied carefully and answered if decisive and rapid action is to be taken towards solving the unemployment and emerging distributional problems of mature industrialised countries.

Box: An individual account for education, labour market search and social insurance

The ability of mature industrialised economies to counter radically increased competition in their traditional production technologies rests on their capacity to shift their production to a new, high value-added technology base. To successfully meet that challenge, excellence in three areas is needed:

- i) **education** to upgrade the competence level of the workforce;
- ii) **labour market performance** to stimulate competence development and to allocate competence;
- iii) **social insurance**, to reduce the negative allocational consequences of risk-averse individuals.

This three-dimensional challenge is a key concern for the individual, who will suffer the adjustment consequences directly. If individuals resist these consequences politically, the entire restructuring of economies are at peril. The policy maker is unable to control the individual outcomes of the restructuring process, and badly-undermined public finances in most mature industrial economies can no longer afford, as before, to generously compensate individuals affected by arbitrary market outcomes. Therefore, the social insurance system will have to be designed to put the individual much more than before in control of his or her own economic and financial destiny.

The actor most competent to take action on behalf of the individual is the individual himself. The reform necessary to put the stagnating mature industrial economy back on a growth path therefore has to incorporate, as a key feature, new institutions allowing individuals to take significantly increased economic responsibility for their own welfare, and to remove the same responsibilities from government. The idea of making the individual responsible for his or her own welfare is not new. It had already been brought up by Wicksell (1905) at a time when the welfare state did not even exist, only the idea. The problem became more of an issue when the welfare-tax state emerged, increasingly depriving the individual and the family of the financial capacity to care economically for their own future. Tax-shelter arrangements or private investment accounts for retirement and education had been suggested by Eliasson (1976b) and Rehn (1983). Later, this concern became more ominous as the tax state not only deprived the family of its resources but also began to suffer from a diminishing capacity to provide the essential services of education, training and social insurance to its citizens. The reason for this lack of capacity of the public sector is not only due to deteriorating public finances but also to deficient incentives associated with publicly financed education, labour market training and social insurance, and the corresponding absence of individual engagement. The recent Swedish committee on vocational training, charged with the task of giving the programme a corporate status and preparing for its privatisation (Eliasson, 1992d, and *Ett hav av möjligheter*, 1992¹) observed that social insurance related to unemployment, education retraining, and retirement is, in large measure, a form of redistributing income over an individual's life cycle through many public tax and subsidy accounts. As such they are full of

(continued)

1. *A Sea of Opportunities*, Swedish Government official publications. SOU, Stockholm, 1992:123.

moral hazard problems, and ineffective from an incentive point of view. To remedy this situation, an individual investment account for education, continuous retraining, and retirement was designed (see Eliasson, 1992d) and then proposed by the committee. A similar idea was put forward by Fölster, Barkman, Meyerson and Pyddok (1993). The argument is for only a minimal provision of educational, insurance and retirement services to be covered by the public budget, and to be financed through taxes (to prevent moral hazard, this minimal public coverage will have to be significantly lower than is currently provided by the public budget in western welfare economies). The rest, part of it being mandatory, would be financed privately, by allowing the individual to set aside, before tax, part of his earnings in an individual investment-education account. Deductibility essentially means that the corresponding tax money is moved to the individual investment account. Providing this would be very simple: only deductibility and well-defined limitations on drawing rights are required. The arrangement is similar to profit carrying-forward rights for firms. It works as a private retirement scheme where retirement wealth can be used prematurely for certain investments, such as education.

At birth the individual will have a limited credit line to draw on for education. During his working life, part of the money paid in goes on charges for health and unemployment insurance. The capital can be drawn on at any time for educational investments and to cover various insurance premiums (unemployment, accident, health, etc.). There could be a complementary government subsidy, and the employee could also negotiate a similar benefit in his or her employment contract. To limit moral hazard, educational investment, for instance, would only be covered up to a pre-set limit. Capital remaining at retirement age would furthermore *all* be available for pension benefits, a provision that would prevent the individual from excessive use of the system, thus minimising the need for government control. To encourage the individual to be concerned about capital growth on this private investment account, he or she should be allowed significant influence on its management; whether to have it privately done or through a public account, etc. There should be no restrictions to domestic investments. Rather, the contrary: if government policies run counter to the long-term welfare arrangements of account holders, individuals *should* exercise a disciplinary influence on government through their portfolio decisions. A design of this type was proposed by the Swedish Committee for vocational training (see *Ett hav av möjligheter*, p. 123). This proposal, and the preparatory analysis (see Eliasson, 1992d), included two specific features to make the investment account arrangement economically effective and, at the same time, acceptable from an income distribution point of view.

The committee *first* concluded that to stimulate the individual effort and motivation needed for successful training, an effective *incentive system* had to be designed. Access to accounts, furthermore, would have to be largely at the discretion of the individual, who would make them available for financing of retraining before he or she became unemployed, and without requiring authorisation from any central labour market bureaucracy. Since the individual pays part of the costs by drawing on his or her private retirement wealth, moral hazard can be minimised. He or she should also decide when and where to receive training. The individual then has a strong incentive to choose the training that makes him or her more competent, and therefore more productive and capable of earning a higher income. He should also be more competent than the bureaucracy to make that choice, but he can always ask for advice if necessary. Hence, there should on average be neither private nor social costs associated with the programme (Eliasson, 1992d). Both productivity and income of the individual would increase from profitable, educational investments, and the retirement fund would catch up or become larger than if he stayed unemployed.

(continued)

Second, the committee argued that in this way, the problems of the disadvantaged and of stigma effects could be solved more efficiently and reasonably than in the current system. This would be accomplished by allowing and stimulating the various vocational training units to compete with one another through innovative product development. Since some of these agencies have already been successful in attracting private, unsubsidised customers, the costs and techniques for successful training have been developed. These programmes tend to be staffed by the best teachers and are also high-cost operations, but firms are usually willing to cover the higher costs. It may be the case, argues the committee, that successfully training the disadvantaged would be even more costly and require very good teachers. This, of course, also has to be recognised by politicians if they want to help the disadvantaged. Paying a market rate for professional training of the disadvantaged would attract the best training institutions and solve the problems of the disadvantaged as well as is professionally possible. Since the disadvantaged would now be involved in a market-based private training scheme, the stigma effects would also be minimised.²

2. The argument on training the disadvantaged is spelled out in Eliasson (1992e).

Chapter 1

The Nature, Creation and Allocation of Economically Useful Knowledge -- An Introduction

1. Humanity's most outstanding quality is diversity. Human qualities are acquired through upbringing, school, experience and work. They make innovative behaviour possible and create skills that command rents in the labour market. When human beings come together they form firms (Eliasson, 1990b). Firms generate even larger rents by combining individual qualities innovatively. Yet it will always be difficult to identify precisely how human competence contributes to economic growth and to individual economic welfare.

1.1 The diversity of human capital and the multiple goals of education

2. This study assumes that *human capital is the key to the economic wealth of industrial nations*. It seeks to *identify the economically valuable competencies that contribute to economic growth* and foster human beings capable of taking economic responsibility for their own future, to define as precisely as possible the "educational" process that builds that competence, and to identify how policy can influence this process. Education policy also has objectives other than economic growth and individual economic welfare, such as *forming socially responsible citizens* and supporting *individual fulfilment*. Economic goals in fact often conflict with other objectives of schooling. In some countries, the agenda for primary and secondary education is so fragmented and overburdened with conflicting objectives that it is hardly compatible with the efficient accumulation of economically useful competencies.

The ability to cope with change

3. Because the total value of the competence of an individual, a firm or an economy depends on how it is allocated, and since the combinations are almost limitless, educational outcomes cannot be assessed without taking into account the allocative performance of the labour market. A badly functioning labour market will make the best educational system ineffective. Education and labour market policies have therefore to be studied together, and labour market institutions are critical to the success of both educational and labour market policies. With extreme heterogeneity and an imperfect labour market process, the economy will always operate well below capacity and will be constantly subjected to unexpected changes due to competition, innovation and improved allocation. Unpredictability is a significant characteristic of what will be here called the *experimentally organised economy*.

4. The organisation of the economic system will also determine which competencies contribute to individual and societal welfare at all levels. These competencies concern, in part, the ability of individuals

and firms to cope with unexpected changes in their local economic environment -- a reaction which has great importance for economic growth. In designing a market environment that efficiently facilitates the changes necessary to accommodate the growth processes of an economy, it is important to provide insurance services to cover the hazards of the labour market.

The development of competence depends critically on the individual

5. The creation and allocation of competence takes place at the level of the individual and cannot easily be measured at higher levels of aggregation. Hence, the study of embodied competence, including competence in the new technologies that figure in economic growth, must concern not only how it is created but also how dynamic the links with the organisation of the firm and with markets. To identify the policy parameters that can be reset to influence growth and employment -- *the educational process*, broadly defined -- it is necessary to examine together the institutions of the labour market and the *organisation of the social insurance* system.

6. The educational process that builds the competence capital which contributes to a change in total factor productivity (see Appendix II) at the macroeconomic level includes the efficient allocation of competence. This allocation depends critically on the institutions of the labour market, and a willingness -- heavily influenced by the conditions of the social insurance system -- of individuals to participate in this allocation process.

Competence development is much more than school

7. The private sector of the advanced industrial economies has long been engaged in education, using resources similar to those of the regular schooling system. It has recognised that the *efficiency of production depends on its organisation, and the same is true of education*. Organisation, and the design of incentives to perform, matter enormously for education output when arranged privately in conjunction with production. Altogether, education, broadly defined, engages considerable resources: in Sweden, public and private education engaged at least 21 per cent of GNP in 1991, including the opportunity cost of lost output (Kazamaki Ottersten, 1994a) or about as much as the value-added in manufacturing (NA code 3000). To warrant such resource use, the investment must be very good, and yet, as currently organised, it probably is not. The issue in the industrialised world should not be to allocate more resources but to radically change the educational product and reorganise its production.

Educational output not well defined

8. In addressing educational production insofar as it contributes to economic growth, this study assumes the necessity for discussing the efficiency of education before examining the resources needed to achieve certain results. The appropriate composition of the educational product is, in fact, unclear. Even firms that carry on significant internal educational activities experiment extensively in order to improve a product that is difficult to define analytically and can only be evaluated through observation. Western societies in fact spend very large resources on public education without any clear definition of the specific product sought. It is therefore important to assess the *product* and the *incentives to acquire it*, and to employ efficiency in producing it.

The labour market is a market for competence

9. The efficiency of the labour market in assessing and pricing competence is the core of the incentive system that stimulates development of competence capital and economic growth (Eliasson, 1992a, 1993b, 1993c). Chapter 2 examines, in theoretical terms, why *education*, in both a narrow and a broad sense, is important for economic growth and what the specifications of the desired educational product are. The bulk of the chapter is devoted to establishing the fact that constant organisational (structural) change is part and parcel of economic growth and that economic competence has to be defined as the capacity of firms and individuals both to initiate growth promoting change and to cope with such, largely unpredictable, change. Chapter 3 discusses how the markets for competence are organised, how competence development is stimulated, how the firm is organised to build and use knowledge, and whether there is a case for underinvestment. Chapter 4 presents what is known about the *efficiency* of educational investments and educational production, while Chapter 5 identifies the policy problem, the role and efficiency of *the labour market and the social insurance system* in making educational policy effective. Chapter 6, concerned with welfare and policy options, examines what government can do, whether there are well-defined parameters, and what knowledge is required to achieve political goals. Chapter 7 offers the research agenda needed for learning how to improve the design of the school organisation.

The many unexplored possibilities of the educational process

10. Education occurs in the family, at school and at work, and the existing organisation is never the best. To understand the importance of education for economic growth, *alternative organisations* must be assessed. Such assessments can only be performed through experiments or international comparison. It is also important to study as well continuing education and retraining in the workplace.

11. When the Industrial Institute for Economic and Social Research (IUI) in Stockholm was planning interviews on educational services in firms and schools, it was assumed necessary to interview a large number of firms to capture the variety of approaches. For schools, a few interviews were deemed sufficient. The implications were clear. The highly regulated primary and secondary school systems of Western industrial nations left schools, students and parents few choices; they not only create uninformed and passive "customers", but they also cannot learn from each other as competing firms do in the market. Such an organisation of production is not innovative. Understanding educational production is both important and difficult and requires an understanding of the economics of the family and of the firm.

Relevant policy hypotheses

12. The goal of this study is to merge existing evidence on education and economic growth in order to provide an encompassing hypothesis to policymakers. The hypothesis will not be fully verifiable, but it has a strong empirical foundation, is internally consistent and is based on reasonable conjectures. It will not only suggest what policymakers can do, but also outline the risks for and of policy failure.

13. Policymaking requires holistic understanding, but it is difficult, theoretically, to link education, broadly defined, to economic growth. Only simplistic versions of such economic theory exist, but they can serve as a consistent accounting framework for analysis and as a means to merging the fragments of available partial knowledge into a whole. The aim is to organise fragmentary knowledge with respect to

broad policy decisions concerning the accumulation of competence, in order to enhance private and societal economic welfare and to make generally implicit decision-making processes more explicit.

Micro-macro analysis and the dynamics of competence allocation in economic growth

14. First, the knowledge capital that drives economic growth will be very broadly defined. Competence embodied in individuals, in teams, in the organisation of firms, markets and the entire economic system will have to be considered. How competence is allocated over the production system matters enormously, not only for the capacity of the economy to perform but also for the rent the individual captures in the labour market. An important part of the competence of a team, a firm or the entire economy, however, depends on the organisation that integrates the human beings of that team, firm or economy. Hence, the institutions that influence the (labour market) allocation process and the incentives that guide the allocation of people become a very important part of the total competence capital of an economy.

15. Second, once the *incentive* problem and the imperfections of markets for competence are accepted, analysis at the micro level shows that the dynamics of agent behaviour and of markets matter for the macro level. More specifically, the efficiency of markets and firms includes their *capacity to take decisions to where the appropriate competence resides*. Do alternative organisations of markets and firms achieve better results?

Interaction of competence rents, economic organisation and macroeconomic growth

16. Firms and individuals use *innovative* competence to *create* private rents, *learning* (receiver) competence to *capture* rents, and *adaptive competence to cope with change* and avoid losing rents. New innovative rents lower the value of old rents, limiting the accumulation of wealth in firms and with individuals while providing, nevertheless, a steady improvement in productivity. Hence, the educational process, competence rents and productivity growth depend initially on one another (see Appendix II). The institutions and the organisation of markets determine incentives and the intensity of competition and thus the balance between the rate of growth, the rate of structural change and the distribution of total product. In fact, change is the keyword in a growing experimentally-organised economy. The economic system itself must be capable of embodying certain characteristics related to accumulating competence (education) and to coping with change (social insurance). Sometimes market institutions are capable of providing educational and insurance services, sometimes not. In the latter case, government has a policy role to play. A main argument advanced in this study is that the choice to demonstrate new, innovative solutions in the market should be open to everybody and not limited to one government monopoly.

Chapter 2

Modelling Competence Development and Economic Growth -- The Identification of Economic Competence

17. The importance of knowledge to economic wealth has been discussed for centuries. To connect education with growth, and to define what kind of, and how knowledge contributes to, growth -- the purpose of this chapter -- requires appropriately formulated growth theory. A useful theory of economic growth will have to recognise explicitly the extreme heterogeneity of human competence, the imperfection of markets, and the role of educational processes. Macro theory cannot handle such categories and, hence, frequently leads to misunderstanding and bad policy decisions. It has to be replaced by micro- or organisation-based macro theory. Part of this chapter and later chapters attempt to show how a micro-based macro model can be used to evaluate the macroeconomic consequences of organisational change.

2.1 Different theories of growth

18. Most early economic treatises, even prior³ to *The Wealth of Nations* (Smith, 1776), understood the importance of knowledge, competence and skills, and economists remained acutely aware of the importance of education for production at least until the mid-19th century, when interest in the topic disappeared (Abramovitz, 1988). The reasons should be sought in the nature of knowledge, which is the most complex and heterogeneous of all capital items (Ysander, 1978b). It is not only difficult to measure, it is difficult to represent analytically in the kind of mathematical models that began to appear with the marginalist revolution. It is vested in human beings and acquired through the educational process (broadly defined). It applies differently, depending upon the use. It is embodied in its carrier, and it does not depreciate with use as ordinary capital does.⁴ The easiest way to deal with it was to disregard it.

3. Westerman (1768) represents a surprisingly modern understanding of the importance of organisation and human knowledge for efficient production.

4. Neoclassical literature rarely recognises depreciation of knowledge capital (e.g. von Weizsäcker, 1986; Romer, 1986). Changes in the value of knowledge capital are, rather, thought of as caused by relative price change (Griliches, 1988). This, however, requires different theory. First of all, theory has to be refined, and categories for which prices can be defined must be identified, which is almost impossible for knowledge capital and furthermore does not allow highly aggregate analysis, typical of neoclassical theory. Second, the selective use of various knowledge categories, including entry of new knowledge and exit of obsolescent knowledge, has to be made explicit, again almost impossible for this type of extremely heterogeneous capital (Ysander, 1978b).

Neoclassical analysis

19. While early Keynesian production analyses made output growth entirely dependent on investment, neoclassical production function analysis makes it dependent only on relative prices, including capital user costs.⁵ Extending the concept of investment does not change this, unless knowledge capital is superimposed on all other factors of production as an organising device.

20. As macroeconomic developments of postwar Western economies surpassed former benchmarks, the Ricardian-Marxian notion of a production system fed by machines, manual labour hours, and possibly land, no longer sufficed to explain the observed rapid productivity growth. Many researchers (Solow, 1957 and 1959; Denison, 1967; Jorgenson and Griliches, 1967) began to look for *quality* factor inputs to explain productivity growth. In fact, one of the pioneers in this field, introducing also knowledge capital in production analysis, was Svennilsson, the director of the IUI in Stockholm, who also conducted a study on the economics of education for the OECD (Svennilsson, 1964). All these studies, however, stayed within the equilibrium framework of neoclassical economics, notably that by Jorgenson and Griliches (1967), who designed a sophisticated method of correcting factor inputs individually for quality, using the implicit price structure of an equilibrium system. In doing so, they essentially removed the residual unexplained technical or productivity factor.

21. It can be demonstrated (see Eliasson 1987a, pp. 90ff, and 1992b; Appendix II) that factor inputs that are unaccounted for, or not paid the equilibrium price, will nevertheless contribute to the market value of production, and thus to a residual value to the owner of capital. Since this residual profit is created by unmeasured factor inputs, or by factor inputs that are measured but not properly paid, it will also appear as an unexplained residual growth factor in macro-production function analysis. If factor inputs are corrected for measurement errors in price statistics, the corresponding unexplained production factor is removed. Jorgenson and Griliches (1967) attempted to do just that.

22. Jorgenson (1984), Jorgenson and Fraumeni (1989, 1990, 1993), and others have recently used the same method to demonstrate the importance of education to macroeconomic growth. They find that education does matter economically very much, since salary differentials -- whether the result of education, inherent talent, or market imperfections -- account for a great part of total factor productivity growth. They find too that the decline in relative compensation for education in the mid-1970s, and the later strong increase (Blackburn, Bloom and Freeman, 1990), also largely explain the curious disappearance of total factor productivity growth in the 1970s and its return in the 1980s. The method guarantees these results, and although they are plausible, they require further research before drawing firm conclusions for educational policy. On the optimal allocation of educational resources, Psacharopoulos (1985, 1991) adds that for underdeveloped countries in particular, educational resources should be allocated to primary rather than higher education so as to upgrade the average level of education. The marginal output contribution of labour input would increase significantly.

23. These results point to important policy problems pertaining to the economics of education that this present study has to recognise. In a 1993 paper, using the method described above, Jorgenson in fact produced even more challenging results on policy. He observed that educational investment is not properly measured in the national accounts, that most education is produced in the non-market sector under monopolistic conditions and is grossly underestimated, and that education analysis tends to miss the crucial

5. This is true for so-called disembodied technical change, not always for the vintage production function.

time-dimension between the outlays for education and the emergence of human capital embodied in individuals. Jorgenson is also highly critical of the standard macroeconomic assumption of homogeneous capital and labour inputs (e.g. in Solow, 1988). He breaks both physical and human capital down into many categories and estimates substitution effects between different capital items. He concludes that when properly measured, including opportunity costs in the labour market, educational investments dwarf those in tangible capital and are considerably greater than the economic value of time spent at work. Then, taking different categories of human capital into account, Jorgenson sets up two education scenarios, one *elitist* and one *populist*.

24. The elitist approach, which increases expenditure and maintains student enrolment, generates a large welfare (output) loss. The populist scenario, on the other hand, which increases enrolment at unchanged expenditure and accepts lowered educational quality, generates an increase in output much larger in absolute terms than the loss in the alternative scenario. These results depend directly on the fact that the increase in compensation is higher between high school and college than it is between college and a graduate degree. The results are intriguing, relevant to the ongoing educational debate, and plausible. However, care must be taken in drawing policy conclusions, as the policy implications hinge critically on the indirect methods of measuring educational expenditures and quality used, and the assumptions about pricing in the labour market.

25. If Jorgenson's method is applied to Sweden -- a country with more compressed wage differences than the United States and long-lasting, large divergences between marginal productivity and compensation because of Swedish distributional policies -- slow production growth will be explained by a slow increase in educational investments, which are small compared to those in the United States, because of the low return to such investments. Hence, the egalitarian wage policies pursued in Sweden will explain stagnation. This is also a very plausible explanation, but the policy implications are different, as will be seen below.

26. The increased demand for highly educated labour in the United States (Blackburn et al., 1990; Kusters, 1990; Bishop and Carter, 1990), accompanied by a matching increase in the return to education, has become something of a "puzzle" for economists. Berndt, Morrison and Rosenblum (1992) find that these increases are related to growth in highly technical (office and information technology) capital (see also Berman, Bound and Griliches, 1993). Cappelli (1993) concludes that "significant upskilling is occurring *within* most production jobs in manufacturing". On the other hand, only a small part of the increase in average skill requirements can be explained by a shift in the composition of the workforce towards higher-skill production jobs. There is no reported positive relationship between growth in competence or in highly educated labour on the one hand, and labour productivity on the other. The problem is to capture the nature of technology change and the interaction of supply and demand of human capital. This will require analysis at the micro level. First, however, a few additional variations on the macro theme are offered below:

The "new" growth theory

27. The so-called "new" growth theory, first developed by Romer (1986) and Lucas (1988), introduces an "infrastructural" knowledge competence as an externality. This knowledge factor confers economies of scale to all other factors of production. In order to obtain an internal solution, despite increasing returns, Romer assumes strongly diminishing returns to knowledge accumulation ("education"). The only difference to the neoclassical model lies in the shift of exogenous productivity, or the trend assumption of macro-production function analysis backward in the investment production chain -- *from* the exogenous total factor productivity assumption *to* the productivity assumption associated with the educational process that shifts the production function. The new growth theory also readily introduces many externalities into the analysis of improved productivity, notably know-how created in other sectors. Government-sponsored education, health care, and insurance, for instance, have spillover effects to private firms (for a mathematical presentation of the infrastructural knowledge capital of the new growth theory, see Appendix I).

28. If there are both traditional economies of scale and unspecified embodied knowledge accumulation, the two normally cannot be econometrically separated in macro-production function models. Thus, if the tacit knowledge capital is perfectly correlated with "scale", a prior scale formulation will explain improvements in organisational competence as originating because of scale, and vice versa. The question, then, is how to represent the dominant competence input in the production process mathematically. Romer's representation of the production function of an individual firm (Appendix I) moves in that direction but does not abandon the static neoclassical world, since it does not account for the accumulation of competence, which must be explained simultaneously with production if competence, or knowledge capital, is "tacit" and can only be "learned" through participation in production. Braunerhjelm's attempt (1993) to model the scale effects of a centrally available, unique knowledge base on all factors of production at the micro level in the divisions of a firm may be a method to move away from the physical, volume-scale economics associated with standard-production function analysis, towards micro-based macro analysis. There is then a dynamic "path-dependent" economic process moved by organisational change (Eliasson, 1989).

2.2 Micro-based macro analysis

29. Two problems must be dealt with. *First*, the macro-production function approach misses the contribution of organisational change to economic growth and the effects of market imperfections on the allocation of resources. This is an unacceptable misspecification considering the fact that productivity growth within the firm and within the economy is largely accomplished through organisational or institutional change (Eliasson, 1989, 1992b, 1992c). Organisational change is also a technology that depends on competence, the effects of which will be misunderstood if such change is not made explicit. Then, it becomes natural to discuss what any changes in firms, in *industrial structure* and in the organisation of markets mean for output growth. Thus, neoclassical theory and the "new" growth theory are not theories of growth. They describe measured economic growth in terms of measured inputs, but since these measured inputs include a large component linked to time or some other exogenous input, the engine of growth is essentially exogenous. In particular, these theories do not capture the importance for economic growth of competition among agents in dynamic, "imperfect" markets and of organisational change within and between firms. The available literature clearly shows that the market for labour (or competence) is extremely imperfect, a fact that invalidates much traditional human capital literature. These

imperfect market mechanisms have to be captured in a model that attempts to link competence development to economic growth, i.e. in a theory of economic growth.

30. In the market-based, experimentally organised economy (Eliasson, 1987a, 1987b, 1992c), the growth process builds on four investment mechanisms: *entry*, *reorganisation* of existing agents; *rationalisation* of existing agents; and *exit* (see Table 2.1 or Box 2.1). Exit is a disinvestment that makes room for new investment and contains inflation. The exit process is as important as the other three investment mechanisms, and it has direct consequences for the labour market. The four mechanisms, furthermore, operate in different time dimensions, require different competencies and, over time, must achieve a certain balance in order to generate stable sustained growth at the macro level. Two of them operate through selection among firms and one through organisational change within firms. Classical economic theory is only concerned with one, *the remaining* rationalisation mechanism. This ad hoc limitation gives rise to erroneous conclusions, especially when studying the consequences for the labour market.

31. The macroeconomic growth process involves all four mechanisms. At the firm level the four processes are intermediated in the capital market, notably the stock market. Individual competencies are traded in the labour market. Through the four mechanisms, competence is introduced and firms are forced to exit and to improve performance through market incentives and competition. Above all, the financial and labour markets become the final arbiters of the allocation of scarce competence capital of the economy, bringing decision authority down to the micro levels where the best competence to make informed decisions resides. Most structural adjustment, when viewed over the medium and long term, occurs through exit, entry, or reorganisation. For the labour market, this means that reallocation of labour largely occurs in the open labour market rather than in internal labour markets within firms. The overall growth process, furthermore, can never be perfectly co-ordinated and it constantly subjects agents to unexpected changes in their local markets. The ability to cope with unexpected change at the micro level becomes an important element of individuals' and agents' competence. Hence, to understand the use of knowledge and competence in economic growth, one has to begin with the behaviour of agents at the micro market level. If economic growth is the policy objective, and the aspects of the production system that contribute positively to growth are appropriately defined, it is possible to derive the characteristics of the competence capital that should be increased. This is necessary in order to say something about the organisation of educational production. To identify the knowledge factor that contributes to economic growth at the macro level, it is necessary to consider each of the three different agents involved: the *firm* or the employer; the *individual* or the employee; and the *policymaker*, each of whom operates in a *market situation*.

32. How individual behaviour results in macroeconomic output then depends upon how individuals team up in firms, how competition in markets affects firms, and how rules imposed by the policymaker affect competition. There are then two aggregation problems: *within* the hierarchies of the firm and *through* markets.

33. Schumpeterian economic analysis describes how agents react to an exogenously changing environment through organisational adjustments that change the character of firms or industries. Micro-macro theory takes a further step (Eliasson, 1991a, 1994a) by making the market environment and its institutions dependent on how agents continually adjust to it. This step reveals the genuine unpredictability of agents and individuals in the local environment that is a property of the experimentally organised economy. Without it, labour and educational economics miss the important links between education, the

labour market and social insurance, and cannot grasp theoretically the critical economic characteristics of human capital.

34. Because of the heterogeneity of competence or knowledge capital (see below) and because -- as the "new" growth theory argues -- knowledge can confer strong economies of scale, efficient allocation of knowledge is very important to growth. Indeed, *macroeconomic growth critically depends on the capacity of the economic system -- the markets -- to take decisions down to the level where the appropriate competence resides*. This means that relevant growth theory *has* to have a micro (firm, individual) basis and that the competence or knowledge endowment of a nation includes the particular organisational knowledge that makes this allocation possible.

2.3 Learning and the market process in the experimentally organised economy

The experimentally organised economy

35. Understanding the nature of the knowledge base that contributes to economic growth requires a model in which firms compete in dynamic markets that never clear, where structures develop as part of an ongoing evolutionary process, moved by unpredictable entrepreneurial initiatives and by a steady flow of mistaken decisions. The *experimentally organised economy* (Eliasson, 1987a, 1988, 1991a) thrives on local uncertainty caused by individual agent behaviour, and weakens with the imposition of *too much* order to reduce that uncertainty. It not only allocates given resources to given uses, it also creates new resources through innovation and entry and forces obsolete resources to move or to exit. The institutions of the system evolve through time, and innovative activity allows the labour market (human beings) to be creative and to upgrade and change abilities. Education and the accumulation of experience, broadly defined, are part of the selection and allocation processes that move economic growth. Unexpected change at the market level is part and parcel of sustained economic growth at the macro level, and business mistakes are a *normal and inevitable cost of economic growth*. The *ability of individuals to cope with unexpected change hence constitutes part of the human capital of the economy*. This ability depends on whether the economic or political system provides adequate *insurance* (Eliasson, 1992a) for individuals subjected to the consequences of business mistakes, making individuals willing to accept such change politically. The model of the experimentally organised economy, then, presents an educational process which explicitly allows for the innovative and educational selection phenomena that constitute economic growth.

The limits to learning

36. New competence can be acquired through internal education, through recruitment, and through the acquisition of competent firms or parts of firms (Eliasson, 1991b). Its economic value is reduced to the extent that competitors acquire that same competence, or better, more rapidly. However, if a firm tries to acquire competence very rapidly it often incurs a business failure. The more rapidly competence is accumulated by a firm, a group of firms or a whole industry, the greater the incidence of failure but also the likelihood of major business success. Since the economic value of acquired know-how depends on what competitor firms do, *there will be strongly diminishing returns to learning* or the acquisition of knowledge because of the rapidly increasing rate of business failure (Eliasson, 1992b). Thus, no individual firm, by temporarily allocating all its resources to learning, can raise its knowledge capital to such an extent that it will forever outcompete its competitors through the consequent gains in economies of scale. The same should hold for a country.

37. Further, an increased failure rate disrupts the stability and the co-ordination of the price system of the economy and makes learning more difficult. This suggests the limits on a decentralised economy's capacity to cope with massive innovative behaviour.⁶

2.4 The agents of change

The firm, or the employer

38. The business firm is characterised by its capacity to organise people with competence into a team capable of satisfying financial (profit) targets. This involves recruitment, co-ordination, and upgrading of competence, a process controlled by top-level *organisational competence* (Eliasson, 1990b) which also has to learn to make superior organisational decisions. This human competence capital dominates other capital in the firm.

39. In the experimentally organised economy, the firm frequently makes mistakes and its basic learnable competence consists in the ability to cope with unexpected change. There is no stable and lasting competence capital because new environmental demands continually require a new competence base. This base can rarely be built through learning and therefore requires re-staffing and hiring. Table 2.1 specifies the competence capital of the firm. It consists first of the innovative business intuition needed to set up a viable experiment. There are few formal, observable routines in this process, except for an organisational design that makes it possible to select the best projects (Eliasson, 1990a, 1990b). The second level of decision-making in a firm is analytical, its task being to identify and correct business mistakes efficiently. This function is observable and constitutes a large part of its management hierarchy (Eliasson, 1976a, 1984a, 1990b). The *third* operational level is responsible for the management of the production process. This is the level that has received the most theoretical and empirical attention.

40. Since the competitive market situation of firms changes, sometimes suddenly and dramatically, the necessary intellectual capacity at the top also changes. Recruiting new intellectual capacity at the top is a primary concern of any company, and its long-term survival depends on its ability to balance innovative capacity at the top and operational efficiency at the bottom.

41. How individuals combine and recombine into competent teams to cope efficiently with varying competitive circumstances is determined by the organisation of the firm (Eliasson, 1990b), and forms an important part of its technology or competence. The organisation determines the firm's need for various types of competence and the relative importance of specific and general knowledge. These various capabilities are merged through implicit and explicit incentive contracts, which regulate compensation for productive behaviour. These matters will be taken up in the next chapter.

6. This does not mean that a hierarchical order (central planning) will fare better. Under the relevant conditions of the experimentally organised economy, the necessary conditions for transparency (perfect information) are not upheld.

The individual in the imperfect markets for competence

42. The firm seeks competence rather than labour hours in the labour market, and the individual supplies it. Market or contract technology is needed to establish the trade in human competence that eventually moves economic growth. There is a market for investment in education that increases earnings capacity and reduces risk exposure in the labour market. There is also an insurance market for covering those risks over the individual's life. The failure of the market to create such markets for social insurance, or a policy that destroys functioning markets through regulation, will reduce the efficiency of the allocation of competence in the economy, and hence macroeconomic growth.

The necessity of efficient insurance

43. The experimentally organised economy thrives on the innovative behaviour of its agents, but this moves the economy in unpredictable directions and causes hardship for agents incapable of adapting to new circumstances. Firms are supposed to cope with this on their own -- this is the rule of the market game -- but people may not be willing to. To create a viable environment for growth, a complementary institution -- an insurance system -- has to be created, through either the market or collective action. The necessity of a viable social insurance system to make people accept the emergence of the capitalistically organised industrial market economy was understood already by Bismarck who created the first welfare state in Prussia. The purpose of a well-designed social insurance system is to help individuals overcome their natural aversion to risk when it comes to investing in long-term competence development and moving to occupations that may suit and pay them better (Eliasson, 1992a). This insurance system can take many forms, but the efficiency of economic growth is closely related to the efficiency of this insurance system.

2.5 The content of economically valuable knowledge

44. Economically valuable knowledge is complex and must be described at different levels of aggregation. It is multidimensional and cannot be assessed at a single point. Parts of it are applied in different circumstances. Individuals also embody very diverse human capital. Firms organise individuals into competent teams, and their organisational technology adds to the qualities of the individual. Firms also form similar interrelations that may create or reduce value through the establishment of monopolies.

Competence capital and the organisation of a national economy

45. Through the economic system, individuals and firms merge to generate economic value (output). Experience demonstrates clearly that markets offer the most efficient kind of co-ordination of a dynamic, innovative economy. Economic theory, on the other hand, which is inherently static has only been capable of affirming that a market economy can only be as good as but never better than a non-market (centralised) economy. This result, however, rests on the prior assumptions of the static economic model and has no empirical foundation (Pelikan, 1989; see also Box 5.1 on the intellectually convincing power of chosen theory). But standard economic theory also fails to account adequately for the allocation of competence. Pelikan goes on to demonstrate that the non-market economy will always fail to allocate competence efficiently, compared to the market economy, but that none of the systems will be perfect. This in turn means (Eliasson 1992b, 1992c, 1994a, 1994b) that the economy will always be operating far below its

capacity and always be capable of significant productivity change through a more efficient allocation of resources, notably competence.

46. This brings in the problem of who is responsible for the organisation of the economy and the size distribution of firms. The number of possible organisational combinations is enormous. In the experimentally organised economy, each "merge" is achieved through experimentation in markets and hierarchies. The key to macroeconomic performance is to organise the economy so that the mass of heterogeneous human and firm-based competence is optimally exploited. This means, first of all, organising the economy so that decisions *can be, and organising* the incentive system so that they will be, taken at the level where the appropriate competence resides. This generally means at the level of firms and individuals, rather than in central hierarchies. The enormous complexity involved in the entire decision process of a firm or a nation means that there exists no simple optimal point. Above all, at no place in the economy will there exist a group of people competent to take on the task of choosing the best organisation of the economy. Economic theory gives no reliable advice and, even with the modest ambition to improve, a policymaker who tries runs a significant risk of making things worse (Eliasson 1993b, Eliasson and Taymaz, 1992).

47. The institutions and the organisation of economies have therefore developed experimentally over decades and centuries. Even in a temporarily closed economy, therefore, the economy will constantly be in flux, moved by agents striving to reach better positions and slowly pushing other agents out of their established positions and changing the institutions in the process (Eliasson, 1991c). In this process of organisational change and innovation, competence development and the allocation of competence in the labour market play the critical roles.

Heterogeneity and redundancy

48. Competence is complex and heterogeneous -- much more complex and heterogeneous than any other capital item -- with the result that very little of an individual's competence is normally employed in any application. This flexibility defines the comparative advantage of the human-being over machines. The task of the educational system is to create such redundancies in order to prepare the individual for the unpredictable demands of the labour market in the experimentally organised economy. The *redundancy of human capital implies* important things for education; in particular, it means *that markets for competence will always be grossly imperfect*, thus creating a faulty incentive system.

49. It also means that the labour market is replete with unused latent competencies. It probably means as well that most people are not doing the job for which they are best suited, and this underscores the importance of labour market institutions for the creation of welfare. *For one thing*, redundant competencies are not compensated on the job (see Section 3.7). *Second*, competencies are therefore only properly compensated if matched by the right job. *Third*, redundant competencies are insurance against unpredicted change in the job market. The implication is that education, labour market organisation, and insurance should be part and parcel of the same policy package.

The general learning problem

50. The ability of agents to compete successfully through innovation is in principle a phenomenon of "learning", as is the ability of agents to cope with unexpected change. The flux in the competitive market process means that the exact nature of firm or individual competencies required for success will change. There is no stable specification of optimal knowledge at each allocation (organisation). Since the requisite knowledge is not a well-defined item that can be replaced when necessary, knowledge capital -- like all other capital -- has to be depreciated and increased through new investment (education).

51. The complex nature of such knowledge makes it more or less unmeasurable, except indirectly in terms of the present value of future expected returns of firms as assessed in the stock market, or directly in terms of the accumulated value of investments in "education" by a firm or an individual.

The recruitment problem

52. Because the unique knowledge base of the firm is constantly exposed to competition that threatens it with sudden obsolescence, coping with change dominates firms' recruiting. The firm needs, at each new point in time, a particular package of competence characteristics. Yet the nature of that package is not known and cannot be predicted with any accuracy. It has to develop the required characteristics through experimentation, and repeated failure is encountered in the process. This means that a firm will be as concerned with discharging people with the wrong competence as it is with acquiring those with what they see as the right competence, if internal retraining programmes cannot be organised.

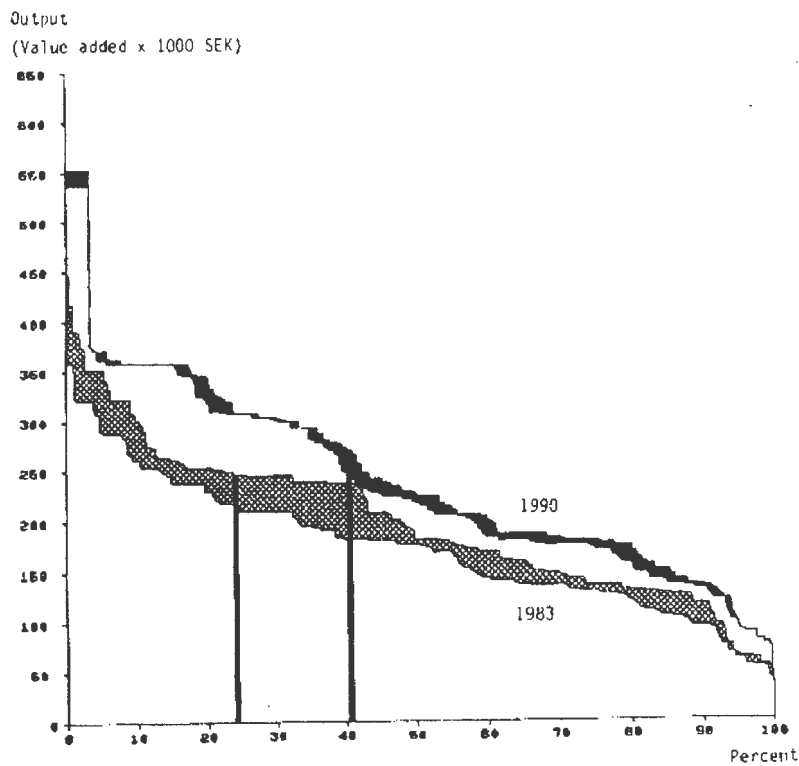
53. The firm's behaviour also determines the local environment of its employees. Employees, typically seen as *risk-averse*, have consequently demanded from the firm, directly and indirectly, through unions or through the political process, *insurance* against the vagaries of the market. And this chapter establishes as a necessary fact of a growth economy that *firms and individuals alike will have to cope with the arbitrary forces of the market*. Since such an enormous diversity of competencies is at work in a functioning market economy, no such thing as fairness or equal treatment can be defined *ex ante*, and there can be only *ex post* compensation for what is politically defined as arbitrary treatment. This is the task of social insurance, which therefore is a necessary institution of a functioning market economy to oblige people to accept arbitrary treatment politically (Eliasson, 1992a, 1994a).

54. *Education* therefore serves a much broader purpose than equipping the individuals with various, directly useful skills. The most important competence is the *ability to cope with unexpected change*, which is partly the ability to learn again, partly a positive attitude to life and its various uncertainties. For individuals, this means experience in a *functioning labour market* as part of their overall educational experience. Appropriate and efficient *insurance* markets must exist to make individuals overcome tendencies that otherwise keep them from moving on in search of occupations that suit and pay them better and contribute to their accumulated experience. What this means for the educational system will be discussed in this report.

Box 2.1. Salter curve analysis of economic growth

The story of dynamic competition in the supply and allocation of educational knowledge services can be theoretically formulated in terms of so-called Salter distributions of the rents from competence (see Figures 2.1a and 2.1b). The discussion that follows will focus on competing firms, but it is equally valid for competition among individuals in the labour market.

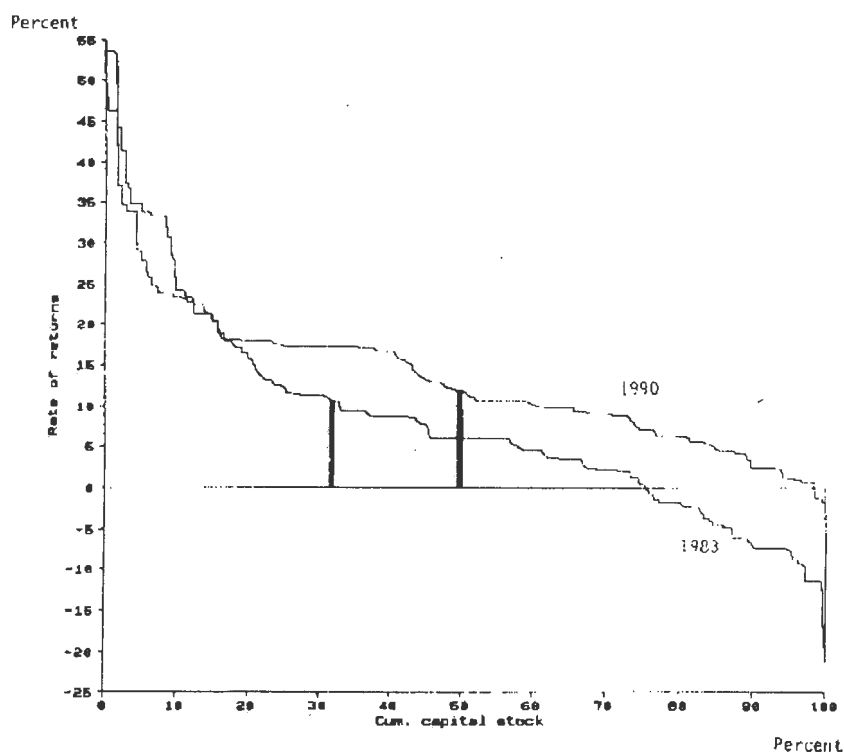
Figure 2.1a. Labour productivity distributions over firms -- Swedish manufacturing, 1983 and 1990



Source: Eliasson (1991a, p. 164).

(continued)

Figure 2.1b. Distributions over firms of rates of return over the market interest rate (the epsilon rents)



Source: Eliasson (1991a, p. 164).

Firms are lined up from the left in terms of their ability to generate productivity or rents or a return above the market interest rate. These performance measures have long been a source of discussion and confusion in economics. Knight (1944) observed that while theory predicted that productivity would decrease with increasing inputs of factors of production, such decreasing returns had failed to show up in research studies. He attributed this to an unobserved factor of production that he called competence. Similarly, McKenzie (1959) had problems with the fact that measured factor compensation failed to exhaust total product value, as equilibrium theory prescribed, i.e. that the rents in Figure 2.1b were not all zero. Again he called in an unmeasured factor input to explain the unaccounted-for rents, namely competence capital. The returns to such competence capital appears as excess profits in the accounts of firms. By this interpretation the distribution of returns over the market interest (= ϵ) in Figure 2.1b can be interpreted as business competence rents. The size of this competence rent is measured vertically and the size of the firm (its capital in per cent of total capital of all firms) is measured horizontally. The value of the firm as assessed each day in the stock market is the present value of all expected future such rents. There is a layer of *ex ante* such distributions at each moment of time, which depicts the *ex ante* perceived rents of all firms, including entering firms and excluding exiting firms, and (very important) the corresponding expected distributions anticipated by each firm. All these distributions change as decisions taken are ultimately realised, reflecting over time the dynamics of competition, driven by the organisational competence of firms. This competition occurs in the capital market, as in the Swedish micro-to-macro

(continued)

model (Eliasson, 1991a, 1992b). Each firm is ranked in each market on the vertical axis on the epsilon distribution, the width of the column representing the size of the firm in per cent of the corresponding total of all firms (Fig. 2.1b shows that even though the firm indicated increased its rate of return between 1983 and 1990, it dropped in rank).

Each firm also has its own potential productivity frontier, with respect to which it is operating to position itself in terms of productivity and rate of return. This is still actual *ex post* performance. The dynamics of markets, on the other hand, are controlled by a second set of potential *ex ante* distributions that capture the planned actions of all other firms, including each new entry.

A third set of Salter curves tells how *each firm sees itself positioned in relation to other firms*. The real world of the experimentally organised economy and its model approximation, the Swedish micro-to-macro model, both show large *divergences between actual and perceived positions*. Those *ex ante* distributions indicate the potential for a given firm to outbid all other firms in wages or the capacity to pay a high interest rate.

Table 2.1. The four fundamental investment categories of economic growth

-
1. New entry
 2. Reorganisation of existing firms
 3. Rationalisation of existing firms
 4. Exit (disinvestment)
-

Source: Eliasson (1992c, 1993a).

The firm learns directly if competitors can do better. Management then knows that it had better improve in order not to be pushed down along the Salter distribution and, perhaps, out. Similarly, when the firm finds itself close to the top, it knows that close competitors are taking action to better their positions through innovation or imitation. If potential Salter distributions are sufficiently steep in the top left-hand group, firms attempt to improve their positions on the Salter curve through innovative activity, rationalisation, or through entry (see Table 2.1). Firms which fail to improve their productivity lose their rents and eventually exit. *Business failure is a normal cost for economic development in a well-functioning market economy*. No firm is safe under these circumstances and constantly has to take action to better its position. This moves the entire economy through a self-perpetuating, growth-creating competitive process. This growth process is the ingenious income-distribution game of the experimental organisation of the capitalist market economy. Firms compete through innovation and product value creation that shift the productivity distributions in Figure 2.1a. Competition among the firms, however, checks the returns that accrue to business competence holders, the "ε" of the firms in Figure 2.1b, from growing excessively (for further discussion, see Eliasson, 1987a, 1992b, 1994a). Adam Smith (1776) was very right in arguing that free entry was absolutely necessary to prevent monopoly formation and to keep the growth process going. Schumpeter (1942) fortunately was wrong in predicting that routinised research in the large companies would become so effective as to concentrate all innovative activity in a few firms, and that this would destroy not only competition in markets but also its political image, democracy.

2.6 Competence, competition and economic growth

55. As shown in Box 2.1, competence development and accumulation in firms is part of the competitive market process that moves economic growth. This accounts not only for the *entry* of new firms, and the *reorganisation* and *rationalisation* of existing firms (see Table 2.1), but also for the necessary frequent *exit* of firms that fail to innovate and improve their productivity performance. *Business failure is a normal cost for economic development in a well-functioning market economy.* Both new entry and exit of firms *should be significant.*

Competition causes business failure and local unpredictability

56. The other side of this growth process is the steady change in the environment of the employees as each firm tries to outcompete its competitors. For those capable of capturing them, opportunities are created; others are simply pushed around. Earlier, it was thought that better planning would replace this experimentally organised, competitive process, and measures were taken that slowed it down, decreased competitiveness of firms and lowered economic growth, eventually causing even greater hardship for people. This chapter establishes as a necessary fact that the enormous diversity of competencies put into action in a well-functioning market economy will constantly subject both firms and individuals to arbitrary treatment, and that only social and economic systems that organise themselves such that individuals can cope with and accept such change politically will experience economic progress. Education and competence development is the important vehicle to achieve that result. Current economic policy sentiment also seems to be moving in the opposite direction as more and more sectors are deregulated and even competition allowed into the most protected sector of all, the public sector. One should realise, however, that this may partly be the result of strong, exogenous forces like technology change and international competition that force local political change. This was undoubtedly the case with the freeing of most industrial economies from exchange controls and the deregulation of the telecommunications market. Hence, to prevent political backlash which will eventually be a negative experience for all, improved educational performance becomes even more important.

Connecting organisational competence back to competition and economic growth

57. The returns to capital, which firms strive to keep as high as possible, reflect the temporary rents from top-level management competence. In the *profit accounts*, these rents involve surplus value created above payments for inputs. In the *production accounts*, they reflect economic value generated without measured factor inputs. By definition, this means improvements in productivity or -- to use the economists' jargon -- a shifting of the production function. Hence, the rents in the profit accounts can be directly related to the shift in the production function or to a change in total factor productivity (TFP). They represent, respectively, payments for and the production results from an unmeasured production factor, which is here called competence (for mathematical proof of this relationship, see Appendix II). The problem of this book is to give economic meaning and practical content to this particular competence capital, which reflects both the (technical) competence to improve the technical characteristics of the organisation of production and the (business) competence to choose the right products, the right markets, the right technology, and the right people to run the business. It also reflects the top-level (ownership and executive) competence to deal with uncertainty, or the ability to convert uncertainty into computable business risks (Knight, 1921; see also Eliasson, 1990b).

58. The technology factor, however, also picks up the contribution of the entrepreneur who exploits market imperfections, for instance by successfully hiring talented people at wages or salaries that are below their marginal productivity. Capital gains will also appear in this measure, and since they are also the result of trading in imperfect markets, they reflect the competence of the entrepreneur to trade and should not be deflated away in productivity measurements. This competence can be seen to be exercised when top entrepreneurial competence ensures the formation of synergistic teams, in which individual contributions are magnified.

Box 2.2. Technicalities of market imperfections, competence and technical change

Scale effects originating in the application of top entrepreneurial knowledge by definition make markets imperfect. Whether the firm operates as a Kirznerian (1973) equilibrator or trader or imitator, making money from moving the economy closer to equilibrium, or as a Schumpeterian entrepreneur, enhancing the productivity of the system by changing its parameters and disturbing the equilibrium, it creates (in both cases) positive value additions to output. Such improvements in allocational efficiency are not normally interpreted as instances of technical change. They do, however, show up as measured technical change in macro-production function analysis, and much work has been devoted to correct price indexes for the effects of such market imperfections (for a discussion, see Dargay, 1988; Färe and Grosskopf, 1990; Morrison, 1990).

If, for instance, prices used are equilibrium prices -- corrected or not -- a new competitive situation is reflected in a new set of equilibrium prices, and all quantities adjust to this new price configuration along the production frontiers. This is the method of computable equilibrium modelling. The *a priori* production technology chosen usually demands a particular price index to leave the shift factor invariant to such adjustments.

If imperfections in markets are, however, fundamentally due not to asymmetrically distributed information or slow learning or adjustment behaviour but rather to fundamental inconsistencies in beliefs, competence endowments, or the formation of business judgements, actions taken on the basis of such inconsistent opinions will constantly reshape the structures which, at each point in time, represent the productivity characteristics of the firm or the economic system which, in turn, shape future *ex ante* perceptions of what is to come. The path the economy takes will spin off *ex ante/ex post* realisations that will be reflected in the shift factor in the production function, since they represent positive or negative value contributions to output (see further, Appendix II).

2.7 The industrial knowledge base of a nation -- what is to come?

59. While it is universally acknowledged that knowledge matters in economic growth, and while models showing that knowledge matters abound, economics has notoriously failed to give empirical substance to this proposition. The inability to visualise statistically the creation and application of knowledge in the economic growth process has to do both with lack of data and with a lack of analytical imagination.

Selection mechanisms rule economic growth

60. Perhaps the best way to understand the knowledge creation process at work in economic growth is to use a system that classifies all economic activity in terms of innovation, co-ordination, selection or learning (Eliasson, 1987a, and 1990a, Chapter I). This taxonomy, which adds innovation and selection to the classical model, fits well with the competitive mechanisms of a market economy and the experimentally organised economy, in which knowledge is tacit and difficult or impossible to communicate.

61. In the past, major technological advances have been closely tied to communication techniques, which have affected both the use of information and physical transport.⁷ Information technologies related to communication and transport are generic in their applications and contribute to co-ordinating and filtering processes in the economy. Hence, they exercise leverage effects on the entire economic system and form the basis for building so-called development blocks (Dahmén, 1950). These advances in information and communication technologies have in turn completely reshaped the organisational forms of those societies that have adopted and accommodated them. A main insight from the micro analysis of macroeconomic growth is that new technologies are almost always introduced through the entry of new firms and the competitive exit (because of new entry of superior technology) of firms with obsolescent technology. In the long run, hence, *economic selection* rules, and the ability of nations to organise their political and economic system to cope with change becomes critical for economic growth. It explains why nations and individuals have experienced tremendous variations in success and why the economic effects of a politically negligent nation can be profound. It also explains why each individual, each firm and each nation face, at every point, a serious "education" problem.

The importance of universal education

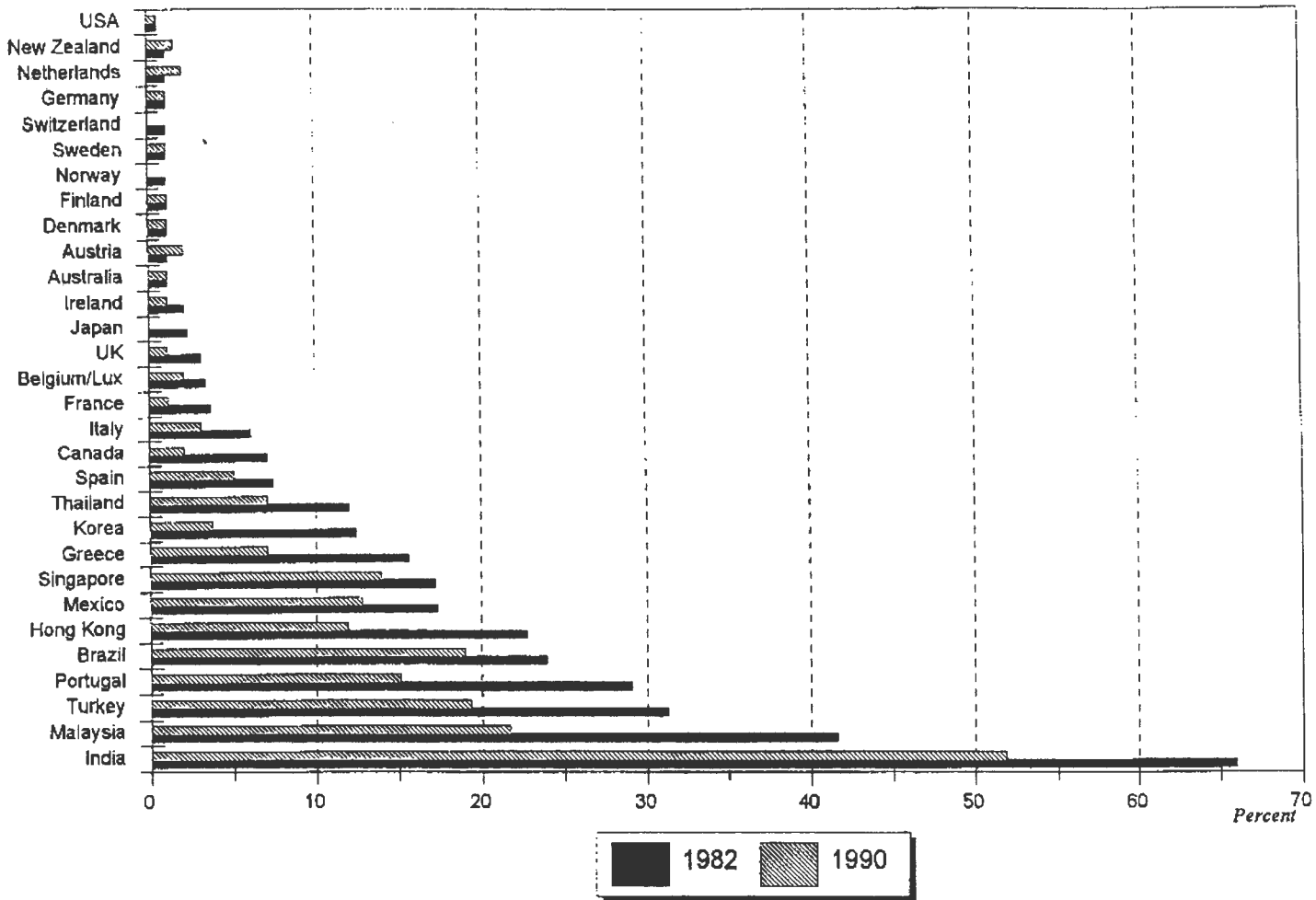
62. Education and scientific research are seen as the means of achieving success in the knowledge-based economy. Therefore, creating a competent receiver system for complex information must be a "generic" factor for generating growth. Thus, a universal education system has often been referred to as a necessary infrastructure for a wealthy industrial economy. The evidence overwhelmingly correlates high levels of literacy with high levels of industrialisation and economic wealth (Boserup, 1981; Eliasson, 1988). It is easy to accept, in principle, the idea that universal education is one of the key "information technologies" on which industrial growth has been built. It is therefore interesting to note that literacy in the developing world has increased significantly in the 1980s (Figure 2.2), while concern is being expressed in the industrialised world that primary education systems are not up to standards and that measured literacy is not functional in advanced job contexts (see OECD, 1992).

7. On this topic, see Eliasson, 1990a, Chapter 2.

63. What does this imply to possible economic growth of mature, industrial nations? Sweden spends about 6 per cent of total GNP on education and research as measured in the national accounts, and the United States more than 8 per cent. The figure is lower for the OECD countries overall. Such figures only give a partial picture of the huge differences in human capital that distinguish the rich nations from the poor and the enormous resources needed to upgrade the human capital of the poor world to the standards of the industrial world. If resources invested in additional education and on-the-job training -- including opportunity costs in the form of lost output -- are added, the Swedish figure would increase to at least 20 per cent (1991) of GNP (Kazamaki Ottersten, 1993), a figure of the same order of magnitude as value-added in manufacturing.

64. Much of the knowledge base of a nation is embodied as tacit knowledge in the individuals that participate in the production process. Most of this knowledge is user-specific or limited to certain expert groups and is difficult to communicate, owing to the lack of receiver competence in other individuals and groups of individuals. As the stock of knowledge expands through innovation and addition of new tacit knowledge, the increased diffusion of knowledge also converts previously tacit knowledge to a communicable form. Perhaps the most important *task of education is to provide a code or a language for converting tacit knowledge into communicable information.*

Figure 2.2 Illiteracy in the industrial and the developing world, 1982 and 1990



Sources: OECD (1986, 1993) and UNCTAD (1985).

The competence base of a nation and the very large business firms

65. A comparison of different countries also shows huge differences in human skill endowment. In the advanced industrial society this endowment is normally taken for granted. It is "tacit" and people may not even realise its significance for their economic well-being.

66. Modern, industrial nations derive their wealth from the costs incurred in the past, in the form of lost physical work, to educate or train the population. Since educating and training the people of advanced industrial nations requires the presence of "teachers" who possess the needed competence -- much of which resides in human beings or teams of individuals working in the advanced industrial nations -- it is easy to understand the difficulties associated with "trying to catch up" through educational crash programmes. Further, the competence endowment of a nation appears to be "durable". The devastation of the Second World War destroyed the physical capital but not the industrial human capital endowment of Germany and Japan. However, political and institutional arrangements can cause the human capital of a country either to deteriorate or to improve in quality and quantity. The problem is that science currently provides few guidelines as to how this happens.

67. Following World War II, giant multinational firms have, for several countries, replaced basic industries as the backbone of manufacturing and hence of economic wealth. This development is perhaps most pronounced in Sweden and some other small, advanced industrial economies. In contrast to developments in other industrial nations where large firms shrank in size and importance in the 1980s, giant multinationals surged ahead in Sweden and became even more dominant because they were more internationalised. Do they represent the efficient future organisation of industrial production? By definition, a firm derives its existence from a "team" or "hierarchical" competence to co-ordinate a production that is superior to the rest of the market. This co-ordination competence is one of the most important knowledge-intensive economic activities in the advanced industrial nations. Administrative techniques in Swedish firms have apparently beaten the market over the last 10 to 20 years in terms of co-ordinating production, and one may wonder if these firms can continue that superior performance into the next millennium.

68. The bigger the organisation the more complex the co-ordination problems. Large business organisations are afflicted with various forms of diseconomies of scale when it comes to co-ordinating the hierarchy (Simon, 1955; Eliasson, 1976a, 1984b). In every case, some specific economy of scale or synergy makes the difference. The wealthy industrial nations have succeeded over the last hundred or so years in exploiting large, and in some cases global, economies of scale, through their firms' ability to organise and co-ordinate large business hierarchies. The co-ordination competence has been efficient enough to overcome their handicap vis-à-vis small competitors in terms of flexibility, bureaucratic overheads, etc., and to generate a large surplus (rent) from the particular scale factor (competence) upon which the firm is built (Eliasson, 1988, 1990b). The question today is where technology, competition, and international market development will lead.

2.8 Is radical technological transformation challenging mature industrial nations?

69. Strong technological forces are generating radical change from within firms in some mature industrial nations. Very strong external forces challenge existing old technologies in mature industries in the market, as competitors develop new and better technologies and as other nations' managers and workers learn the mature technologies of the old industrial nations. This process appears to be speeding up.

Where will technology and markets take us?

70. The last couple of decades have witnessed a break in three trends which had their origin in the industrial revolution: *i)* the increasing relative wage of unskilled labour; *ii)* the diminishing importance of traditional economies of scale in private production; and *iii)* the share of wage contracts in employment.

71. New technology is making small-scale production economically feasible in traditional manufacturing, and demand for customised products with a higher knowledge content has grown. As a result, manufacturing has fragmented into smaller production units, producing customised products with a high knowledge and skill content. This emerging new industrial structure becomes apparent when the rapidly growing private-service production sector in the analysis is included. In this development, US industry appears to be leading. Recent developments show emerging profitability in small-scale competence intensive production, particularly in the private service sector, but surprisingly also in Sweden in traditional large-scale commodity manufacturing (Carlsson, 1989).

72. While private service production has expanded rapidly -- again notably in the knowledge-intensive sectors -- standard, machine-intensive bulk production of manufacturing has slowed down among the rich industrial nations. This development means fewer jobs for workers with low skills and an increasing demand for educated ones. Here again, the United States seems to be leading this development. There is every reason to expect this trend to continue, creating -- if educational production does not lead the development -- a persistent mismatch between supply of and demand for skills.

73. Earlier, large manufacturing firms have been a haven for low-skilled workers, offering them wages they would not command in a more demanding labour market (see Eliasson, 1986a, 1990a, on the unintended internal welfare system of large firms). The reason is the difficulty of maintaining productivity-related wage differences within shops.⁸ Increased global competition is putting pressure on large firms to shed such internal welfare systems, and new technology is making it possible to outsource production. This will benefit poor, low-wage countries if they provide the required political and institutional environment for international firms (see Eliasson, Rybczynski and Wihlborg, 1994), and it will further increase the pressure on low-skilled, overpaid workers in the advanced industrial countries. This development is accelerated by a parallel increase in financial market efficiency in shifting funds out of mismanaged firms and economies to where the most profitable investment opportunities reside. This puts even greater pressure on firms to make changes or shut down unprofitable parts of their production.

74. The increasing possibilities offered by technology and demand changes to capture competence rents through small-scale production and self-employment means that the internal income redistributive mechanisms of the large firm are gradually diminishing. As a result, not only does low-skilled labour earn less but it also becomes increasingly difficult to carry on production staffed with overpaid low-skilled labour.

8. This was possible earlier, when in many countries' manufacturing offered piece-work reward systems.

The educational system deprives simple production of human capital

75. Education does not only act as a filter by putting quality labels on students and by allocating people to jobs. It also shifts people from skill-based manufacturing jobs to knowledge-based jobs, largely located outside manufacturing. To be viable and competitive, manufacturing has to receive a minimum of high-level talent. If it is competitive, it provides a large number of skilled and unskilled workers with downstream jobs. If the skilled workers of the next generation go to college and increasingly engage in personally more rewarding professional service jobs, manufacturing industry may lose not only its critical talent -- it will also have to replace the skills lost by training lower-quality workers. This may be difficult, costly or even impossible. The rapid increase in the demand for highly educated labour in the United States bears this out. It is possible (Eliasson, 1990a, 1991b, 1992a, 1993b, 1993c) that the move of talented young individuals -- because of higher education -- out of manufacturing into private service production is an important part of the difficulties of the US manufacturing industry experienced in the 1980s. This process is less visible in hardware manufacturing-based economies such as Japan and Germany, where the educational system has in fact discouraged such flows of talent out of manufacturing (see Soskice, 1993).

76. It is also critically important for a country planning to expand higher education, that a competent private industry exists that can make efficient use of highly educated people. If this is not the case and/or if the public sector offers good job opportunities -- which has been the case in Sweden -- the result may be a lowering of national productivity through an inefficient use of talent. This is a reason for examining carefully the educational and industrial systems of the above four countries (see Chapter 4). It becomes extremely important for economic policy formulation to understand the role of the educational system as a talent filter rather than as an upgrader of knowledge. At the same time, it is important to reassess the traditional view of the role of manual workers and manufacturing production in a nation's welfare.

The radical industrial transformation ahead

77. The industrial world is currently facing potentially dramatic change in its technology and organisation. Western European and North American industries are essentially based on the organisation of production developed during the industrial revolution some 150 years ago. That mechanical engineering technology is rapidly being learnt by other, previously less advanced, nations. This is forcing changes in high-wage European and North American industries and a massive reallocation of labour from low-competence to high-competence industries. Since many laid-off workers are not sufficiently competent to work in the new industries, retraining becomes an important policy issue. Since the bulk of structural changes take place through exit and entry rather than through the reorganisation of existing firms (see Table 2.1), an increasing part of the reallocation of labour takes place in the open labour market, forcing the responsibility for upgrading unemployed labour on the individuals themselves and/or on public authorities. This change in labour market circumstances makes radical retraining of labour market and educational policies necessary. Above all, policymaking itself is becoming dramatically more competence-demanding, making it necessary to devise policy instruments that empower individuals with resources to take responsibility for their own economic future (see Box, p. 16).

78. It is instructive to observe that the competence that still keeps the firms of the advanced industrial nations ahead is organisational and not based on the actual manufacturing of goods (Eliasson, 1986a, 1990a). This is reflected in Table 2.2 which shows, in simplified form, the intellectual structure of the firm. The giant multinationals in mechanical engineering industries have shifted their base of competitive

Chapter 3

Incentive Contracts, the Organisation of the Firm, Productivity, and the Market Allocation of Competence

82. Economic growth occurs through the creation of new industries and new jobs, thereby forcing old industries to contract or close down, thus causing the laying-off of workers with obsolete skills. The labour market has increasingly, in recent years, been characterised by an undersupply of competent labour and an oversupply of low-ability labour, given established relative wages. The undersupply of competent labour retards growth, as does the oversupply of obsolete labour, if the presence of the latter means that old industries do not contract sufficiently fast and relative wages are sticky.

3.1 The mismatch problem and incentives to invest in competence

83. The mismatch problem, as it has been called (Osterman, 1983), is serious both from the point of view of economic performance and of society. In principle there are two policy solutions: a *negative* one that allows the mismatch to clear through wage adjustment; and a *positive* one that relies on education and retraining. The problem for the first is that a significant part of the working population would become so badly paid that it is politically unacceptable. The problem for the second is understanding *how to do it*. One thing, however, is certain. If relative wages do not reflect reasonably well the value of individual contributions in the workplace, no educational policy will work; a wage difference in favour of competence is both an incentive to further competence development and a way of allocating competence over the labour market and within firms. Furthermore, the quality or competence of labour in a dynamic economy cannot be acquired once and for all. The specifications of needed competence change constantly, which is why *redundancy* and continuous intellectual retooling are so important. Finally, using price mechanisms will also further socially-desired ends. Hence, no educational policy will work if wage-setting in the labour market is not allowed to properly reward competence and not overpay low-ability workers.

84. The problem can be considered as follows. Within each firm, or workshop within a firm, there is, for a large spread in the productivity of individual workers, a corresponding but much smaller spread in individual worker compensation. Firms wish to increase the reward spread and to discharge low-ability, overpaid workers. Low-ability workers should be concerned to upgrade their competence, while high-quality, underpaid workers should be looking for better-paying jobs. This occurs to some extent but much less than economic theory predicts. The reasons lie in the explicit and implicit contracts that regulate employment and wages in the labour market, and the high transaction costs for firms and individuals alike associated with hiring and firing workers. The new industrial technology that is in the process of being introduced will, however, force a break-up of old contracts, promoting smaller-scale production and making the labour market more efficient in the sense of equalising individual (marginal) productivities and pay. The

question, to be treated in the next chapter, is to what extent this "problem" can be nullified by education.

85. In the present situation, the classical conditions for market equilibrium ($MP=w$) are not satisfied. If markets are not perfect then wages will not properly reflect labour quality. Existing competence will not be efficiently allocated or investment in competence accumulation optimally stimulated, nor will educational services in a broad sense be efficiently produced. All these circumstances will lead to an undersupply of competence in the economy where it is in high demand.

86. It is easy to compose a strong and logically consistent argument that underinvestment in knowledge occurs. The interesting possibility, however, is that the assumptions on which such arguments are based (using the analytical tools of modern industrial organisation theory -- IO) will emphasize the lack of incentives on the part of the individuals to engage in their own competence development, and will show up the badly functioning and uninformed (imperfect) labour markets. The suggested policy remedies will be to modify the institutions of the labour market to improve the market functions, rather than call for more government regulation or subsidies.

87. Since the imperfections of the labour market are largely the making of government regulation and law, and union cartelisation permitted by government, a paradoxical policy situation prevails. Above all, we would not expect tradition, vested interests and authorities to be positively inclined to move rapidly in the direction of *freeing the labour market from regulations*, in particular when it comes to an increased variety of contract formulations. The latter is particularly important for establishing the right *incentives* for competence accumulation among individuals and firms.

3.2 The efficient incentive contract

88. For the firm of the experimentally organised economy, its survival capacity depends on its ability to staff itself with the right, superior competence (Eliasson, 1990b). This engages it in a recruitment and "internal learning" process that is fraught with obstacles. Firm management constantly faces the problem of retraining or discharging people with the wrong specifications. Employees resist this, demanding "insurance" on top of their pecuniary compensation. Internal education may offer a partial solution that satisfies both employer and employee, but what internal education can achieve with obsolete labour is an open empirical question. The interaction between employer and employee is excessively complex, owing to the extreme heterogeneity and instability of competence demands and supplies. For this reason, the organisation of this interaction can never be perfect, but it is amenable to improvement through experimentation if experimentation is accepted or allowed. The outcome at each point in time is the state of organisational knowledge of firms.

89. In the firm as a hierarchy of competent work teams (Eliasson, 1990b) the recruiting, training and firing of people with heterogeneous competence attributes, and the methods chosen to perform these selections, are critical, since competence, or talent, is largely tacit and difficult to communicate and evaluate. Choice is made after inspection in use. Hence, the choice of the incentive contract used to monitor and compensate labour becomes a critical organisational technology.

90. A wave of recent literature has addressed this issue, but it is difficult for analytical models to cope simultaneously with the many elements of a job contract and the flexibility that is a desired workplace property. Optimal contracts have to be rather loosely structured and rest largely on informal agreements.

Using very simple partial models, several recent articles have explored certain aspects of such job contracts, such as controlling *shirking* through *deferred wage payments* (e.g. Lazear, 1979, 1981). Grossman (1977) studied deferred but high pay as a way to prevent good workers from quitting, and Salop and Salop (1976) offered wage profiles as a criterion for screening quitters from non-quitters.

91. With risk-averse labour, deferred wage payments can also be interpreted as a form of *insurance* for unstable income streams. Harris and Holmström (1982) have the employer charge a premium, in the form of a lower wage, for accepting downwardly rigid wages. This premium diminishes with seniority or age, and they thus demonstrate the existence of a tilting of the wage schedule with age, over and above what is warranted by productivity. They conclude that implicit long-term contracts will emerge that protect risk-averse workers from wage changes induced by fluctuations in perceived productivity.

92. Such contracts would be even more likely with a job market characterised by constant and unexpected shifts in required competencies, which render formerly productive labour less so on the new types of tasks demanded. They would also be expected to include provisions for retraining. Feuer, Glick and Desai (1991) pursue this possibility, arguing that firms offer trained workers the expectation of long-term employment which workers buy at lower pay, even though they have received general, firm-financed training that increases their tradability in the market. They explain this in terms of a lowered bargaining position in the internal labour market. Risk-averse employees become hostages to an employer who is well informed of their new capacity compared to the external market.

93. The standard explanation for the upward tilt of the pay schedule, however, is productivity improvement through *on-the-job training* (as in Mincer, 1974). The job-matching models of Mortensen (1975) and Jovanovic (1979a) were originally designed to study turnover phenomena, but give interesting insight into the consequences of *employer learning* and the *allocation* of tasks. With seniority, the employer learns about the skills of the employee and matches skills better with jobs, thereby increasing productivity. This is another explanation of the tilted wage schedule.

94. In his 1981 article, Lazear argued that the incentive arrangements to eliminate shirking were what mattered for the upward-sloping wage schedule, not on-the-job training. Lazear and Moore (1984) pursue the same theme by setting up a model in which the employment and self-employment contracts are compared. In the latter, incentives to avoid shirking are not needed. They conclude from an empirical application that most of the slope of the age-earnings profile is accounted for by the need to provide incentives, not by on-the-job training. Kandel and Lazear (1992) argue that a relevant discussion of labour market efficiency should include the whole range of contracts between regular employment and self-employment, especially partnership and profit-sharing arrangements, but also all kinds of endogenous, implicit contracts operating through peer pressure of various kinds. They conclude that when profits are shared, *peer pressure* helps control the free-rider problem in firms. If such peer pressure cannot be organised, free-rider problems increase with the size of the partnership. *Norms of behaviour* that develop in firms should be looked at as an equilibrium phenomenon aimed at internal self-control to the benefit of most members of the competent team. But peer pressure can also work against the interests of the employer if workers team up to set low standards; or, in schools (Bishop, 1993b) where, in the absence of teacher-imposed standards, or very strong student incentives to the opposite effect, the worst students set the norms.

95. Many other aspects of the job contract could be studied. However, they cannot all be dealt with analytically in the same model, nor can they be dealt with explicitly in the same contract. To study them

all in one context, it is necessary to use non-analytical simulation models. A more detailed discussion of some of these partial models in which the competence and incentive problems are discussed simultaneously can illustrate the practical problems of contract formulation.

3.3 The firm as an insurance company: the internal insurance market

96. Labour market theorists traditionally approach their problems from the point of view of the employee, forgetting that the employee works for an employer concerned with extracting surplus value from her/his effort, and they present the firm and the labour market very much as a social insurance operation (e.g. Solow, 1990). In this respect, the firm of modern labour market theory is theoretically and empirically at variance with the theory of the firm suggested by the "modern" theory of finance (Eliasson, 1992a). Lately, labour market analysis has begun to incorporate the labour management problems of the firm (e.g. Milgrom and Roberts, 1992, Chapter 7) and, in an attempt to address the upward-sloping wage schedule, goes beyond the human capital analysis and the training of employees whose compensation should increase with seniority. *Contract theory* has -- recognising the dual nature of the firm as an employer and an insurance provider (Azariadis, 1974) -- been a moving force in this development. Asymmetric information and the demand for insurance of labour therefore characterises these approaches. The modern approaches emphasize the nature of the labour market contract and the problem of controlling for moral hazard. Also, the employer wants a guarantee against costly disturbances in the workplace. The contract can therefore be seen as an agreement on how risks and income should be shared (Miyazaki, 1977). A particular problem is the ability of *insiders* and the employed to exclude outsiders from their beneficial agreements to secure overcompensation for themselves (Lindbeck and Snower, 1988).

97. Becker (1964) and Mincer (1974) observed that the worker's wage is not in line with his/her productivity. Lazear (1981) does not take this as a refutation of the assumptions of human capital theory, arguing that it is optimal for a worker to be underpaid early in his/her career and overpaid later, and that this arrangement is also optimal for the employer. This requires that the worker has a reliable contract that guarantees the higher pay when his/her productivity is low (essentially the same as a pension contract with the employer). Lazear then argues that the employer wants a constant, reliable work input and no shirking, while the *employee*, who is risk-averse, wants a stable, predictable income. Hence, the prerequisites for an *internal firm insurance market* exist. This corresponds to an extension of the lifetime-consumption hypothesis, adding insurance for labour market risks and pension saving to the tasks of the firm. The insurance premium is the internal market price. The more efficient the labour insurance work contract in minimising shirking, the cheaper the insurance for the employer (Eliasson, 1992a, p. 110). Such internal firm insurance markets combine naturally with internal firm markets for competence ("labour"). But we are now in the exclusive domain of very large firms. The small business market for competence and insurance, where a large part of business innovative activity occurs, is an entirely different matter.

98. Harris and Holmström (1982) argued that risk-neutral firms are imperfectly informed about the productivity potential of risk-averse labour. With downwardly rigid wages, the employer wants a guarantee for the lack of flexibility and the risk of having to keep highly paid low-productivity labour, and it therefore pays less, upgrading the wage (reducing the "insurance premium") as the employee learns. Because of the external market and the time it takes to learn, firms demonstrate that earnings can be positively related to seniority (or experience) even after controlling for productivity and the insurance effect.

3.4 The firm as an educational (learning) organisation

99. The business firm operates on, and extracts a surplus profit from a dominant competence capital (Eliasson, 1990b). This knowledge or competence is embodied in groups or hierarchies of individuals which together create larger production values than the sum of all individuals. The art of the firm as a "competent team" is to compose an efficient such team structure. To build and organise such knowledge in firms has come to be called "organisational learning" in recent literature (Eliasson, 1991b, 1991c, 1992b). An important part of this internal learning is the career of the high-level people in the organisation. Most of organisational learning is a joint production process (Rosen, 1972) indistinguishable from production. The most important cost for organisational learning is business mistakes made by career people on their way up (Eliasson, 1990b). Some of this learning takes place in separate classroom contexts and many big firms, notably US, maintain separate university campuses for their career people -- we know that resources devoted to total internal competence development in private industry are very large and of an order of magnitude of the entire US college and university system (Eurich, 1985). Few studies have, however, been devoted to the internal educational activities of private industry, even though interest in the research community has increased in recent years. Most attention has been principal and theoretical, and empirical insight is what is needed to choose among all the theoretical ideas proposed. Above all, such empirical studies should tell us something about the nature of competence that firms attempt to build, and also give ideas about what schools should teach to make students better prepared for the labour market. Above all, we will probably then find (a hypothesis -- Eliasson, 1990b) that firms want their employees to be prepared for change and educated to be ready to retool intellectually, i.e. to have a good basic knowledge in communication skills (see further below).

100. Even though empirical insight is lacking, some theoretical analyses highlight important principal problems in a very pedagogical way. For instance, if labour quality is what matters for compensation, and if quality depends on on-the-job training, the upward-sloping compensation schedule should be the result of internal training. Lazear (1981) rejects this view, but Becker (1964), Carmichael (1983), Mincer (1974) and Waldman (1984) support it. Both Hutchens (1987) and Björklund and Åkerman (1989) present empirical evidence in favour of the training hypothesis.

101. How to handle risk-averse employees in a risky labour market situation is another contractual problem that requires principal (theoretical) analysis before it is studied empirically. To what degree (and why) do firms have to cover some of these risks, and to what extent can they be outcontracted in the market?

102. *Insurance, lack of information, and competence*, hence, constitute the core problems of the labour contract. It will be argued that insurance and education are alien but possibly profitable production tasks for the firm. But should the firm take on the insurance task? Are there not more efficient insurance specialists in the market than in the firm (see Box 5.1)? There may be, and market forces currently appear to be pushing firm organisations to use them. This raises questions about how to formulate the employer-employee contract with respect to the exposure of employees to normal labour market risks.

3.5 The recruitment problem

103. In the experimentally organised economy, knowledge will typically be tacit (Murnane and Nelson, 1984) and difficult or impossible to communicate. When recruiting new talent, the employer takes a risk

which she/he seeks to avoid by *screening* potential employees and by using properly formulated *incentive* contracts. In Hirschleifer's (1973) terms, the worker becomes an "inspection good".

104. Holmström and Ricart i Costa (1986) examine a risk-neutral firm (an owner) ready to hire a risk-averse manager. The owner can only learn the manager's talent through observation. Thus, the formulation of the employment contract becomes an important part of the firm's organisational technology. The employer/owner wants both to *learn* about the manager's quality and to keep this knowledge secret from the outside market so as to be able to keep a good manager and get rid of a bad one. Harris and Holmström (1982) demonstrated that the asymmetrically informed market normally will exhibit rigid (upward and downward) compensation schemes. Wage increases occur when the external market understands that the manager's value exceeds his/her current wage, thus forcing the employer either to raise his/her salary or lose him/her. Similarly, risk-averse labour accepts a lower wage as an insurance premium for unexpected adverse changes, thus creating a downward rigidity in wages.

105. Ricart i Costa (1987, 1988) further elaborates this model. The hired manager knows his/her talent (productivity) better than the market and the employer do. This means that the manager will be paid below his/her productivity and produce less than what is socially optimal. An incentive contract that forces the manager to take on some of the employment risk and thereby be stimulated to exhibit his/her competence is more efficient for all parties. This contract analysis can of course be generalised to all kinds of employer/employee relationships, including the recruiting of workers in a factory. It also gives a rather clear picture of how the responsibility for, and financing of, training should be shared between employer and employee.

3.6 Incentive contracts coping with asymmetric information

106. If the manager, the employer and the market are all differently informed about the capacity of the manager, potential external employers can perhaps observe the results of his/her work, but they cannot distinguish between talent (or competence) and luck. The external employer will therefore offer a wage below the productivity of a good manager but above the wage of a bad one, i.e. above the market wage. Very good managers will stay and be exploited, while lucky bad managers will leave. This is a case of "adverse selection".

107. The solution is a contract that makes it possible for the good manager, by taking on some risk, to exploit the fact that she/he knows more about her/his own capacity than the employer or the market. There are many possible such contracts. Ricart i Costa's manager takes her/his contract and shows it "to the market" which will offer better terms but with an incentive contract which raises the offer if she/he is good. Waldman (1984) finds, using similar assumptions, that external firms will assign wage rates to jobs rather than abilities. Since workers holding "high-ability jobs" may only be marginally better than the workers on low-ability jobs, many such assignments will result in overpaid workers on high-ability jobs and inefficiencies.

3.7 Overinvestment or underinvestment in competence accumulation; on productive redundancy

108. The above discussion sheds some light on the classical *argument for underinvestment* in on-the-job training, which is that firms investing in the education of their labour will lose their trained workers.

It is argued that the firm carries the training costs, while an outsider firm, which does not, can hire the upgraded worker and pay a higher wage. This is overly simplistic. Competence is always heterogeneous and extremely difficult to evaluate for employments other than the exact one for which it is currently employed. The employer investing in the worker will always know much more about his/her competence than will the external market, and hence will be willing to pay more, provided the investment in education has been profitable. The uneducated worker, who cannot benefit from the investment in training and be profitable, will not receive internal education. Since workers are differently endowed with respect to their ability to profit from education, only those with high *receiver competence* will be profitable investment objects for the employer. They will receive the training, as data on the distribution of resources for training within firms indicates. This transforms the on-the-job training issue into a selection problem: only the best receive investment in education at their employer's expense and then become even better. This conclusion is supported by empirical evidence (see, for example, Eliasson, 1986a).

109. The *overinvestment* issue (Arrow, 1962; Hirschleifer, 1971) builds on the waste of resources that follows from competition through duplication, although it has also been argued (Nelson, 1959) that duplication is necessary. The *underinvestment* issue, instead, sees knowledge (information) as asymmetrically distributed, in which case maximum exploitation of competence is not achieved. This is true if diffusion of knowledge (learning) is costless and/or if knowledge is homogeneous and substitutability is possible in each application. Both propositions are false in the experimentally organised economy.

110. The problem with concepts like education, knowledge and competence is that they are positively defined. Competence always gives positive effects, and you can never have too much of the good. Bishop (1993a), for instance, is very careful in pointing out that a broad excess education is good for workplace ability, since (in particular) it makes the individual both more flexible and more productive. Rumberger (1987b), Tsang (1987) and others, however, do not completely agree. They find that the individual does not get paid for such excess skills, only for skills employed at work. If correct, this observation suggests that the employer does not value the existence of extra but temporarily idle skills, indicating a preference for firing and hiring when new skills are needed, and (in this case for the US labour market) for low transaction costs. Hence, "stand-by skills" should be looked at as a private investment on the part of the individual, to activate when he loses his job: an *insurance*.

111. More serious than underpaying excess competencies is the possibility that excess education may make the individual less productive, a possibility observed already by Berg (1970) and supported empirically by Tsang (1983), Burriss (1983) and others. The argument is that overeducation creates dissatisfaction on the job (Tsang, Rumberger and Levin, 1991) resulting in lower performance and a pronounced inclination to change jobs. For the employer this is a negative factor, since it is extra costly to have a dissatisfied, perhaps low-ability, worker on the job who is constantly on the move elsewhere.

112. The literature on overinvestment and underinvestment is based on the erroneous notion of almost homogeneous capital and the definition of a well-specified equilibrium benchmark for what is optimal. Once the extreme heterogeneity that is typical of human capital has been introduced, redundancy becomes a desired property of human capital as a means to achieving on-the-job flexibility.

3.8 Tradability in talent and certification of skills

113. The above arguments for and against the underinvestment hypothesis can be further complicated by considering *tradability of competence*. On-the-job training and education are normally user-specific, even though there is plenty of evidence to suggest that career people get extensive general education at the expense of the employer and that firms (occasionally) upgrade the general skills (reading, maths, etc.) of their workers to make them more productive on increasingly sophisticated machines.

Investments in tradable skills -- a private affair

114. Skills and competencies are more or less tradable in the market in the sense that the same competence capital can be applied efficiently at many job locations and that the market can to some extent assess the talent-competence combination embodied in an employee. Hence, the traditional argument for underinvestment in work skills -- that the worker will leave, taking her/his skills -- can be given a different meaning, also supported by evidence from firms. Certain worker skills related to decentralised production processes (welders, etc.) are more easily tradable in the market than are job-specific skills tailored to the assembling of particular products. If not available locally or nationally, production can be relocated to where such skills are abundantly available. This appears to be one reason for the outsourcing of certain low-skill production of Swedish and US multinationals. This means that for a worker in a tradable-skills profession the task of providing for training becomes a private matter. If the individual is risk-averse and will not take on the investment, underinvestment may occur. This is one important reason for making it easy for the individual to provide for his own insurance and financing of continuing education along the lines suggested in the box on page 16.

115. The situation was different in earlier phases of industrialisation when markets for skills and competencies did not exist and the skilled worker became a hostage of the employer.

Efficient training requires both competence and incentives

116. Worker skills were then developed in so-called industry schools established close to production sites at the initiative of firms and paid for by the employer. This practice still continues in Germany and in Japan. In the United States, practice varies but the general situation appears to be that there is little left of what may have taken place in the past. The Swedish Government, opting for an egalitarian solution to the wage-setting problem, gradually socialised the production of worker-training services during the postwar period. Since the development of job skills had been subsidised by government, the compensation (or competence rent) was correspondingly reduced. Two serious consequences followed this reorganisation of worker training: it lost in efficiency from being alienated from production; the quality and experience of teachers was lower. Furthermore, incentives to train were fewer. This point will be returned to in the next chapter in the discussion on the relative efficiencies of the four models of worker training: the Swedish, German, Japanese and US.

Certification and standard contracts conserve the work organisation

117. Tradability requires a fair amount of homogeneity in specification to reduce market information costs, or a sophisticated and flexible *certification* technology. The theoretical literature has therefore focused on the ability of managers to assess workers' talent before hiring them and on the possibility of

formulating contracts that provide incentives for workers to show their talents. This is also very much a concern of real managers.

118. The general conclusion one can draw from literature and from the analysis in this chapter is that tradability of skills or competence benefits both the worker and the economy. Welfare for the individual and output of the economy can be increased by improving the functions of the labour market and by improving its efficiency in allocating competence.

119. A particular instrument for this improved allocational efficiency is *certification*. Certification means that particular skills are graded, or minimum skills are certified, such that the employer does not have to test or try them out during a first inspection period. The first problem is whether the useful (on-the-job) skills can really be ascertained and certified; the second whether jobs and skills traded in the modern labour market can at all be specified and are stable enough to be meaningfully certified. The discussion of certification or quality control of training and education has often been carried out along the lines of certified production in the modern industrial production system. This is a complete misunderstanding of what skills mean in the workplace. First of all, the competence capital offered by the individual is extremely heterogeneous, even within the categories of certified skills. Certification in manufacturing production means quality control of well-defined specifications. Even recognising that, certification of skills by necessity means that some kind of standard of skills has to be applied. This standard has to relate in some way to an existing job specification. If the existing one is complex and the skills needed likewise, some kind of simplification is required. Two kinds of error will thus unavoidably creep into any standardisation scheme. Simplifications will decrease the information content (to the employer) of the certificate. The changing nature of jobs and the increasingly-used job specification will either make certification obsolete or impose conservatism on the work organisation, in the sense that innovation and modernisation slow down. Even though there is a need for improved signalling in the markets for competence, certification of skills is a technology in itself that demands significant competence to design and implement.

Does efficient signalling through grades and certification make the labour market more informed?

120. This problem of improved information signalling in the labour market through certification is perhaps most important at the first hiring decision, considering the fact that the newly recruited worker today is normally first put into a training sequence and that the employer is very concerned that his training of work-specific skills be efficient and profitable (Kazamaki Ottersten, 1994b). For this, general communication skills are demanded, calling for improved means of filtering out low-grade and, hence, low-ability workers already at recruitment. Lacking other information (recommendations, etc.), the employer often looks at high-school grades as signals of general communication skills. This leads to the question of standards of learning at school, efficient grading (or certification) and the general problem of creating an informed labour market in an economy subjected to constant structural change. This question will be addressed in the next chapter on the production of school services.

121. Some theoretical literature, however, backs away from formalised signalling and, rather, argues that the market itself has better ways to come up with improved signalling devices if it is left free to do so. There also exists a rather sophisticated theoretical literature arguing that the fact that a worker receives a particular contract is a signal to the market that he is good -- and, vice versa, that he is bad if he receives subsidised government training (see below). There is also the perhaps more relevant possibility to consider,

that tradability or mobility in the labour market is part of the training and competence capital that accrues to workers or managers, and that too much seniority on a job makes a worker obsolete.

3.9 Receiver competence

122. Competence is the intangible asset that contributes to a firm's performance by conferring economies of scale to all other factor inputs. Competence resides in human beings or in teams of human beings in the business organisation, not in the machines. It is the result of past intangible investments in education. Converting invested money or time into productive competence capital is, however, a production process in itself which requires, above all, prior receiver competence. The perhaps most important "capital" of an individual or an organisation is the ability to learn efficiently and to be flexible in learning, a competence we sometimes call communication skills or simply receiver competence. The allocation of resources in internal markets for competence development within a firm will therefore be strongly dominated by workers' characteristics, notably their competence to receive education -- a factor that affects the firm's profitability and its willingness to spend internal resources to train individuals.

123. The conclusion appears to be that well-educated workers are more capable of rapidly adding new knowledge to existing knowledge and will receive more education than those with little basic schooling. Training resources will be allocated only after a period of inspection. Since the employer knows much more about the employee's productivity than does the external market, investments in training of well-educated and/or talented employees should always be profitable, even though the employer pays the employee more than the external market will offer (Eliasson, 1991c, 1992a).

3.10 Education as a cumulative process

124. The underinvestment issue recurs here as a difference between private and social returns to educational investment. Should scarce educational resources be allocated towards solving the workplace problems of the disadvantaged at the expense of economic growth, or should they be allocated to maximise economic growth, and the distribution of income generated then tilted in favour of the disadvantaged? Both solutions have been advocated and tried in different nations. The final income redistribution scheme affects incentives and, hence, growth negatively, while compensatory education appears not to work. At least the resources needed to correct later what students failed to learn in primary education are very large compared to the results. To sort out this question will be the task of the next chapter.

125. It is clear that incentives to invest in education matter strongly to individuals. These incentives must therefore be incorporated in the school system for it to be efficient. Thus, a change in the incentive schemes of the economy will have consequences for the organisation of school production. There are several issues:

- individual incentives to make long-term decisions (the *leverage effect*);
- the joint efficiency of the educational system and the labour market to help the student find his/her *optimal career path through school and work*;
- the capacity of markets to evaluate and reward competence (*labour market efficiency*);
- the content of education (the *educational agenda*).

126. These items are not unrelated but should be discussed separately:

The leverage of basic education: receiver competence

127. The leverage issue is by far the most important and is raised very early. Attitudes are formed in the family, mainly before school begins. Important communication skills begin to develop in primary school, and the competence base for further education takes shape during a period when the individual is typically uninterested in the long-term rewards of education. The leverage effect works through the *cumulative development of the competence* to receive more education profitably (receiver competence). Its significance depends on the relative importance of the educational-investment hypothesis, and if the investment effect is strong, choices made in the school career affect leverage even more so. Public policy probably has a task here, provided authorities are sufficiently competent, in comparison to individuals, to take responsibility for people's long-term decisions.

128. Measures should then be directed towards:

- making basic education more attractive and more necessary;
- making the wages of young workers low enough that their on-the-job training incentives and possibilities are not endangered;
- improving the capacity of the labour market to reward competence.

129. An important problem is whether it is possible to identify some *basic general competencies* that the school should focus on. There is a hypothesis that creativity is what matters and that school should "teach creativity" (Reich, 1991). A more relevant concern is how to organise school and work so that the creativity of the individual is not destroyed. This will be discussed in the next chapter.

Labour market reorganisation in support of educational policy -- labour market deregulation

130. The competence endowment of an individual is not known to the employer for a considerable time. Evaluations are made at hiring and throughout the career. It is to the disadvantage of individuals if this evaluation does not proceed smoothly through job changes and throughout careers within the organisation. The assumption here is that the individual will rarely find the best employer early. Poor labour market performance can make the best educational system economically ineffective. This means that most individuals will have less than satisfactory jobs for most or all of their working life. The labour markets of Europe in particular are cluttered with restrictions on mobility and with discriminatory treatment of newcomers to workplaces. Much of this is the work of unions and employers. Government has an important responsibility for removing such market imperfections.

The rewards for competence

131. In no other market than the labour market are restrictive practices aimed at lowering the level of information encouraged by authorities. Quality evaluation in markets conflicts directly with ambitions to equalise income, irrespective of contributions to production. Revealing low ability on the part of the employee to the employer will probably mean that he or she will not be hired. For similar reasons, high-

school grades will sometimes not be made available to employers in the United States. This affects incentives for individuals to invest in their own education negatively. Taken together, such restrictions lower the efficiency of the labour market to stimulate competence development and to allocate competence, and probably also the welfare of individuals. There are two sides to this problem. Talented students who would otherwise have become very productive workers decide on a low-profile career that involves less effort and affords more leisure. For instance, they become medieval historians rather than production managers in a manufacturing plant. Untalented students find it meaningless to struggle to learn, because learning is difficult and frustrating and will not significantly affect their earnings. In the long run, however, the consequence is that they earn much less and the income redistribution problem becomes even more severe. Second, from the perspective of a dynamic life-income cycle, incomes policies aimed at redistributing income in the short (static) run may result in larger income differences and unemployment in the future, due to lower incentives to invest in education, a consequent lower quality of workers, less favourable income developed and greater labour market risks. The more relevant the educational investment hypothesis and the mechanisms filtering the students onto different educational paths, the stronger this effect.

The content of education: the basic competencies

132. Education appears to matter for growth, and general communication skills matter significantly more for productivity than other skills, notably those that enhance the capacity for continued on-the-job learning. The school agenda is cluttered with items that have little to do with work performance. It does not emphasize building skills that do appear to matter, and in many countries it lacks items that would contribute to communication skills. School production could be reoriented and incentives could be tailored so as to achieve a reorganisation and *focus of educational output* and effort. Although there is little research evidence that shows how best to change the school agenda, the evidence does suggest the lack of:

- a) *communication skills* that should have been provided at school, to the disadvantage of employees;
- b) *the work discipline* that should have been developed prior to entering the labour market;
- c) the ability to organise one's own work and to work hard, even though this is not likely to be known at hiring.

3.11 The problem of heterogeneity and underinvestment in equilibrium

133. Underinvestment has no empirical meaning unless it can be compared with some well-defined, better or optimal equilibrium. These better-equilibrium situations are always fictitious, since they involve theoretical constructs. Hence, theoretical concerns always underlie any discussion of the possibilities for underinvestment or overinvestment. The existence of equilibrium in turn always has to be seen in the context of a theoretical conception of a model of the overall economy. Such economic models are practically always static and thus not very useful for analysing long-run phenomena like education. The underinvestment issue thus becomes a very complex one and it may not even be a relevant concern.

134. Jovanovic and Rob (1989) present a knowledge-dependent growth model that operates on differences in capacity to understand new things. The heterogeneity of knowledge creates difficult problems for the economist in establishing unique and stable equilibria to be able to derive clear results. The reason for this is the presence of adverse selection phenomena, which are most severe when the increase of heterogeneous knowledge is dominated by imitation rather than invention. In equilibrium situations, underinvestment in knowledge occurs because of externalities at the diffusion stage, since imitators capture the rent from innovation (the standard argument). Without such externalities, equilibrium coincides with the maximum of discounted output, net of matching costs. This means that there must be a trade-off between imitation and invention that maximises output.

135. The important problem of heterogeneity, however, relates to the difficulty of organising perfect markets. If heterogeneity arises as a result of on-the-job learning, each particular competence package is optimal for a particular task. With sufficient levels of heterogeneity (or diversity), the conditions for an experimentally organised economy will exist, and perfect, full-information equilibrium and markets will not. For present purposes, it is sufficient to observe that simple on-the-job learning, or experience accumulation in general of the kind the Jovanovic and Rob (1989) article suggests, is sufficient to create such market properties. The career is an illustration of this situation. What the analysis of consequences suggests is that the prime concern of government educational policy should be to make sure that the labour market for competence works. This is something very different from the problem of underinvestment in education.

3.12 The career

136. The career is a particular form of labour-quality selection combined with on-the-job training. While the training for tradable labour skills can be separated from the job, the accumulation of higher management competence must take place on the job, and the more so the more unique the competence capital of the business organisation. The qualities needed to run a firm are typically tacit and non-specialist. Acquiring them requires intense and risky work effort. The job contract has to be designed to support the tacit organisational competence of the top competent team (Eliasson, 1990b). Typically, as long as the competence specification of this team passed on through organisational learning is competitive and captures a rent in the market, it will be accumulated synergistically with work.

137. Such team competence acquired through organisational learning is capable of innovative behaviour, but improved innovative behaviour or the organisation is not the purpose of team-learning that always draws significantly on internally accumulated experience. If the competitive situation changes radically, the competent team may be incapable of dealing with the new situation. The team's situation is then similar to that of a worker who has acquired his skills through rote learning. It does not possess the explicit intellectual capacity of an educated individual to retool itself. As a rule, rapid injection of external know-how is needed. This requires destroying lower-level resistance to change by removing people. This has been the situation at IBM during the last few years.

138. For all practical purposes *a firm*, whether large or small, *cannot be organised for doing something else* if needed. Hence, the focus of internal competence-accumulation has to be on its main business: technology, markets, etc.

3.13 Organisational learning and the firm as a learning organisation

139. The firm incorporates organisational learning as a natural production and investment activity. Organisational learning (Eliasson, 1990b) is much more than the training of people. It includes building the tacit competence-capital of the firm that is embodied in its organisation. This organisational mode is a technology in itself, and it significantly affects the life and experience capital of its employees.

140. The problem raised by organisational learning concerns the way to give this typically tacit knowledge visible analytical form. Aoki's model (1986) is particularly useful if one attempts to link education and internal training, via firm organisation, to the performance characteristics of the firm. Aoki distinguishes between the American A-type organisation, which achieves efficiency through internal specialisation, and the Japanese J-type organisation, which builds on the ability of workers to relate to the whole organisation, thereby acquiring competence to solve local problems that would otherwise require other specialists, and to discover new possibilities, an individual capacity that is systematically built through self-motivated learning-by-doing and job rotation.

141. The A-type organisation requires specialists in co-ordination (managers) and incurs large administrative costs for monitoring and control. Specialisation also means standardisation of tasks and markets for standardised, specialist tasks. This may increase labour mobility among firms but means that the integration of specialties in production becomes another, higher-level specialty. As the A-type organisation is further specialised and refined it leads to production automation and efficient production, provided the organisational structure stays optimal.

142. The J-type organisation, on the other hand, makes co-ordination an organic part of the whole and therefore requires fewer specialist co-ordinators (managers). Mutual understanding among the members of the firm (a culture) is the result of the systematic training of individuals. It takes a long time to develop and therefore requires longer life-time employment contracts.

143. Aoki especially emphasizes the capacity of the J-type organisation to communicate internally efficiently, which means that it does not need the elaborate A-type organisation with well-defined responsibility and decision hierarchies and a preoccupation with shirking. The J-form is self-monitoring and difficult to represent in organisational charts. It is not exactly known how decisions are taken and executed and how responsibility is exercised.

144. While the J-type organisation takes good care of its workers -- this is in the interest of the firm -- and gives them useful training and work experience, they become hostages of the firm because they have a knowledge capital that is difficult to trade. This specificity of competence capital will also be characteristic of the entire firm, making it efficient in gradual innovation but less capable at radical innovation to cope with entirely different competitive situations. Again the recent situation of IBM is illustrative, as should be that of several Japanese companies.

145. The A-type organisation can force change "top down" when the situation demands it, by imposing new specialists on the organisation to ensure "specialist" top management. The J-type organisation does not possess this top-level specialist group. The organisation has been trained to self-organise, and large changes would destroy the self-organising capacity of the firm's experimentally developed internal signalling system (Eliasson, 1976a, 1992b), leaving nothing to put in its place if the old system fails. The J-type organisation will therefore be conservative and find radical innovation difficult.

3.14 The self-employment contract

146. It has become standard jargon to discuss economic matters in terms of employed workers and capitalist employers. Technological development since the industrial revolution has led to a predominant use of the wage/employment contract, a development that has been further strengthened by the union movements. This is by no means necessarily the best organisational format of industry, and the labour market and the efficiency of the *wage/employment relation as the standard contract form* in Western industrial nations is likely to be affected by ongoing technological change. In fact, new technological change that favours smaller-scale, competence-intensive service production is gradually undermining the efficiency of the wage/employment contract as a standard contract. The market is gradually recognising that an enormous variety of contractual forms exist between the employee contract and self-employment.

147. The more initiative and risk placed on the employee by the job contract, the closer she/he moves to "self-employment" status. The new contract-oriented literature shows that inefficiencies of the classical employer-employee wage contract increase as employee quality matters for job performance. The employer can only assess quality after a long inspection period, and this lowers incentives among myopic and risk-averse individuals to invest in personal upgrading. Very competent labour -- which knows its competence -- will always be grossly underpaid on a wage contract. The employer does not know the full scope of a superior competence and does not have to pay for it because the external market knows even less. In any case, there are limits to internal wage differentiation on the basis of competence. Thus, a competent worker who wants to be fairly paid has to work under a different contract: self-employment or close to it. It is logical to assume that efficiency will increase as initiative and labour market risks are moved from the employer to the individual, since the employee will make a greater effort and the competence of the employer will be more efficiently exploited.

148. If this is so, one would expect to find a higher propensity to operate on contracts closer to self-employment than wage employment among high-quality individuals (whether because of talent or education). This is to some extent supported by facts. It has even been shown that the self-employed receive greater pleasure from their work than those who are employed (see Blanchflower and Oswald, 1993). During the last two decades the hundred-year downward trend in self-employment as a proportion of total employment has reversed in the United States, and the self-employed tends to belong to the most highly qualified labour market groups (Blau, 1987). One reason appears to be the change in industrial structure, which has made small-scale, competence-intensive production increasingly profitable (see Chapter 1). Consultants appear to be the most highly educated professional group both in the United States and in Sweden, and typically work alone or in small competent teams (or firms).

149. It is interesting to speculate about whether similar factors explain the strong increase during the last one or two decades in the employment in the United States of highly educated labour at strongly increasing relative wages. Will there be even more self-employment as highly educated labour finds that it can only capture a fair share of its competence rents through self-employment? One may also wonder why US industry employs more highly educated labour than in other advanced industrial nations.

3.15 Main conclusions

150. There is no solid information about the best educational practice. The educational process continues far into working life. The organisation of school and labour market are part of the same problem.

The identification of talent and competence is very lengthy owing to extreme heterogeneity. If the search process is to be efficient, employer-employee contracts have to be designed so that decisions are automatically taken at the levels where competence evaluation is most efficiently done. The heterogeneity of human capital and the increasing predominance of competence-intensive production means that the standard-form wage employment contract will be increasingly abandoned in favour of a more differentiated contract-technology in the labour market. This means that the scale efficiency associated with a dominant standard-employment contract is losing ground to more flexible contractual arrangements in the market. The way this contract and market technology is organised is also a significant part of the knowledge base of the economy.

Chapter 4

The Production of Educational Services

151. In manufacturing, once the product has been defined one can proceed to organise production efficiently. Educational output, instead, is badly defined. This makes the assessment of the efficiency of educational production particularly difficult.

152. In order to proceed quantitatively, the purpose of education needs to be narrowed. Among the three traditional tasks of education -- to support *individual fulfilment*, to build *economic competence* and to create *socially responsible citizens* -- the following discussion will focus on economic competence. However, earlier studies (see Section 6.3) have shown that the more important aspects of social responsibility are also critical to economic competence at the workplace. Workers unable to co-operate with colleagues have lower rank in most workplaces. It is also obvious that economic competence is a major element in the ability of the individual to achieve other objectives.

153. Even within the restricted scope defined here, it is necessary to address several problems that have so far either received scant attention or have remained unresolved. *First* is the relative importance of the investment and signalling (filter) effects of education. There are several widely divergent theoretical versions of this issue, each of which implies different policy advice. Learning and selection occur simultaneously and the lack of empirical insight poses problems for educators. *Second* is the problem of separating individual performance (talent, efforts) from school performance; and *third*, the contribution to scholastic achievement of home and parental inputs, the so-called *social capital*. *Fourth*, the incentive problem discussed above recurs as student motivation and scholastic interest.

4.1 Does general education matter?

154. The analysis of the incentive problem in Chapter 2 suggests that the educational process can be roughly broken down into four types that serve different purposes:

- i) basic ("high school");
- ii) higher education (university);
- iii) vocational (specialised training centres or on the job);
- iv) updating (recurrent education).

All are carried out in a *classroom context* in educational institutions separated from the job, on the job, or mixed.

155. *Basic* education is general in orientation and serves to build the competence for further education (receiver competence). These are communication ("academic") skills such as language, mathematics, presentation techniques (writing, oral presentation, etc.). Basic education also includes the development of non-academic qualities such as discipline, certain moral principles, etc., to the extent that they are not developed at home. In that respect, basic education is important for shaping socially responsible citizens.

156. *Higher* education can be a mixture of basic education and on-the-job education, since some of the skills taught at universities are professional and include a vocational element (doctors, lawyers, architects, etc.). It is probable that higher education, more than other forms of education, allows the individual to achieve personal goals not necessarily related to his/her economic job performance.

157. *Vocational* education has a more professional focus: the acquisition of skills, useful specialist knowledge, or *professional* experience. The main goal is job-related usefulness. The more advanced the job, the more vocational education matters. For simple jobs, vocational skills are acquired directly after high school as on-the-job training. For more advanced jobs, an academic degree often precedes a varied career. Formal classroom education may be important, but only as a stepping stone (one extreme case is the research career, which, despite its location, is vocational).

158. As a number of studies on the nature of jobs in advanced industry show, work tasks are becoming more *abstract* and further removed from the actual physical processes, which require less and less manual involvement (Eliasson, 1980, 1986a, 1987b; see also Reich's notion of the "symbolic analyst", 1991). Such vocational skills increasingly demand prior advanced academic education.

159. *Updating* or recurrent education, or adult education, adds something that is lacking to an existing store of knowledge or replaces knowledge that has become obsolete. It involves taking the worker/student out of the job context and/or into a new job context.

160. Prior to World War II, on-the-job and recurrent education received little attention. Basic education was provided in elementary and high schools, and vocational education (training) was provided through the apprentice system. The latter was replaced in the postwar period by government-run vocational schools, separated from the job. Recurrent education, run and subsidised by the public sector, increasingly became a matter of public concern as well, and Sweden took the policy quite far (see below).

161. The high and increasing public share of educational production activities is partly explained by the "fairness" motive in the "compensating-education" doctrine of the early postwar period. Failure of early idealistic school reforms may explain why the "nationalisation" of educational production is now giving way to various forms of privatisation. The *conventional view* of the educational performance of various countries appears to be:

	Basic	Higher	Vocational	Recurrent
<i>United States</i>	Poor	Excellent	Poor	Poor
<i>Germany</i>	Good	Poor	Excellent	?
<i>Japan</i>	Good	Poor	Excellent	?
<i>Sweden</i>	Medium	Medium	Medium	Good?

162. What is meant by "poor" and "good", and why is school performance seen as better in some countries than in others? In the absence of a well-defined school product, the efficiency of schooling requires addressing three problems:

- the selection problem;
- the definition of performance of the school organisation;
- motivating students and parents.

163. Increased public resources are being spent on primary and secondary education as well as on higher education. The motive has been to improve the welfare of individuals and (recently) to stimulate international competitiveness and economic growth. A largely-publicly financed educational system that uses resources equal to about half, or more of the value-added of manufacturing industry in advanced industrial nations, certainly requires attention from the point of view of efficiency. If all the resources spent on vocational, labour market, and on-the-job training are added, the need becomes even clearer. Depending on whether it is educational investment or filtering which dominates, the efficient organisation of schooling differs radically and an incorrectly organised process of competence creation would be very costly indeed. Most educational production studies typically *assume* one variant -- generally the educational investment hypothesis -- and ignore the other, thus running a not insignificant risk of reaching entirely erroneous policy conclusions. It is obvious that the selection issue is closely related to the incentive organisation and allocation issues of the previous chapter.

4.2 The selection issue: talent vs. education

164. Bishop's studies (notably 1988a, 1992) indicate that mathematics is a good predictor of performance on practically all jobs: crafts, technical, clerical and other. The question is whether mathematics adds to ability or serves as a proxy for general talent characteristics such as problem-solving ability, a well-organised mind or a capacity to conceptualise. Most probably, both investment and signalling effects are at work. Hence, it is necessary to understand (rather than assume) their relative influence in order to formulate policy. If the *filter dominates*, the rational policy would be to encourage those with talent to choose mathematics and discourage those without. If the *investment effect dominates*, everyone should be encouraged to study mathematics, and the less talented should perhaps do more.

165. *Verbal* characteristics figure differently in performance. Verbal capacity appears to be negatively linked to crafts (Bishop, 1992). In technical and clerical work it is positive and pronounced. It is worth observing that crafts rely on rote training, while technical and clerical work involve abstract tasks and much

communication within and among teams. These types of jobs are becoming increasingly dominant in the advanced industries.

166. So far, the discussion has looked at the individual from the point of view of her/his usefulness in contributing to the objectives of the firm. From the point of view of the individual, one can, as is typical of labour market research, look at people with problems. Or one can look at individuals who have acquired the right competence and have succeeded in landing good, well-paid jobs. The latter procedure is better for helping identify educational policy parameters and to support economic growth by enhancing human competence. To understand what causes success and failure in the labour market, the entire range of outcomes has to be represented in the empirical material and in the theoretical model. To identify the critical parameters, selection and educational-investment problems have to be dealt with simultaneously. It is also necessary to look at the pricing of educational services and the entire incentive structure that relates individual decisions to productivity increases at the workplace. This will mean taking a position on the interaction of on-the-job learning and schooling, and the possible existence of important tacit knowledge in the production process (Murnane and Nelson, 1984).

4.3 The school and the job

167. John Bishop at Cornell University appears to be one of the few persons who have seriously taken on the huge empirical task of identifying and quantifying the effects on job performance of the basic competencies acquired at school. There are a number of difficult issues to resolve.

Educational attainment and job performance

168. The *first* is modelling *the transition from school to work*, a typical selection problem that involves a series of choices. For talented individuals, basic schooling (through high school) is practically always a step towards higher education. The incentives to continue (future salaries, work environment, freedom, power, etc.) are a powerful filter that induces talented young people to shun manual work, even when it involves professional skills (the problem that this may pose for manufacturing, which relies on skilled workers who enter the labour market from high school, will be addressed below).

169. *Second*, it is often found useful to adopt a distinction between general and specific educational content, sometimes equated with the distinction between *education* and *training*. Becker (1962, 1964) argues that general education is best provided outside the job context by specialist educational institutions (schools, universities), while specific training for a job is less portable and may have to be provided on the job. The distinction is analytically convenient, because it is then possible to assume that employers concentrate on organising specific training, while school should be made responsible for the teaching of general communication skills. In retrospect, this appears to be one of the many simplifications that induce economists to make strong policy statements based on assumptions rather than on empirical evidence.

170. *Third*, the costs and prior talent or knowledge (receiver competence) needed to acquire additional knowledge or competence are often forgotten. This competence is supposed to be provided initially at school (communication or academic skills), but must be maintained and constantly updated (Eliasson, 1992b). This general competence characteristic can be defined for individuals and firms as well as entire economies. There are thus time-leverage and aggregation (scale) aspects to such knowledge accumulation.

171. *Fourth*, in addressing all these issues empirically, care must be taken, as Bishop (1992), notes to distinguish between educational attainment, occupational category and job-performance category. The specific problem to be addressed here concerns the effects of educational production on individual job performance. Most performance is, however, measured in terms of occupational categories or, even worse, in terms of educational attainment. A relevant study of the effects of schooling on economic competence has to include job performance in the educational output measure (see Chapter 7). Only under perfect labour market conditions (which never exist when human capital matters -- see Chapter 3) will earned income be an acceptable proxy for job performance. Few researchers (except Bishop) have put in the effort needed to link school directly to properly measured job performance.

Education as filter

172. The investment or human-capital approach is rooted in neoclassical production theory. The filter theory, first formulated in the early 1970s (Arrow, 1973; Spence, 1973; Stiglitz, 1972, 1975) -- probably as a critique of the simplistic extension of capital theory to human capital -- has become part of modern signalling and information theory. In its extreme form, the filter theory of education makes educational production a machine for putting quality labels on workers. There is a considerable amount of literature on the signalling value of school grades. A particular variation is the stigma associated with low-ability workers in an imperfect market, where true quality is very difficult to evaluate.

173. The problem for educational policy makers is to evaluate empirically the relative importance of both mechanisms when only the extreme versions of the two opposing theories have been modelled and "tested". This is no innocent matter, since the educational policy of nations is often built on such erroneous specifications.

174. Few attempts have been made to bridge the two sets of assumptions and they have been coloured by controversy. The assumptions critically determine the analytical outcome. Both Albrecht (1981) and Lazear (1977) emphasize the near-impossibility of separating the two hypotheses empirically, while Griliches (1988) leans strongly on the human capital theory, thereby indicating that neoclassical theory has difficulties with the filter problem. Each hypothesis tells part of a relevant story, but a shrewd choice of assumptions makes it possible to create any number of educational policy stories.

175. What is needed is a specification of the model at a level of disaggregation that allows for representing both selection and investment phenomena simultaneously. This entails specification down to decision makers (individuals, firms). For the school, this specification should be particularly clear, as the school is a selective transition filter (a path) into the labour market (Lynch, 1992b). It would also be desirable to capture the family (Stafford, 1987) as part of the total sorting process through which children move into the job market. In fact, social capital accumulated prior to entering school appears to play a not insignificant role (Kazamaki Ottersten, Mellander, Meyerson and Nilson, 1994), but appears as educational investment effects if not properly specified in econometric tests.

4.4 Productivity and income effects of schooling

176. To capture the effects of schooling on individual job and income performance, analysis has to be broken down into four steps; *i*) the effects of school organisation on scholastic achievement; *ii*) the effects of grades (educational achievement) on income; *iii*) the effects of grades and choice of courses on job productivity; and *iv*) the relation between education and the capacity to learn on the job.

Step I: Effects of school organisation on scholastic achievement

177. The Coleman report (1966) could explain very little of the variation in scholastic achievement by differences in resource inputs in schools. This was a shock for a welfare-minded industrial world preparing to solve social problems with more investments in, and resources allocated to, schools. Jencks et al. (1972) very provocatively observed that school meant nothing. The Coleman report correctly emphasized that educational, like all other production, required organisational competence on the part of school authorities. Solving the problem was not only a matter of more resources; the competence to organise and run schools efficiently was also needed. The report was later criticised (Hanushek, 1986; Murnane, 1984), and when Fägerlind (1975) retested the Jencks et al. results on Swedish longitudinal data -- the only proper statistical procedure -- his results turned out contrary to those of Jencks et al. The emphasis on the need for organisational competence to run schools is, however, even more obvious today. Can an enormous educational leap forward be achieved with the same resources but through a different way of doing things? This step will be referred to below as "educational production functions". But estimating such functions requires that final school output is properly defined and measured, which is difficult if selection and imperfect signalling is important.

Step II: How does income depend on scholastic achievement?

178. There is a significant body of literature on human competence which relates education (usually only formal schooling) to wages. Part of this literature makes the standard human-capital assumptions at the outset and then translates the results on income into productivity effects at the end. Positive effects of schooling on income are usually reported. Such studies have been criticised as naive since, by assumption, they exclude selection effects. The positive effects of education on income might instead be the result of talent, for the talented tend to go to school. Griliches (1977; see also Griliches and Mason, 1972) objected to such criticism, arguing that education is in fact endogenous and the outcome of conscious and rational economic decisions involving future expected income. Using a model that makes this decision explicit, Griliches concluded that the effect (coefficient) on income is underestimated. This study was, however, carried out before the development of modern information and signalling theory, which requires taking account not only of an individual's educational decision but also of an employer's ability to recognise talent.

179. Research offers little help in resolving the investment filter controversy. Jones and Jackson (1990) observed that it is difficult, perhaps impossible, to test one theory against the other. They point out that while Wise's study (1975) of college graduates in large firms suggests a human capital interpretation, Lazear's criticism (1977) of Wise suggests that a filter is at work. Lazear's argument is that selective biases in the data base at different stages make the explicit representation of each hypothesis in a single, empirically testable model impossible. Jones and Jackson, recognising the difficulty, attempt to identify

particular implications of the two hypotheses to see which are empirically supported. They find that internal educational investments in firms do not increase with the grades of the employee, a circumstance that they advance against the filter hypothesis. Higher grades, furthermore, imply higher income irrespective of the degree of internal education. Unlike Wise, Jones and Jackson find a positive relationship between college grades and initial salary. They conclude that they found no support for the filter and no strong reasons for rejecting the investment hypothesis.

180. Albrecht (1981) attempts to set parameters for both hypotheses with the same model but obtains no significant results for either. Lang and Kropp (1986) find support for sorting, when studying differences in school time between students who differ with respect to talent, applying the fact that school time is sometimes mandatory, sometimes not. Bishop (1989b) builds his analysis on a selection model and finds -- not unexpectedly -- clear support for sorting. Kostiuk and Follmann's study (1989) of recruitment practices of the US marine corps illustrates the mechanisms behind the sorting hypothesis.

181. If one accepts the existence of imperfect markets for human qualities, the situation looks very different. Furthermore, educational decisions are sequential and at each step rational and informed. If job choice is first determined by preferences for type of job and then possibly influenced by income-maximising behaviour, it is very difficult to keep selection and investment effects separate (Orazem and Mattila, 1991). In fact, as Bishop has repeatedly emphasized, education is itself part of the selection process, in which the learner becomes more and more informed as to her/his final job-income potential. The final choice is, however, as emphasized above, restricted by previous choices, so that the long-term leverage of education appears to be considerable.

182. To understand the selection mechanisms and the leverage effects, a distinction must be made between high school and higher education (college and beyond) and between students who plan to continue their studies and those who intend entering the job market immediately after high school.

183. Bishop (1987, 1988a, 1991a) has studied these choice processes empirically. He finds that high school students who plan to continue their studies behave very differently from those who do not. The former have to take certain mandatory and difficult courses in natural sciences and attend courses that develop communication skills (notably languages and mathematics) in order to be eligible for higher education, and they must also achieve good grades.

184. For those who plan to enter the job market directly, Bishop's first conclusion is that young American males do not capture high initial wages from taking high school courses in the natural sciences, language or mathematics. Rather, it pays them to take courses in simple computational skills and in technical subjects, which can be directly converted into productivity effects on the job. Young women, however, capture an initial wage advantage from taking courses in the natural sciences, languages, or technical subjects.

185. It is important to know whether these results reflect true job performance or basic imperfections in an American-type labour market. In the latter case, they will pay off later as the basic skills acquired are being observed by the employer.

Step III: What are the relationships between education and productivity?

186. Bishop's second conclusion brings another surprise: high school courses in the natural sciences, languages, and advanced mathematics significantly contribute to workplace productivity and worker quality, even though the workers have only acquired a high school diploma.⁹ Similarly, technical competence acquired in high school is positively correlated with the job performance¹⁰ of skilled workers and technical staff.

187. Bishop's results build on studies of US Department of Defense tests, in which a large number of job categories have closely corresponding counterparts in the civilian labour market. Similar results have been reported by Boissiere, Knight and Sabot (1985) for Tanzania and Kenya. A particularly interesting observation is that excess, redundant, or "under-utilised education" does not result in a higher wage (Rumberger, 1987). This appears to be so at all job levels. On the other hand, redundant education or experience should be a valuable individual quality which makes her/him more flexible in the job market and better "insured" against labour market risks.

188. Kang and Bishop (1989) observe that academic courses in high school (in mathematics, languages and the natural sciences) give stronger effects on workplace productivity than on wages, at least in the short term. A balance between academic and vocational skills is important, however, to ensure a maximum immediate wage. Over the entire 12-year school career, they conclude, four years of vocational training and eight years of academic courses pay off significantly better than vocational high school courses alone. It was not at all worthwhile taking more than four years of vocational courses. This suggests that the average employer is demanding more general communication skills that increase the individual's receiver competence and flexibility. These results come from the United States, but there is no reason to expect that the results would differ in any other advanced industrial nation. One would assume that the more advanced the work environment, the more important these observations.

189. The results reported all concern immediate wage and productivity effects on the job. There is very little available on the long-term effects. Yet it is important to know how the on-the-job learning capacity of individuals is influenced by prior qualities and early scholastic achievement. Bishop (1991b) concludes that for non-college high school graduates, competence in science, language, and mathematical reasoning increases productivity on the job, including blue-collar jobs, in the long term. However, during the first eight years after leaving school, young men receive no rewards from the labour market for developing these competencies. It is therefore normal for them to avoid difficult courses unless they go on to college, where such courses are both mandatory and later rewarded in the labour market.

9. The Saturn division of General Motors "selects blue-collar workers entirely from within the GM ranks -- but only those it considers adaptable, able to work well in teams, and possessed of good communication skills" (*Business Week*, 17 August 1992, p. 37).

10. Bishop (1992) reports that *verbal education* has a negative impact on craft performance, but a positive one on technical, and a strongly positive one on clerical jobs. Apparently, the more that has to be communicated on the job, the more important is verbal capacity.

Step IV: What is the relationship between formal education and the capacity to develop new competencies (to learn)?

190. The results are as expected: the higher the academic level of high school courses (especially in communication skills like mathematics and languages), the more efficient the downstream learning of vocational skills. Simpler "computational skills" do not have the same effect (Bishop, 1991a, p. 7). Even though "academic" competence acquired at high school does not confer immediate or medium-term effects on the wage level (Bishop, 1991b), an increasing number of jobs require competence that has positive productivity effects on the job, especially in complex tasks related to the maintenance of advanced machinery ("technical literacy" and mathematical capacity are related).

191. This survey of empirical results should be enough to demonstrate that the filter is at work in the schooling system. There is, however, so far no theory or model capable of empirically keeping the two mechanisms (investment and filter) apart, something that is needed to design educational policy.

4.5 Educational levels and recruitment practices

192. Firms in general attempt to avoid hiring low-ability workers. A typical observation at the hiring process, even in normal mechanical engineering workshops (Kazamaki Ottersten, 1994b) is that educational requirements have increased. This normally means that minimum-level requirements of communication skills have been raised. The interesting question is whether this mirrors the increased demands on receiver competence for effective continued development of specific skills at the workplace (the explanation normally advanced) or simply the use of grades as a filter to avoid the "lemons". In order to know this, very careful on-the-job studies -- not yet done -- have to be carried out. Under the latter filter hypothesis, filtering and the labour market selection process become part of the educational process.

193. Even though the discussion may appear academic, its resolution is critical for policy decisions. Empirical evidence supports both versions. Thus, Psacharopoulos (1985) observed from data on developing countries that returns to education were at their highest for elementary education and decreased according to the level. Psacharopoulos' (1991) rather general conclusion is that it would be profitable for the economy to redirect funds from higher to lower education. The rationale would be that the ability to hold even a simple manufacturing job in an advanced industrial society requires a high minimum "technical literacy" and "verbal capacity" that demands few resources to develop at an early age but is very costly to develop later on. Thus, the provision of basic communication skills in advanced countries becomes a matter of necessity for employment and requires efficient organisation of early education so that all individuals achieve a minimum basic competence *before leaving school*. Jorgenson (1993) reports similar results. The problem, however, is that the same econometric results would have been reached on the same data even under the filter hypothesis as formulated above -- namely, that firms raise educational levels to avoid hiring "lemons". If the ability of elementary and high schools to educate less-talented individuals decreases and if high school grades tell less and less, this econometric effect should come out stronger.

194. Has the efficiency of basic education slipped, as is frequently reported, in countries like the United States and Sweden? Is the pool of unemployable workers increasing? If so, is the decreased efficiency a matter of the increasing number of students dropping out of the educational process, or is there a more evenly-spread average decline in student capacity? The selection "problem" could be "solved" by accepting that an increasing segment of the population remains poor. The second explanation would suggest a general

decline in the wealth of knowledge of the nation. The distinction should be made, because it has also been argued that the increasing educational level demanded in advanced industrial economies means a demand on prior intellectual capacity that cuts higher and higher in the talent distribution of the student population. If so, educational efficiency and the later job-allocation process would improve if individuals could be pre-sorted according to talent.

4.6 Is it possible to pre-sort according to competence characteristics?

195. Educational selection is closely related to sorting in the labour market. The labour market filter begins at school. A huge and controversial amount of literature deals with the capacity of various sorts of ability tests, including school grades, to predict job performance.

Using tests for sorting

196. Firms in Sweden and the United States rarely use tests when hiring. The personnel director may not believe in tests; the costs of using tests may be considered high compared to hiring people and firing them if they do not meet standards; or tests may carry legal risks. If formal criteria are used, school grades are the most common. More specifically, employers check on whether the applicant has taken certain courses. In Sweden today, an academic qualification (at least of Bachelor-degree level) appears to be a minimum requirement for a higher-level career in a large firm.

197. Educators have, however, argued that productivity improvements of as much as 40 per cent can be achieved if more resources are devoted to ability tests at hiring. Other studies show that both scholastic performance and results from such tests influence workers' wages independently. Mueser and Maloney (1991) ask, therefore, why (American) employers behave irrationally, and they argue that legislation in favour of minorities makes selection through tests difficult. In addition, personnel managers in firms have learned from experience that ability tests may not be as good predictors as psychologists and educators believe. It even appears (Gottfredson, 1985) that the employer who uses a "test" looks at the high school diploma. The preferred mechanism seems to be the market: employ a person on rather loose criteria, inspect him on the job, and promote or fire as one learns more about the employee.

198. If ability tests were generally used, if they improved the allocation of people with appropriate qualities to jobs, and if this screening was less costly than using the market, what would the consequences be for the firm and the economy? Hunter and Schmidt (1982) designed an assignment model in which people are allocated to jobs according to their earlier performance at school or on the job. They conclude that even crude sorting should improve the allocation of scarce competence in the economy. Hunter and Hunter (1984) even estimate that "if the Philadelphia Police Department were to change its use of cognitive ability tests to select entry-level police officers, the savings to the city would be more than \$ 170 million over a 10-year period" (p. 72).

199. Hunter and Hunter (1984) also determine at around 0.5 the correlation between ability according to cognitive and psychomotor tests and workplace productivity. At the same time, they observe a correlation of no more than 0.1 between educational achievement and productivity. However, Mueser and Maloney (1991) argue that these results depend critically on the method of estimation and the imposed limitation on the estimation range, which technically means an underestimation. If the limitation is

removed, the correlation can increase to 0.7. Then high school grades can predict job productivity as well as ability tests.

200. Brenner (1968) finds that teachers' ratings of student skills and work habits are better predictors of performance on the job (according to supervisors) than aptitude tests. Absenteeism and discipline in the workplace can therefore be well predicted by school-attendance records and by teachers' ratings.

201. Whatever the value placed on tests, Bishop argues (1988b, 1989b), the labour market only very imperfectly (and slowly) rewards students (through high pay) for taking difficult courses that lead to high job performance. If the use of ability tests stimulated the students to take the right courses, it would both increase the educational level of students and perhaps also improve the allocation of the acquired competence on the job.

How are private and public gains affected by pre-sorting?

202. Tests of ability to produce are examples of sorting using the filter hypothesis. Given the use of such tests, what are the advantages of sorting? If such tests are reliable predictors of individual performance, firms that understand how to use them will (on average) employ higher-quality people than those that do not, and sorting is thus worthwhile partly because competing employers do not understand how to use the tests. "Smarter" employers using tests therefore do not have to pay a higher wage that reflects the greater productivity but only the lower wage which uninformed employers would be willing to pay. This is a typical case of "adverse" selection, and employers who do not use tests, even though they may be as good or better in other respects, eventually go bankrupt. Hence, there is a *private* gain from using ability tests, *provided* they do carry predictive information.

203. Mueser and Maloney (1991) ask whether there is a *public* gain, such as a positive GNP effect, from using tests. They find that if left to choose freely, firms may "do more testing than is socially optimal". *First*,¹¹ they argue that if tests become common, job applicants will learn to exploit the random variation in tests and be tested until they perform well by sheer luck. *Second*, if firms use tests excessively, and productivity on the job only increases slowly, the selection of employees will be biased and -- even if the tests give information -- the wrong people may be promoted. There will then be no positive macroeconomic allocation effect through testing, and the allocation may in fact be worse than market sorting. Since there will be transaction costs associated with the use of tests, the overall social macroeconomic effect will be negative.

204. Another welfare argument would be that if the above two negative circumstances are not at work, and tests do in fact improve or speed up the sorting process that would otherwise take place less efficiently and more slowly through the market, then the distribution of wages would widen and become more compatible with the distribution of productivity. Through improved information the labour market would become more "perfect" -- as economists tend to term such a situation.

11. referring to an argument by Rothschild (1979).

Concluding remarks on selection

205. Research has apparently provided little insight into the selection phenomenon. Can schooling nevertheless be reorganised to cope with this problem? Will the distributional problem be accepted politically when it is recognised that equality cannot be achieved, or will political restrictions be imposed on the educational system and make its production less efficient for students capable of coping with increasingly deficient schools?

206. Answers to these questions are needed in order to formulate effective educational policies. Unfortunately, the talent (filter) vs. investment controversy remains unsettled. Behrman and Taubman (1989) conclude that it is difficult to refute the proposition that basic talent explains most of the variation in educational achievement. Other factual circumstances such as family affluence, parents' educational levels, etc., offer a partial but not full explanation. The earlier ideology of a "compensatory schooling" system (e.g. Okun, 1975) is not supported by empirical evidence, when models that are not *a priori* favourable to the compensatory principle are being tested (see also Coleman, 1988; and below).

207. Unfortunately, Behrman and Taubman (1989) continue, ambitions on the part of schools to compensate for underlying disadvantages will create inefficiencies rather than a more even distribution of competence in society. Hauser and Sewell's (1986) earlier study agrees, even though they emphasized "family background".

4.7 Social capital and high school performance

208. Coleman (1988) introduces "*social capital*" as an infrastructure with positive externalities. He observes that family social background has three dimensions: financial, human and social capital. He studies the effects of social capital on drop-out rates among high school students.

Main reasons for poor school performance

209. Bishop (1993b) gives four reasons for the poor performance of American high school students. They are, in order of importance, low effort, parental disinterest, weak public support, and voter apathy. Not one is an economic reason and the most important of them relate to family background.

210. Low effort on the part of students -- measured by *time* spent on tasks and on *homework*, *competing uses of time*, *avoidance of demanding courses* and student *passivity* -- appears to be, by far, the most important negative influence on student performance. On all counts, American students compare unfavourably with those in the other countries studied. Learning (i.e. student performance) is strongly, positively related to time spent on tasks and on homework. Japanese secondary school students spend almost twice as much time in school as American students and much more time on homework.

211. The total amount of time devoted to study, instruction and practice in the United States is 18-20 hours per week. The typical high school senior spends nearly ten hours a week on a part-time job and almost 20 hours watching television. Time spent watching television is negatively correlated with student performance in school.

212. Avoidance of demanding courses is a particularly tricky problem, since most students do not take rigorous college preparatory courses in science and mathematics. Increasing the number of mathematics and science courses required for graduation -- as was experimented in many American states -- does not help, since this is usually accompanied by a lowering of standards. Most students avoid such courses because they increase their work load and lower their grade-point average (Bishop, p. 7).

213. Student passivity, which is almost certainly based on attitudes developed at home, reinforces this problem and places a heavy burden on teachers who must rely on their own capacity to motivate students. "All too often [they] compromise academic standards because the bulk of the class sees no need to accept them as reasonable or legitimate. ...Motivating students to take rigorous courses and to study harder needs to receive much more attention from reformers" (p. 8).

Parental apathy

214. Parental apathy is the second reason for the low performance of American high school students, according to Bishop. Goodland (1983) had already ranked "lack of parental interest" as the second most important problem in education. Studies indicate that parents think students should not necessarily take difficult and demanding mathematics or science courses. And American (but not Taiwanese and Japanese) parents report satisfaction with both school and student performance (Stevenson, Lee and Stigler, 1986).

215. If American parents were dissatisfied with local school performance, as they should be (Bishop, 1993b), they would have their children given extra tutoring, as in Japan, or send them to private schools. Yet private school students do not learn faster than public school students (Cain and Goldberger, 1983). Private schools are usually attractive because of better discipline and the absence of disruptive students.

Family environment and length of schooling

216. Does more or longer schooling improve student performance? Björklund (1992) studies the importance of family background for length of schooling in Sweden. He distinguishes between a *financing* hypothesis, which assumes that children from poor backgrounds are affected negatively, and a *comparative advantage* hypothesis, which assumes that children from rich families receive higher returns from schooling. He finds no evidence for the financing hypothesis but considers that this may be due to too little variation in financing data. In Sweden, financing costs (marginal costs) do not depend on family background.

217. On Björklund's assumptions, the weak evidence for the comparative advantage hypothesis suggests that individuals from rich families choose longer schooling because returns to school are high. The main explanatory factor is, however, the father's education. In another interpretative framework, the explanation might be *tradition* (students from educated families study longer) or a highly educated father (who gives direct support), a possibility that Björklund acknowledges. There may also be a common talent factor, which is not part of Björklund's hypothesis.

218. It pays to stay on at school, Ashenfelter and Krueger (1993) conclude after having studied identical twins. Their effects are much higher than those reported by Behrman, Hrubec, Taubman and Wales (1980). Students who do not continue their education after high school are much more exposed to labour market risks than are those who continue their studies (Lynch, 1992b). This effect is even more

pronounced for the 25 percent of 17-year olds who drop out of high school in the United States. Lynch puts particular emphasis on the important role of post-high school education as a path to the labour market, and the importance that schools take some responsibility for preparing students for life in the working world.

219. While Lynch and others have emphasized the importance of acquiring vocational skills preparation for work life, Psacharopoulos (1991) argued strongly that even if work specialisation is a glorified ambition, it ought to be delayed as long as possible to focus scarce public educational resources on giving the student a high minimal level of general communication skills. Vocational training, he concluded, should be offered outside the traditional schooling system.

220. Angrist and Krueger (1991) have exploited the fact (in their econometric analysis) that school-start depends on which year one was born and hence also affects the number of years students remain in school before leaving without a degree. The authors review conclude that students were forced to stay longer in school than they wanted, in order to receive a higher wage. It is of course possible to imagine that other factors will also influence this relationship (see Eliasson, 1994a). Grubb (1991), for example, shows that signal effects matter and that students who continue on to college but do not graduate will not earn higher salaries than those with no college education at all. Lang and Kropp (1986) also found support for sorting, using school attendance for equally talented individuals to detect investment effects.

221. So-called head-start programmes -- sending children from disadvantaged backgrounds to school very early -- have often been argued to compensate for bad family background by putting the students early into a higher-quality environment. Currie and Thomas (1993) claim that this improves student IQ performance. The interesting question is what they would mean if such programmes become mandatory and children were also taken out of good social family environments and placed in bad schools.

222. Coleman (1988) finds that *parental attention* and parental (especially maternal) expectations significantly lower the college drop-out rate. The more children in the family the higher the drop-out rate, especially among the younger ones. A combination of negative factors reinforces the effect. Björklund (1992) reports that increased family size has a negative effect on length of schooling (see also Stafford, 1987b; Juster and Stafford, 1991; and Lazear, 1980).

Ethnic environment

223. Contrary to the standard view, even third and fourth generations of immigrants to the United States refuse to fit a standard mould. The United States remains a multicultural and pluralistic society in which different ethnic groups are clearly distinguished by income levels. Borjas (1992) finds that the skills of the subsequent generation depend not only on parental inputs and the quality of the ethnic environment but also on the *average* skills of the ethnic group in the parental generation.

224. The father's educational attainment appears to affect significantly that of the children. However, if the father's education is held constant, ethnic capital significantly and positively affects educational attainment (ethnic capital is represented by several variables put together as an ethnic dummy; average skills are measured by mean educational achievement of the ethnic group). A one-year increase in the average schooling level in an ethnic group increases that of the average level of the next generation by 0.2 years. The coefficients of ethnic capital and parental education variables are of a similar magnitude, except

that parental educational levels vary more. This suggests not only that ethnic capital is a significant determinant of educational attainment in the subsequent generation but also that it significantly contributes to preserving ethnic differences in educational attainment.

225. The sample Borjas uses indicates substantial improvements in educational achievement across generations but none in occupational prestige. The data show a wide dispersion across ethnic groups in educational achievement.

Attitudes, student motivation, and the importance of high quality parental inputs

226. The Coleman report, using the educational production function approach, made it clear that preschool, family, and non-school environmental variables explained much more of the variation in scholastic achievement than school variables. Bosworth (1992) emphasizes the importance of student attitudes for school performance and argues that such findings are almost certain to alter the balance of the debate away from resources and towards the role of parents and schools in modifying attitudes and behaviour of young people. He finds that absenteeism from school significantly lowers student performance. Absenteeism, in turn, depends significantly on family background. High parental income is correlated with good school performance. Subsidised housing, low-income or high-unemployment areas, and living away from home are correlated with poor school performance. The possibility is large that selection effects will be mistakenly interpreted as investment effects in erroneously specified educational production functions (see below).

227. Okamoto (1992) tells an interesting story about Japanese schooling. Japanese society believes or assumes -- although the belief is empirically unfounded -- that young students are equipped intellectually equal. Thus, poor school performance can only depend on poor teachers or lazy students. If teachers cannot be proved guilty of poor performance, which is difficult in a society that highly respects teachers, the explanation is clear. As a result, students are forced to work very hard at school, and the less talented they are the harder they have to work and the more disciplined they must be. Therefore, standards do not fall as much as they would if the poor students, in addition to being poor students, were lazy. It is interesting to speculate on what this might mean for welfare. The Japanese attitude is of course hard on the less talented students, but so is work life on less able workers. In addition, unless a significant effort is made during the first years of schooling, the leverage works against a student (see Section 3.10), and this is especially true for the less talented. The less talented in Japan suffer more when young, but the less talented in poor Swedish or US high schools suffer when entering the labour market. From a pure efficiency point of view, the Japanese system of forcing the young to work hard is of course superior. This problem is also closely related to Coleman's (1988, 1992) discussion of the intangible social or infrastructure capital.

228. The family plays the important role in providing social capital services to children. It internalises, to some extent, several functions normally provided in the market by government, such as insurance, retirement and education, including the management and financing of education -- all areas where altruistic family behaviour may occur. For the pure human capital theorist this is of course a disturbing analytical circumstance, and attempts have been made to put social capital, like altruistic family behaviour, on a truly rational footing. Becker and Tomes (1976) have formulated a provocative internal family allocation model in which the parents attempt to do for family members what an egalitarian welfare government attempts to do (through taxes) for all inhabitants, namely to allocate resources for family members' education such

that family wealth is maximised, and then attempt to redistribute income *ex post*. This means allocating resources to those best fitted to acquire income-generating knowledge. The final distribution is then corrected through gifts and inheritance.

229. The critical theoretical problem is how to control the *ex post* redistribution. This can only be done in a family with considerable financial wealth, or for that matter human income-generating capital, to transfer. The final equitable distribution requires certain assumptions to overcome the strategic avoidance measures taken by the more talented in welfare economies attempting to do the same thing as the Becker-Tomes family, but on a grander scale. To some extent the final distribution of course depends on whether the talented children are willing to part with some of their income, as the parents desire. That egocentric, talented children will do that (Becker, 1974) is an assumption rejected by Nerlove, Razin and Zadka (1984). If they are right, the analytical results change. There is also an additional complication. Suppose that successful educational outcomes depend on children's efforts which in turn depend on compensation. If such efforts depend on how seriously the final egalitarian distribution is enforced, the whole analysis collapses. Hence, the explanation of human capital accumulation for improved and more remunerable work performance may require support of some background social capital that cannot be derived from the same rational postulates.

4.8 Motivation and willingness to pay for education

230. The more motivated the student the more efficient the education. If education is organised as a contest and/or students themselves have to put up a not insignificant part of financing, their own educational efficiency increases. At the same time, fewer students dare to engage in education, even though the expected pay-off is larger, especially if they feel insufficiently talented or if they come from home environments of low intellectual quality. One educational policy question is how to balance these two counteracting circumstances.

Willingness to pay at different levels

231. To begin with, the effects of own financing will differ significantly at different levels of education. Also, equity financing input can be anything from a little to all. It might occasionally be privately very efficient to keep the number of educated people low in order to limit competition for the educational rent by having a 100 per cent equity financing. Furthermore, at higher levels of education (college and up), students always contribute significant own financing by abstaining from income during their education. The problems addressed here are the motivation and efficiency effects at a relatively low level of own financing.

232. Since Manski and Wise (1983), the general view has been that the propensity to go on to college (in the United States) is correlated negatively with costs and positively with the amount of student aid. Choice of college is also affected by relative educational costs. Hansen (1983), however, argued that this analysis failed to take account of the level of affluence of the student's family. He also observed that increased access to student aid for those from below the medium-income level had not increased the supply of educational services for these "groups". McPherson and Shapiro (1991) reconfirm the original view that costs reduce the propensity of students from low-income families to go on to college. However, they question the early views on student aid and argue that federal student or financial aid have not affected the

propensity to go on to college -- even though, they add, answering these questions really requires panel data which are not easily available.

233. Equity financing is usually associated with higher education, for which significant self-financing is reasonable. Psacharopoulos (1985) observes that the highest returns to education are really achieved for primary and secondary education. It should therefore be socially efficient to transfer subsidies from higher education to primary and secondary education. Gertler and Glewwe (1990) in fact observe that families in Peru are willing to pay for secondary education, a tendency that increases with family income. The quality of the school (notably teacher density) strongly affects willingness to pay. It should be noted that these empirical results were reached on data from developing countries, where the returns from primary and secondary education should be high.

Risks and limited financing

234. "A striking feature of US public education," begin Fernandez and Rogerson (1993), is "the large disparity that exists across communities in spending per student". They conclude that this is mainly due to the financing of US public education through local taxes, to the large differences in average income across communities, and to the endogenous adjustments of different income groups over communities so as to avoid paying for other people's public costs. Bishop (1993b) observes that, by all measures, the United States spends less on education as a share of per capita income than other countries, and concludes that this contributes to the internationally low academic performance of US high school students. Part of the problem appears to be that a larger than normal share of total secondary school costs is devoted to tasks other than academic instruction, a ratio that contributes negatively to student performance (Anderson, Shugart and Tollison, 1991). A particularly negative factor, observes Bishop (p. 11), is low teacher compensation. In international comparisons it is low even in absolute terms when compared to countries with a lower per capita standard of living. Compared to compensation in other occupations, teachers' income is very low both within the United States and internationally.

235. Lazear (1980) asks whether variations in levels of attained schooling across groups can be explained by a model that assumes perfect capital markets and wealth-maximising individuals. Do differences in financing costs explain variations in education and income, so that poverty is perpetuated through poor families, as argued by Bowles (1972) and Jencks et al. (1972)? Policy implications vary significantly according to whether the reason is the financing of cost differences, or differentiated returns to schooling, e.g. through discrimination or imperfections in the labour market. In the first case, subsidised financing would be the recommended policy. In the second, policies designed to reduce labour market imperfections would be recommended.

236. Lazear finds no evidence except for very small differences in financing costs. They are significant but so small that one cannot say that particular groups (the poor with low initial endowments) are discriminated against. Hence, the problem should be looked for elsewhere, for instance in the capacity of the individual (talent) to benefit from education, or in labour market discrimination.

237. Whether empirical research will provide better insight into these matters is an open question. Human capital theory normally makes the Japanese assumption (see Okamoto, 1992, above) and connects education directly to productivity by assuming that everybody is equally capable of learning and being productive. This makes it necessary to explain the income differences in developing countries, which are

even larger than in the advanced countries (Ljungqvist, 1991), in terms of different access to the financing of education and/or the assumed fact that risk-averse individuals, to educate themselves, demand a considerable risk premium in the form of a very high wage. In both cases, government can in principle step in and solve the access to financing and risk-aversion problems for those who are not rich. Search theory, however, offers an entirely different explanation in terms of limited or asymmetric information, which creates equilibrium wage distributions that are more diverse the less markets (i.e. the search processes) are developed. Incentives to search matter, and the policy implications, are contrary to those of the human capital explanation. The human capital theory hence short-circuits the labour market by assuming it to be perfect, and finds the explanation in an imperfect credit market and the impossibility of mortgaging a future higher income. Alternatively, the risk of educational failure may be great and thus requires a very high return to investment in education as an incentive. The risk premium is high because failure means a big decrease in life income (Ljungqvist, 1992). If these assumptions are correct, then government can step in, not to subsidise education directly but rather by taking on the risk through supplying a loan guarantee that makes it possible for students to borrow in the market at reasonable rates. This has in fact been standard policy in some industrial countries.

Does the individual or the government know best?

Different theories, different assumptions, and different policies

238. Before a policy conclusion is reached, the underlying assumptions have to be sorted out. The "filter" view would emphasize individuals' inability (bounded rationality) to choose the right educational paths or to find the right job, or the fact that the employer cannot sufficiently evaluate the individual's competence. The latter explanation has been proposed by Bishop (e.g. 1989b). It does not emphasize educational failure or credit market imperfections.

239. *Research based on human capital theory assumptions normally often suggests that more tasks should be given to government, while search or filter research suggests greater emphasis on the individual's capacity to take care of himself or herself.* Yet these biases, which generate policy advice, are embodied in those theories by assumption. An additional complication arises if the family undertakes welfare policies (Becker and Tomes, 1976). Since the family constitutes a much more informed and controllable economy than a nation, more important effects might arise from internal family policy than from that of government. Becker and Tomes observe that if publicly financed education designed to compensate children from disadvantaged home environments makes parents reorient their allocation of internal family resources, the intended policy effect may be entirely eliminated.¹²

240. It remains worth considering whether the returns to basic education are lower or higher in the advanced industrialised economies, given that the higher-level abilities acquired at higher educational institutions or on the job, which are assumed to create industrial wealth, cannot and/or will not be acquired unless the appropriate receiver competence is gained at school. In any case, the educational result is not only a matter of student talent or educational costs and financing. Prospective returns and attitudes to education also matter.

12. This conclusion about the potential failure of compensatory education does not require (as does Jensen, 1969) that the children who receive compensatory education are less talented than others.

4.9 Educational production functions

241. The Coleman report (1966) shocked the educational world in two ways. *First*, it introduced a host of new empirical methods that more or less initiated (Hanushek, 1979) the study of "educational production functions". *Second*, it observed that variation in school resource inputs explained almost none of the variations in school performance. This was clearly disappointing for a school world intent on solving the social problems of the industrial world through increased spending on education (e.g. Okun, 1975). Coleman observed that educational productivity, like all other production, suffered from efficiency and organisational problems. Compensatory education programmes were not simply a matter of increased public spending. It took competence to organise and operate educational facilities. The educational production function was the tool through which such effects could be studied that would also make it possible to generalise results. Such was the optimistic view, and many researchers set out to study the most difficult and heterogeneous kind of capital of all: human capital. A new research field in quantitative educational economics developed.

242. When Hanushek's (1986) survey article was published, practically all studies of school or student performance measured it by *student achievement*. The much more interesting gauge would of course be either long-run labour market performance or some broader *utility* measure. Recent years have witnessed efforts to merge educational economic and human capital theory, in which student post-school earnings performance is related to various aspects of school experience. However, very little has been done on measuring the effects of schooling on productivity performance.

243. The new multiple input/multiple output methods were particularly suited to the study of heterogeneous inputs. They also allowed producers to operate below their production frontiers and not even aim for cost minimisation. This was useful, since some prices and services are not measurable and others are not exogenous, due to monopoly or monopsony power.¹³ As pointed out by Grosskopf, Hayes, Taylor and Weber (1992), econometric research on school productivity has taken one of two paths: estimating single-output average production functions; or more recently, estimating multiple-output production functions, allowing for scale effects and technical and allocational efficiency. Studies on school districts in Texas (Bessent and Bessent, 1980; Bessent et al., 1982, 1983, 1984; Grosskopf et al., 1991, 1992), in Missouri (Färe, Grosskopf and Lovell, 1988) and in Connecticut (Callan and Santerre, 1990) find significant evidence that schools do not allocate efficiently, and in particular use capital excessively. Barrow (1991) obtained similar results for the United Kingdom.

244. These studies use cost functions in their analysis, and this makes it possible to employ a dual technique in specifying (school) production technology. One reason is that public enterprises in general, including schools, and private firms as well, are probably not cost minimisers and, furthermore, are not free, because of regulations, to choose the most efficient educational methods (Grosskopf et al., 1992). Hence,

13. The method has its foundation in Shephard's (1974) *indirect production function* method, in which *distance functions* (Shephard, 1953, 1970) are defined, such that a dual method can be used. These distance functions are closely related to the family of efficiency measures originally proposed by Debreu (1951) and Farrell (1957). Färe, Grosskopf and Lovell (1988) apply this method to school performance in reading, mathematics and economics in Missouri. They also point out that *data envelopment analysis* (DEA: see Charnes, Cooper and Rhodes, 1978; Bessent and Bessent, 1980), which is rapidly becoming popular with educational economists, is related but goes to the extreme of ignoring all prices and all behavioural motivation to evaluate performance solely on the basis of the efficiency of the physical transformation process.

schools operate below, but at different distances from, their production frontier, although some may operate on their production frontiers. The technique is to estimate the apparent best-practice frontier for the best schools, using a stochastic linear programming technique.

245. The problem with these methods -- as with all other production function methods -- is that it is difficult to capture output quality. On the other hand, the frontier method should make it easier to capture quality of educational output than the single-output production function, by making it possible to take at least all quantifiable output dimensions into account.

246. Jimenez (1986) has found economies of scale in primary and secondary schools in Paraguay and Bolivia, which suggest that larger schools are cheaper to operate. Butler and Monk (1985) address the question of optimal school district size, using data from New York state. They find two distinct parameter settings, one for small and one for large schools. The small schools show economies of scale while the large schools exhibit constant returns to scale, indicating perhaps that different scales are associated with different organisations of production. They suggest that the small schools would realise economies of scale with marginal increases in size, which is not possible for those that are already large.

247. Grosskopf et al. (1992; see also 1991) simulate deregulation of schools. They first correct the school output measure (test scores) for inputs produced at home and (undefined) previous student attainment, to obtain a better measure of the value-added created by the school. They then look at the contributions to value-added of four variables: administrators, teachers, support staff and teaching aids. They also look explicitly at one "fixed input", namely "operations and maintenance". They find that school districts are subject to *diminishing returns*, and this suggests that there is a school district size that should not be exceeded. If schools are free to reallocate inputs with an eye to efficiency, a gain of between 4 and 10 per cent in student performance is possible.

248. The size of the school or school district, however, is only one measure of school organisation. To capture the influence of school organisation on quality of output and the efficiency of educational production, far more sophisticated modelling is needed.

4.10 Organisation and productivity

249. Anderson et al. (1991) have recently studied the importance of school organisation for student achievement. They find that the higher the share of resources invested in teachers and physical school facilities (mostly classrooms) as a proportion of the total school budget, the better the level of student achievement and the lower the propensity to drop out. In other words, the higher the share of school bureaucracy (administrators, advisors, etc.), the worse the level of student performance.

250. Card and Krueger (1992) also show that the number of teachers per pupil increases student performance, as measured by the private returns to education that are associated with higher earnings from work. In general, however, the size of classes does not appear to matter much for student performance.

251. Callan and Santerre (1990) study multi-input educational production functions in Connecticut. They find significant substitutability among instruction, administration and support staff input. They also observe short-run economies of scale in local public education, which they take as an indication that further

consolidation of school districts would increase efficiency. They find no support for economies of scope over those of scale -- in the sharing of complementary resources, for example.

252. Wahlberg and Fowler (1987) study average scores on state-developed and nationally standardised tests of third-, sixth- and ninth graders in New Jersey districts in order to determine the productivity of school districts with respect to "increasing the learning of their students beyond what would be expected from their family socio-economic origins". They find, *first*, that test scores are significantly and positively related to the socio-economic status of the district; *second*, that they are insignificantly and inconsistently associated with education expenditures per student; and *third*, that they are negatively correlated with the size of the district. This confirms earlier studies and suggests that "educational policies of districts and instructional practices in classrooms rather than expenditure" determine achievement and efficiency. It is interesting to note in this context the phenomenal public school performance of the New York City slum schools that have been isolated from the "systems goals" of the public school bureaucracy, 6 000 strong, of New York City and that solve their problems individually and innovatively, including the hiring and firing of teachers (*The Economist*, June 13, 1992, pp. 50 ff.).

253. Hanushek and Taylor (1990) try to measure state variations in school performance, or the effects of different state-wide school policies, by estimating marginal school effects at the state level. They find that most traditional measures of school performance, including the aggregate SAT scores, are very biased. The best are value-added, or achieved growth measures over time. They find, holding a whole range of other conditions constant, that about 10 per cent of the variation in school quality occurs between states.

254. While many studies find, or argue (e.g. Chubb and Moe, 1990), that students in public schools fail because monopolistic school bureaucracies stifle innovative local initiatives and impose regulations that decrease efficiency, other studies (e.g. Reich, 1988) hold that more public investment is needed to attract good teachers and to finance education. The latter position is hard to accept on the basis of observed, bad student performances considering the very large public resources invested in primary and secondary education in advanced industrial countries. Both points of view can, however, be true if investments in education have been small compared to the productivity or profitability of educational capital. On this too little is known to tell. Productivity could perhaps be increased even further if schools were privately organised to a larger extent and if students financed a larger part of their own education and therefore increased their effort. Very little research has been done on this topic, probably because the western industrial nations have taken the position that primary and secondary schooling is a public task. There are, however, a few studies from the developing countries and on US higher education, which is both private and public.

255. Since individuals are typically risk-averse, they will abstain from acquiring education if they have to pay their way themselves, even though the efficiency of schooling may increase markedly when financing is private. Is there a role for innovative financing arrangements which make individuals overcome their risk-averse behaviour and which also capture the efficiency effects of the private school, without exhibiting the possible adverse selection effects of a 100 per cent private schooling system?

4.11 On-the-job competence development

256. A related problem has been investigated more thoroughly, perhaps because of more acute concerns for concrete results. It is the problem of creating the right internal firm culture to motivate personnel to

learn the job and to perform better. This on-the-job competence accumulation process is an integral part of forming efficient teams (Eliasson, 1990b; Kandel and Lazear, 1992).

257. On-the-job training (OJT) is the typical method of developing work-related, specific and tacit competencies that cannot be efficiently taught in a classroom. There are still no conclusive results as to whether industrial or vocational skills can be efficiently developed in a classroom context or in schools which have the necessary equipment but are not organised to allow experienced production workers to participate in the teaching. The more pronounced separation of teaching and research from production in university-based natural sciences departments -- as compared to technical institutes -- has sometimes been cited to explain the difficulties university graduates have in finding good jobs in business firms, as compared to engineering graduates with a similar education.

258. Organisations can learn, by developing not only individuals but also competent teams. The sociological literature often emphasizes the capacity of the organisation to elicit desired personal characteristics, such as work motivation, that are not as efficiently obtained through pecuniary incentive schemes. Schou (1991) and others have shown, in the case of engineers, that this motivation is important. The organisation of work was, however, decisive, especially for newly employed engineers during their first decade of work. Thereafter, motivation declined if the task remained the same, and the older the employee the less the work environment mattered. This in itself suggests that an organisational benefit results from rotating people. Explicit appreciation of work mattered a lot, notably from final market users and from managers or superiors. Clearly spelled out compensation rules made employees less satisfied (a possible explanation might be that low performance would be revealed to the individuals themselves and to colleagues, while high performers would consider themselves underpaid). Employees in research departments, however, often tended to be satisfied with relatively lower pay, because of the more open work environment and greater freedom of choice of work tasks.

259. Motivation rather than pedagogic methods or support material is decisive for efficient workplace learning (Holmqvist and Jarrå, 1990). These results correlate well with the few results on school production available. Motivation is higher when students understand the importance of what they are learning. The same problem is raised in Aoki (1986). Very specialised work -- as in the A-type (American-type) organisation -- does not motivate skill development as much as the organic J-type (Japanese-type), in which each person understands his or her importance for the whole.

4.12 Higher education

260. Secondary education is either a pathway to vocational training and the labour market or an entrance ticket to higher education. Strong educational criteria select and guide the students into either of the two careers.

Is more higher education good for the economy?

261. Recent concerns about the declining competitiveness of national industries and a deteriorating technological base have activated the discussion of the economics of higher education. It would appear that students who go on to higher education and research careers are the more talented, more motivated and more willing to work. Do these students then enter useful occupations that contribute to economic growth? If not, higher education may have a detrimental effect on economic growth. In the past, the academically talented generally entered the clergy or the military, and in more recent times and in some countries, the bureaucracy. Since the human products of institutions of higher education often enter the research world, the question of efficient appropriateness of research arises. Is it possible that the very efficient US research establishment has not developed the competence to transfer R&D output to competitive industrial production, to the benefit of other countries more capable of doing so, such as Japan and Sweden (Eliasson, 1991c)?

262. Most economic literature assumes, however, that more higher education is good for the country and for economic growth because it adds to the qualities of the labour force. Various computations (Denison, 1967, 1979; Jorgenson and Griliches, 1967; Jorgenson and Fraumeni, 1989, 1990) indicate that this is so, thereby strengthening the argument for more resources to higher education. On the other hand, both Psacharopoulos (1985, 1991) and more recently Jorgenson (1993) argue that it may be more beneficial to the economy to reallocate money from higher education to primary and secondary schooling. However, the computational methods used could not possibly produce other results. They normally disregard the issue of the efficiency of school production, a factor that might change the policy conclusion *from* a need for more resources *to* a need for reorganisation of higher education.

263. In a survey of the literature on the productivity effects of higher education, Pencavel (1990) concludes that only when research is undertaken at the micro level can what he sees as a positive relationship be understood (it is surprising that he does not cite those who have attempted to understand the micro level, namely Bishop and Osterman and associates). Studying the micro level will require dealing with the difficulties of effects of selection. When this works successfully, strong positive results may occur at the micro level. Yet the allocation machinery may also move talented people through higher education, when they would otherwise have become more productive skilled workers. The macroeconomic effects could be negative in the long run (Eliasson, 1990a, 1992a, 1993c).

Increasing returns to higher education

264. Pencavel (1991) observes that educated people show a much higher capacity than the uneducated to retool intellectually and to learn new technology. He also observes that individuals responded rapidly to the significant increase in returns to higher education during the 1980s by increasing their educational investments. He warns against political decisions to squeeze salary differentials and thereby reduce these

strong supply effects, so that the market becomes unable to deliver scarce resources to the areas of the economy which most value them. Highly educated labour appears to be better paid in industries with rapid technological change (Bartel and Lichtenberg, 1988; Dickens and Katz, 1987; Davis and Haltiwanger, 1991). This could be interpreted to mean that competence and skills developed in school and in higher education are most profitably put to use in those industries (under standard human capital assumptions). Adams (1990) approaches the same problem from another perspective and emphasizes the economic importance of academic production per se. "How large," he asks, "is the role played by the international differences of basic science in the twisting of the US wage structure in favor of the highly educated?" He finds accumulated academic knowledge to be "a main contributor to productivity growth" but that it takes about 20 years to convert research results into academic knowledge. It should be reiterated that industrial knowledge may not locate to the country where the academic knowledge has been created if the necessary industrial receiver competence is lacking (Eliasson, 1991b).

Chapter 5

On-the-Job Training, Selection and the Labour Market

265. Recurrent education and retraining are largely guided by the path taken through school and the labour market. In the distribution of human competencies at a given point in time and their allocation over time, selection effects are primordial. They affect the supply of and demand for competence. The organisation of the choice process at school and in the labour market and the freedom of contractual arrangements become critical for macroeconomic as well as individual economic performance.

5.1 Is manufacturing losing its competence base in once-advanced industrial nations?

266. To ask whether talented individuals are being filtered out of manufacturing is not an academic question, given the development of industrial technology and the shifting of competence and educational rents. In wealthy nations with a large population of highly educated individuals, demand patterns are rapidly shifting towards the output of the service sector, notably its high-quality low-scale end. Technology is, as has been demonstrated above, simultaneously causing the same effect in manufacturing hardware production, pushing up rents in its high-quality low-scale end. This should mean that the high-quality end of the talent distribution is gradually shifting in the same direction, as a comparison of the distribution of jobs in the United States and in Sweden indicates (see Table 5.1).

267. The first industries to suffer are the manufacturing sectors whose skilled workers invest in higher education and move up to higher quality production, leaving manufacturing with low-ability workers. This may be precisely what US manufacturing suffered from during the 1980s. A similar effect may occur in high-level engineering, as talented engineers move from processing into R&D and probably out of mature hardware industries into more intellectually rewarding ones, such as defence and space. Evidence from the United States, Sweden and Japan suggests that this may in fact be happening.

268. Human capital theory neither recognises this selection effect nor treats it as a problem. The micro-based approach of the present report forces observation of such selection phenomena and allows them to be explained. The natural policy question to ask is whether the drain of talent from manufacturing sectors to high-quality production is of any great consequence if the talent is gainfully employed in prosperous service industries. What would be the problem if the talent does not find *economically* gainful employment in private industry?

5.2 Vocational training and labour market retraining

269. School is partly a means to knowledge creation, partly a selection mechanism, and partly a pathway to vocational training and the labour market. The three functions overlap and cannot be studied separately. Labour market training and retraining, to be efficient, are in a large measure a labour market search-process. It has long been understood (see, for example, Lundquist, 1942) that retraining outside the job context is not effective. Thus, incentives to be trained should enter the employment contract.

270. Labour market training and retraining are normal aspects of advanced production. All modern industrial firms carry on informal on-the-job training programmes to stay competitive. On the average, at least 3 per cent of the total wage and salary bill in the average Swedish manufacturing firm is allocated to internal education. This figure is probably very underestimated, since firms do not explicitly account for educational charges (see Eliasson, 1990a). Internal education is, furthermore, heavily biased in favour of those who are already well educated and trained. These are the labour categories that are profitable investment objects.

271. The nature of these internal training programmes still remains rather obscure. With the exception of partial studies of learning curves, there is little research available. Studies on labour market training have a strong bias towards workers who encounter problems in the labour market, and focus on heavily subsidised labour market retraining programmes, which often take place outside the workplace. The results on retraining are negatively flavoured by these biases.

272. There are three main reasons for labour retraining:

- In an active, expanding environment of growth, new technology makes constant competence upgrading necessary.
- In a depressed economic environment subject to restructuring ("steel, simple manufacturing") obsolete labour skills have to be replaced and people moved to new jobs ("steel workers upgraded to electronics engineers").
- Production establishments (often very low-tech) are closed down in regionally distressed areas where no new industries will locate. Laid-off labour has to both retrain and to move.

273. The organisation of training programmes differs significantly in the three instances. The first category is by far the most important for economic growth. It should require no public subsidies and should work on its own, within industries.

274. The two other retraining situations represent two different stages of a social problem, due partly to risk aversion among labour and partly to the lack of private pay-off to commercial retraining programmes, because of low receiver competence or to high age. This may be a case for government subsidies. In certain respects, the organisation of labour market training in various countries reflects national attitudes to the private and social sides of such retraining.

Four different labour training models

275. Academic studies usually recognise four different types of labour organisations and labour training models:¹⁴

- i) The *German apprentice system*, in which youth pay for their education and experience through a low salary. The content of the training and the balance between specific and general training are the object of negotiation. The apprentice receives a *certificate* at the end of the exercise.
- ii) The *Japanese model* is not an apprentice system. It is not occupation-oriented but firm-oriented. This means regular job rotation and broad-based experience. The presumed risk for employers is that educated workers will leave for another job, but pay is low during the learning years, so that workers in fact pay for their education. The risk of departure is low in any case because of associated high social transaction costs.
- iii) The *Swedish model* essentially means more government involvement to overcome presumed market failure. Vocational training as an industry was gradually nationalised during the post-war period.
- iv) The *US model* means largely private training, with different approaches depending on the firm, no apprenticeship, and pronounced specialisation.

276. The choice of internal training model is not independent of the relative importance of specialist and general knowledge at the workplace which, in turn, depends on the organisation of work. It is very important to realise that work or firm organisation in itself is perhaps the most important industrial technology (see above). Hence, the development of technology and firm organisation very much determines both industrial performance and the efficient organisation of team training of employees. If work organisation is, as many believe, the slowest (after individuals) to change, then established but obsolete forms of labour organisation (contracts), including arrangements for training, may be the real impediments to change and progress. Aoki's (1986) comparison of the Japanese J-organisation with that of the American A-firm raises the interesting question of which solution is most appropriate for the organisation of work in the industry of the future.

277. While the US organisational form is analytically transparent and peopled by specialists, the Japanese J-firm forms an integrated whole with generalists at all levels. The A-firm requires co-ordination specialists, and managers, while the J-firm is able to self-organise and, to some extent, self-reorganise. Since all workers see themselves in relation to the whole, they understand the problems that arise and can take action to remedy them. The J-firm organisation hence requires the firm-oriented vocational training typical of the Japanese firm, while the A-firm trains, or rather hires, specialists in the market. This synergistic property, however, changes the investment required -- notably time and effort -- to establish and maintain the employment relationships that make the firm run efficiently (Hashimoto, 1991). One cannot simply say that one labour relations model is generally better than the other. Each has different characteristics which are both good and bad, depending on the view taken of the development of organisational technology in future industry. Will it require more frequent drastic work reorganisation, in

14. from a presentation by Lisa Lynch at a seminar on Human Capital Creation in an Economic Perspective, Helsinki, May 14-15, 1992.

which case the A-firm may be better, or can change be accommodated gradually, in which case the J-firm may be better?

278. The old Swedish labour organisation system was different from both these models. It recognised that firms have to change radically now and then and sometimes fail completely, and it had an explicit insurance aspect, partly involving subsidised mobility. It also included re-education. Unlike Japan and Germany, Sweden assumed that retraining, like insurance, could be separated from work and run by government. Following World War II, Sweden gradually moved from a German-type apprentice and industrial school system towards separate schools operated by the public sector. The model was formally documented in a number of joint publications of the Federation of Employers and the Central Labour Union Organisation (see Eliasson and Ysander, 1983). A clear guiding principle was that business decisions should be taken where the appropriate competence resided.

279. The old Swedish policy model is summarised in Table 5.2. It functioned well as long as heavy hardware technology and large-scale factory organisation made up manufacturing frontier technology, as long as manufacturing was the principal creator of value-added in the competitive sectors of the economy, and *as long as* desires for redistribution were kept at bay. It can be said that the model created enormous synergies between management and unions, which were very productive during the 1950s, 1960s and part of the 1970s.

280. Industrial change, rising redistributive ambitions, and a growing aversion to geographical mobility after the green revolution of the 1960s and the 1970s, gradually weakened the foundation of the old Swedish policy model, which has since been replaced by something very different. In particular, the model no longer worked when a large part of "production" took place under the "protected" conditions of a huge and growing public sector which appropriated a growing part of the value-added of the economy. Increasing international economic integration, and greater mobility of capital and competent labour, forced a massive redistribution of resources and have made this type of government-run system both unmanageable and detrimental to macroeconomic performance.

281. The four labour organisation and training systems presented above reflect different solutions to the problem of the normal retraining needs of a viable growth industry. The German and Japanese systems are based on the idea that labour is risk-averse but willing to pay for retraining. The social aspect is internalised through "insurance", and differences in talent or receiver competence are reflected in pay differences. The Swedish model treats labour insurance, and labour training in general, as market failure. It did not try to overcome this presumed market failure by stimulating the market, but rather by taking over educational services and removing them from the work context to a classroom situation. The typical US model, at the opposite extreme, takes little notice of the social problem. Despite the obvious simplification, these stylised presentations show very different efficiency characteristics, depending on how labour market training is treated.

Firm insurance and internal education

282. *Education, labour market insurance and job choice* are joint decisions on the part of the employee. Given risk-averse labour, it follows that it will demand insurance for labour market risks and be willing to pay for it -- in fact, they should be willing to pay a lot more than a risk-neutral market would charge.

At the same time, the most efficient way for the individual to reduce labour market risks is to acquire the appropriate combination of education and experience.

283. Risk-neutral employers may therefore find it profitable to extend both education and insurance services to its employees, provided that internal insurance and education do not create negative (external) effects on their main production activity. Thus, training is not provided (see Chapter 2) if positive synergies are not present, but it is if on-the-job training is a joint production activity that is necessary to build unique firm competence. As a result, firms prefer not to organise training in tradable worker skills, but seek to organise efficient careers.

284. Insurance has many dimensions, two of which are important here. *First*, there is a standard coverage for normal labour market risks: loss of employment, job-related accidents, etc. *Second*, internal education increases workers' competence and lowers their labour market risks, especially for job loss and/or other employment. Labour market insurance and internal education seem to complement each other.

285. Within the industrial organisation field, studies are emerging that deal with the possibility of a rational foundation for making *insurance* for labour market risks and further education and training part of the firm's internal activity. In that event, there would be a case for spontaneous market formation of sustainable, mutually beneficial contract relations between employers and employees, which might earlier have been concealed by moral arguments and prevented by regulations. It appears, in fact, that the insurance problem has to be studied together with issues of internal training and production control.

Consequences of internal competence development

286. The conventional view is that firms do not provide general education in portable skills to workers, because workers would leave for other employers who can pay higher salaries since they have no education costs. In its simplistic form (Becker, 1975), this hypothesis is controverted by facts. Feuer et al. (1987) report that workers whose firms pay for most of their post-high school course work do not necessarily earn less than workers who pay their own way, and that when firms pay for this education, separation rates are lower.

287. There apparently is a mutual benefit that makes firms pay and employees stay. Feuer et al. propose an *insurance* explanation. Firms offer trained workers the expectation of long-term employment, which workers buy at the price of lower pay, even though their firm-financed training has increased their tradability in the market. They explain this in terms of a lowered bargaining position in an internal labour market. Yet the same results would follow from assuming that the employee is more risk-averse than the employer, and/or that outside employers do not know the competence of the trained individual and offer less in wages than the current employer is happy to pay.

Human capital theory and imperfect labour markets

288. Becker's (1975) argument was that general training is a public good that would not be provided by firms if it was not financed by the employees directly or indirectly through lower wages. This argument has been so logically "convincing" that training provided by firms has often been defined as specific, non-portable training. The logic of this argument has been contested for cases in which general and specific

training are provided jointly (Glick and Feuer, 1984), in which firm-provided education is a form of insurance (Feuer et al., 1991), and in which labour in the quality part of the labour market is very heterogeneous (Eliasson, 1992a, pp. 110 ff).

Box 5.1. How change in labour market theory changes our understanding of education, the labour market and the firm

Prior assumptions influence predictions of theory. This is particularly so for theory in social sciences, where measurement is difficult and the empirical tradition underdeveloped. Labour market theory is currently undergoing a radical change in its *a priori* assumptions, partly reflecting changing values in society, partly owing to emerging new technologies and industrial organisation. This divide between two intellectual worlds is reflected in literature but very obscure to the unexperienced reader and receiver of policy advice.

Typical of this development is the application of *industrial organisation* (IO) methods in US labour research, methods that allow educational aspects to be integrated with production and labour theory. Several strands of thought within IO economics are currently knocking at the door of labour economics. In fact, the "theory of the firm" emerging in labour economics is organised to provide services that are normally seen as being offered in the market or by specialised institutions. Most typically, these services are:

- a) employment insurance
- b) internal education
- c) allocation of competence (selection, hiring, assignments)

Labour economics is here moving in the opposite direction to financial economics, where assumptions have been tailored (see below) to create a firm that outsources the same functions, notably risk management, to the extent that the firm, at least in earlier literature, vanished as a meaningful entity to be investigated (see Fama, 1980, and comments in Eliasson, 1990b). Only recently has this reconstruction of theory begun to be rationalised in terms of the relative efficiency of internalisation and outsourcing of typical labour market functions.

Lazear (1981), coming out of labour market economics, continues on the Alchian and Demsetz' (1972) analysis of productivity monitoring of a team inclined to shirk. Feuer et al. (1991) provide sketches of the firm as an insurance provider to risk-averse labour. Rosen (1972) discusses on-the-job learning in the firm as joint production, and Aoki (1986) the best organisational design to facilitate internal learning. The organisation of the internal allocation of people (the assignment problem) enters with Sah and Stiglitz (1985) and Ricart i Costa (1988), and in a tournament setting with Lazear and Rosen (1981). None of these references are really concerned with the theory of the firm, but a labour market version of the theory of the firm is close, emphasizing the synergy capacities associated with the formation of *competent teams* (Eliasson, 1990b). The competence explanation, in fact, provides a realistic link between labour market theory, organisational learning and the theory of the firm (Eliasson, 1992a, 1992b) that undermines the very foundation of classical labour market policy research and beliefs of the post-war period.

(continued)

First and very naturally, since the 1970s labour market *search* and *contract theory* have been slowly undermining the standard implicit divide between employed wage earners and the firm (see e.g. Holmström and Milgrom, 1991, and Jovanovic, 1979a, 1979b). *Second*, with competence being recognised as the dominant firm capital, *principal agent* theory, internal education and the theory of the firm are merging (Eliasson, 1990b). Lazear and Rosen (1981) and Rosen (1982) look at reward or incentive schemes in the form of *tournaments*, that make workers, notably high-level management, perform. Kandel and Lazear (1992) extend this analysis to the development of efficient internal rules and cultures of partnerships or firms. *Third*, in allowing for imperfect matching and pricing in the labour market, heterogeneity and selection phenomena, all these theoretical developments mean clear departures from the perfect labour markets of neoclassical human capital theory. Human capital theory, assuming homogeneous human capital and perfect pricing in the labour market and a direct link between money invested in education and productivity effects (Ysander, 1978a, 1978b), almost by assumption comes out with conclusions suggesting more government intervention and more subsidies. The new approaches, on the other hand, which allow for market imperfections and selection phenomena, tend to favour policies that remove imperfections in the labour market and leave more choice and responsibility up to the individual. A shifting of assumptions away from neoclassical economics towards more realistic IO assumptions then radically changes policy advice by giving a larger role to the individual. This is of course confusing for those who are not familiar with all strands of theory.

The change away from social concerns, notably with macro unemployment towards attempts to understand how markets work and interact with heterogeneous and differently talented individuals, may appear on the surface to mean a diminished concern with social problems, and particularly so for those who have based politics and ideologies on a particular understanding of economics. They now find their views undermined by differently organised (by theory) hard facts. These new approaches, however, are clearly in place, even though modern labour market theory has yet to be made a sub-chapter of industrial organisation theory.

The clash of theoretical *a priori* assumptions is even more illustrative when we observe the contrary directions of modes of thinking in financial economics and labour market theory. With the Markowitz (1959), Modigliani and Miller (1958) and Sharpe (1964) shifting of prior assumptions in finance establishing separability between risk management and production, and assuming the existence of separable perfect markets for risks, the classical idea of diversification to reduce company risks becomes a false one. Firm management should focus on what they are supposed to be best at -- investment and production -- and leave the problem of financial risk management to more competent traders in separate markets, who do a better job for the investor. After a decade or so, the influence of this theoretical shift had been diffused via business schools to management consulting and practice.

(continued)

The shifting of assumptions in labour market theory has gone the other way, treating the internalisation of education, labour market insurance and pension guarantees as a joint activity with main production and management control. While financial economics, for instance, is shifting the insurance function to specialist traders in the markets for risk, assumptional drift in the opposite direction is arguing the case for internalisation of labour market insurance. These assumptions, while not well founded empirically, are very much in line with the labour market culture of the industrialised West, based on the standard employee/employer contract. In that academic culture, even the extreme conclusions of Solow (1990) of "the labour market as a social institution" are naturally accepted. Solow's idea would, however, have been thrown out on the assumptions of financial economics. Labour market insurance should then be outcontracted (out of firms and government) into a specialised market for labour market risks, and job guarantee laws should be abolished. Policy advice apparently clashes, and since enormous resources are moved around according to policy advice based on extreme assumptions, such assumptional drift is not only confusing. It is socially very costly because it may lead to inefficient educational, labour market and insurance policies.

The problem is that none of the extreme versions of theory in labour and financial economics are correct. There are always some synergies at work, and there are always possibilities of outcontracting labour market insurance in the market, a fact of economics suggesting the need both for more comprehensive theory and better empirical research.

289. Mincer (1991) maintains the human capital assumption and concludes that more than 10 per cent of the US wage bill is made up of on-the-job training (OJT) and that this accounts for most of the observed increases in individuals' earnings over their working lives. His human capital conclusions (p. 16) can be indirectly reinterpreted to mean that the more training a worker receives, the more specific to the firm it is, and consequently the steeper the worker's wage profile, the slower the turnover and the lower the incidence of unemployment. This is a restatement of the Mincer and Jovanovic (1981) "duality hypothesis". Mincer also concludes that more prior schooling means more OJT and that faster technological progress means more training provided by the firm.

290. The correlation between training and tenure is also reported by Stafford and Stobernack (1989) for high-tech industries. They conclude that sophisticated firms need trained and experienced workers, not fresh college graduates. But without good school grades (Eliasson, 1992a, pp. 86 ff.) workers will not receive training, or rather, cannot profit from investment in training.

291. These results would be very plausible, were it not for the suspect human capital assumptions and the equally suspect distinction between general and specific training. The problem is that practically all studies on the effects of schooling or labour market training relate to wage effects and are biased by the human capital assumptions.

292. While no other country has been as ambitious in enacting broad public labour retraining efforts than Sweden, Björklund observes (1989a, 1989b, 1991), little effort has been expended on evaluating the effects of these programmes. The opposite situation holds for the United States, where very few public resources are spent on labour market training, while, in relative terms, much more has been done on evaluation than in Sweden. It is therefore of interest to devote an extra section to the experience of both countries, and particularly so since much of the research results from the United States both supports the limited policy ambitions of that country and can be carried over to similar but much more ambitious policies enacted but not evaluated in Sweden and in other European countries. Of particular interest in these comparisons is, of course, the very different organisation of the labour market in the two countries.

United States experience of education and labour market training

293. Blau and Robins (1987) observe that there are normally no positive (wage) effects to publicly financed labour market education. They suggest, however, that these negative results may depend on the fact that practically all empirical studies are public. Using a general equilibrium model that takes account of the scale of retraining programmes, the results may be altogether different. They find that public high school vocational training programmes have strong positive effects on the marginal return to training, but they also observe a negative relation between the income effects and the scale of the programme.

294. Kang and Bishop (1989) point out that prior high school education matters significantly for workers' wages and that there are decreasing returns for educational specialisation. Vocational training and education in basic academic or communication skills have to be mixed appropriately. A student not planning to go on to college ought to take vocational courses, but not only vocational courses.

295. Lynch (1990) finds that OJT figures importantly for 70 per cent of all new workers in the United States without a college degree. She notes that a new employee who wishes to receive wage-increasing internal education needs to have a high school diploma and should have some further education. This is

particularly important in order to have the opportunity to participate in firm-sponsored external education programmes with no specific job orientation, a form of education that appears to be on the increase (Lynch 1990, 1991) and which increases possibilities of a career leading to better pay in other firms.¹⁵

296. Lynch (1992a) summarises the properties of different training programmes. On-the-job training appears to be highly firm-specific and non-portable in the United States. It raises wages on the current job but has no effect on wages in subsequent employment. Off-the-job training, which is less specific, has little effect on wages on the current job but raises the expected wage in subsequent employment.

Experiences from Swedish labour market policy

297. Given the size of the Swedish labour market policy budget (3 per cent of GNP on average), it would be important to devote more research to evaluating the effects of Swedish programmes. Negative macroeconomic side-effects may follow if these resources are inappropriately applied (Eliasson and Taymaz, 1992). As little research has been done in Sweden, it is necessary to complement Swedish results with those from US research. Furthermore, research in the United States has been rapidly adopting modern IO methods (see Box 5.1), while Swedish research still focuses on socially oriented unemployment problems and remains strongly influenced by human capital assumptions. These assumptions create a positive bias in favour of traditional Swedish labour market policy and affect empirical conclusions through chosen prior assumptions. Thus (e.g. Smith, 1993), evidence is steadily increasing, suggesting welfare benefits to be a cause of both unemployment and sustained poverty. When the US methodology is applied, the results should be even stronger for Sweden, because the Swedish labour market programmes have been so much more ambitious. It may well be asked whether in fact the social and economic consequences of Swedish labour market policy have not become negative (Skedinger, 1994). Both mobility and training issues are involved.

Mobility in Sweden

298. Holmlund (1984) and Björklund and Holmlund (1989) observe that labour market mobility has a high private pay-off, especially if initiated by the individual early in the job career. But employer-initiated moves do not appear to have negative wage effects, so long as employees move and find a stable job.

299. In an earlier study, Dahlberg (1978a, 1978b) compares workers who have made (subsidised) moves with those who remained at their jobs; he concluded that it paid workers to move if they did not later return to their former job. To enter local employment programmes definitely did not pay in terms of wages. Another study on middle Sweden (for a survey, see Björklund, 1989a, 1989b, 1991) demonstrates that intensified efforts by the local labour market agency significantly shortened periods of unemployment and increased the probability of finding a permanent and better paid job. However, a similar econometric study on data for northern Sweden (Ohlsson, 1988) finds no significant improvements beyond those achieved through the regular labour market service.

15. This should be distinguished from the complementary general education that a few firms offer workers who have dropped out of high school. It appears to be a handicap to be a woman or non-white when wishing to be offered such compensatory education opportunities.

300. A third study of unemployed youth in four cities (for a summary account, see Björklund, 1989a, 1991) showed that temporary public or subsidised private jobs increased the probability of finding a permanent position, although relief work, labour market training or any other educational activity did not. Intensive and tailor-made searches and better information improved prospects for the unemployed. The search and matching process becomes more efficient when potential employers are better informed about possible employees. Labour market imperfections are thus reduced, although potential-selection effects should also be considered. Most important, this improved information concerns a quality developed through education and training, making *labour market search and training a joint activity*.

Labour market training in Sweden

301. In an early, and by modern econometric standards perhaps somewhat primitive, study Dahlberg (1972) observes positive income effects of labour-market training with workers over 25 years of age who take jobs in their field of training, compared with individuals with the same training who have to take jobs in a different field (pp. 87 ff.). He also observes that those who have had the opportunity to use what they have learned also have less risk of being laid off (p. 168).

302. Today, however, while results concerning labour market agencies are inconclusive, results on labour market training are negative (Björklund, 1989a; Björklund and Moffit, 1983; Axelsson, 1989, p. 340). Being unemployed also has significant negative effects on the probability of finding a job. Although Axelsson reports positive wage effects, they appear to be biased by selection effects (Björklund, 1991) due to specification problems in the econometric model (these models generally make simple human capital assumptions, and this makes the results suspect, in particular when wage effects are reinterpreted as productivity effects).

303. Axelsson further observes that, however measured, labour market training programmes had negative effects. Yearly income effects were positive, hourly wage effects were negative, and disposable income effects were negative or not significantly different from zero. Axelsson could not directly observe productivity effects from labour market training; he imposed human capital assumptions to use income as a proxy and thus obtained a negative productivity effect by assumption. The best income measure to use as a proxy for productivity would have been hourly wages, which were not affected by training programmes.

304. Axelsson is aware of the risk of selection bias affecting the outcomes. Those who enter government-sponsored labour market training have a lower than average general education. This should mean lower than average receiver competence for labour market training and hence small positive effects. If general receiver competence acquired at school depends largely on talent, the question is to what extent it is worthwhile complementing labour market training with general education. If in fact there is negative selection of participants in publicly financed labour market training programmes, publicly financed training will soon carry a stigma, and the consequence will be a negative overall effect. This is not known, but the magnitude of resources allocated in Sweden for moving people in difficulty through such programmes suggests that the possibility should be carefully explored. In a recent study, Axelsson and Löfgren (1992) try to control for the negative selection effects for participants in labour market training. They restrict their attention to effects on yearly income, a measure that reflects both changes in employment (hours worked) and income. They find no real change from the earlier (1989) results and no significant relation between

the evolution of yearly income and completed periods of education of different duration and skill orientation.

Small scale preferable

305. Edin (1989) and Ackum (1989) find no positive effects from labour market training. A study by the Employment Security Council¹⁶ suggests that, to be viable and to lead to new jobs, internal education has to be tailor-made to the individual but not necessarily lengthy. It needs to be a co-ordinated package ending with an examination (a form of certification) and, ideally, a job.

306. Three conclusions can be drawn. *First*, the negative results were obtained from econometric studies on data from labour market programmes run *as currently organised*. There is good reason to expect labour market intermediation and training to provide positive allocation, productivity, and welfare effects. There is a strong presumption that other organisational forms would give better results than the prevailing ones. *Second*, stigma and adverse selection effects exist and may largely eliminate possible positive effects from training. *Third*, labour market search (intermediation), market training and market insurance are joint production activities best organised on a *small scale* so as to allow for the adaptation to the individual that is necessary to reflect the heterogeneity of the labour force.

5.3 The problem of the disadvantaged

307. In general, labour market studies are strongly biased towards those with labour market problems, probably because public financing of such research has the same bias. These research results do not, however, give the information needed to understand those without such problems, yet it is necessary in order to understand how to upgrade the disadvantaged. Information on successful retraining programmes of people without labour market problems is important for a full understanding of the competence needed on jobs.

The disadvantaged need help very early

308. Generally, no attempt is made to solve the problems of the disadvantaged in the labour market until they become acute and the person is unemployed (Bishop, 1989a). In his survey of public retraining and labour market programmes in the United States, Bishop clearly shows that those who receive public labour market service carry a label, a stigma. People in a publicly financed programme were probably not productive workers; employers learn this and tend to avoid them. In doing so, they use very simple filters and are likely to reject even excellent people who have happened, by bad luck, to participate in a labour market retraining programme. In other words, the filter works even if retraining makes the worker more productive. In fact, Bishop reports on positive productivity effects from public retraining programmes.

16. The Trygghetsrådet-SAF-PTK (Employment Security Council) is an organisation for placing laid-off white collar workers, jointly sponsored by the Swedish Employers' Confederation and the Union of Salaried Industrial Workers.

309. In order to reduce the stigma effects, the Swedish government, for example, monopolised labour market services and retraining, so that it covers all such training. The consequence, in Sweden at least, has been to increase the number of people employers are reluctant to hire, and to lower the quality of the training services. This approach is ineffective because, through generous benefits, it lures many into the programmes who do not need training, while its excessive coverage and scale make impossible the intense, tailor-made and very costly efforts required for the disadvantaged. This can only be done for a small number of people in small-scale, professional operations.¹⁷

310. In addition, the really disadvantaged in the labour market carry their problem with them from an early age. The time leverage is considerable and almost impossible to correct later in life. Remedies should begin to be applied, at the latest, in secondary school.

311. Lynch (1990) notes that US firms sometimes (8 per cent of 645 observed firms) offer general internal education to "high school dropouts". This low figure does not appear surprising, since general internal education increases the probability that young workers will take better paid jobs elsewhere. The same is not true for job-specific internal education. Changes mostly occur when the firm offers an employee general education outside. Lynch interprets this to mean that such training reinforces the signal that this is a good worker and therefore improves his or her probability of getting a better paying job.

312. While Ritzen's (1991) argument that "the market fails to provide the socially efficient amounts of general training" may be correct as stated, this does not exclude the possibility of perhaps far more serious non-market failure in the government training programme, as this overview and Hansen's (1991) survey suggest. If both types of failure exist, there would still be a case for government action, provided government understands what is needed. The advice it receives from the research community does not make it possible to draw this conclusion. In any case, it would appear best for government to co-operate with the market rather than try to do it all alone.

Selection effects and the two markets for labour training

313. It is important to keep two dimensions of competence development and retraining separate. On the one hand, industrial growth and individual labour market success require human competence; therefore, competence and retraining activity should be a viable commercial activity. On the other, human beings differ significantly in their ability to upgrade their competence, so that not all individuals are profitable educational investment objects, either for employers or for themselves. This is a social problem and not a case of market failure, and the decision to correct it through subsidies is a policy issue that should be covered separately.

314. Quality differentiation in the labour market presents an increasingly serious problem if:

- a) demand for increasing competence keeps rising in the job market;
- b) the ability to receive education profitably (*receiver competence*) differs significantly among individuals;

17. See Eliasson (1992a). See also the suggested method of minimising the stigmatisation problem by using economic incentives for the retraining institution; Eliasson (1992e); and *Ett hav av möjligheter*, SOU, 1992:123.

c) receiver competence is based more on talent than on education.

315. If a) and b) but not c) prevail, better education is the solution; if c) as well, the problem is *more* fundamental. In addition, to the extent that *receiver competence* can be developed, it is a cumulative process and has typical leverage characteristics. These are such that certain basic communicative capacities are decisive for the later efficient acquisition of particular skills. This makes competence development sequential *and school* the early primary focus of policy. *How should school be organised to prepare for later efficient learning on the job?*

316. Since early entrance into the labour market constitutes a learning experience in itself, school has to compete with work as a different but still viable institution for developing competence. A poor school may therefore be worse than little or no elementary education, especially for the disadvantaged, because it keeps the young person away from a better training experience on the job. Modern youth spend their most receptive years in an artificial classroom environment, where they find little of the pressures they will encounter in the job market. If the school is poor, they may spend twelve years learning little and failing to acquire discipline and good work habits. They will thus be less attractive for employers. This is a particular hazard for the disadvantaged student, who will find themselves limited to jobs which demand hard manual work and discipline. The talented students who go on to higher education are in an entirely different situation.

317. Evidence on the effects of various forms of education on variously endowed individuals is inconclusive in this respect. The important lesson here is that *education* cannot do it alone. It *must be supported by a well organised labour market and social insurance policies*. Some research reported in earlier chapters indicates the possibility that educational resources are seriously misallocated and that more resources to primary and secondary education and fewer to higher education might improve macroeconomic performance. The exact nature of that possible misallocation remains to be investigated. Suffice it to note here that for every dollar spent on a student in secondary education in advanced industrial countries, almost twice as much is spent on each student in higher education.

318. It has been asked whether not only the less educated but also the disadvantaged should receive more schooling to compensate for their disadvantages. This occurs in some labour-market training programmes, and in the past it was common to see students who performed badly have to repeat a grade (or year). There are two sides to this issue. *First*, is it economically rational (profitable) in terms of contributions to relative growth to shift more resources to the less educated or disadvantaged? *Second*, should this be considered socially desirable by some other criteria? If so, which ones?

319. In any case, evidence from the job market (Eliasson and Kazamaki Ottersten, 1994) does not suggest more school years but a different and more demanding school experience or earlier entrance into the job market where learning also takes place. The latter, however, will result in a permanently lower quality work experience. For such students (drop-outs) the stigma effects in the job market are particularly devastating (see, for instance, Lynch, 1992b).

320. While it is obviously important to channel the young through an efficient and demanding schooling system from the start, the problem of the disadvantaged remains unsolved. However, it is also clear that *a bad early school experience (unmotivated students or poor school) will affect the disadvantaged more than the talented*. Whether one believes in or has a sceptical view of the capacity of schools to solve the human quality problem, *more demanding and more efficient elementary and secondary schooling is still*

relatively better for the disadvantaged. If the current view that schooling is deteriorating is correct, there are likely to be bad times ahead for the disadvantaged.

5.4 Summing up on labour market policy

321. If the objectives of education and labour market training are to provide productivity and income effects, research results show that education has to be supported by adequate labour market organisation and an efficient social insurance system that stimulates labour market mobility. Intensified and tailor-made job search programmes should be merged and restricted to people with problems and should make greater demands on the effort, motivation and initiative of participants. Volume production of labour market services (training, intermediation) appears to be particularly ineffective for the disadvantaged.

322. Many studies also show that work is itself the most efficient form of education. The Swedish Employment Security Council, which offers tailor-made programmes for helping unemployed salaried workers to find new work or start their own business, appears to be an efficient way to get people re-employed. The Swedish Government labour market agency monopoly is an inefficient form of labour market service, notably for the disadvantaged, not only because of its large-scale volume but because it is unable to develop, through experimentation, the needed innovative and individually tailored services.

323. If, in addition, stigma effects are associated with participation in government-subsidised training and job search programmes, participation will send a negative signal to the market, even though it in fact contributes to productivity when tried on a job. This will be increasingly so the greater the number of disadvantaged persons, as others will stay away to avoid stigma labels. Large-scale government-sponsored monopoly programmes for solving the problems of the disadvantaged may have organisational problems and, in some cases, may do more bad than good.

324. The recent Swedish committee on labour market training, charged with giving the programme a corporate status and preparing for its privatisation, learned these lessons (Eliasson 1992e, 1994b; and *Ett hav av möjligheter*, SOU, 1992:123). It observed that social insurance related to unemployment, retraining, education and retirement is, in a large measure, a form of redistributing income over individuals' life cycles but that the redistribution, as now organised, takes place through many public tax and subsidy accounts. The committee concluded that to stimulate the individual effort and motivation needed for successful training, an effective *incentive system* is also needed, and these accounts should be largely managed by the individual, so that he or she can avoid becoming unemployed before being eligible for financing of retraining as decided by the labour market bureaucracy.

325. The proposal is that the individual can, under certain conditions, use savings from an insurance-retirement account for education and training. The individual pays part of the costs by drawing on his or her retirement wealth and decides when and where to receive training. The government finances part of this programme, varying the subsidy according to the situation. This arrangement makes the individual rather than the government responsible for him- or herself and should be a powerful incentive that raises motivation and makes decisions more informed. The individual who chooses appropriate training should become more competent and therefore more productive, and later earn more and be able to recoup the investment. There should be neither private nor social costs associated with the programme (Eliasson, 1992e, 1994b). The committee argues that, in this way, the problems of the disadvantaged and of stigma effects can be solved more efficiently and reasonably than in the current system (see further, Box, p. 16).

326. While researchers have found it difficult to discover direct positive effects from the labour market programmes, Björklund and Holmlund (1991) diplomatically conclude that the overly large Swedish labour market programmes at least have kept open unemployment low.¹⁸ This raises the interesting problem of whether very low open unemployment of the Swedish type is something positive in itself, i.e. whether it is important to keep people formally on the job whether they produce or not, rather than remove them from the workplace when there are no profitable tasks for them at the wage they demand.

327. It is recognised that work is the best post-school educational experience, but this means productive work, not simply presence in the workplace. Being idle may be as bad an experience for the unemployed individual as it is for his or her colleagues and the employer. In such a situation, being compelled to seek a job, to market oneself and to learn may be both the best long-term solution and the best work experience. This solution should at least not be excluded from an experimental labour market policy programme.

328. If, as Björklund (1989b, 1991) observes, more research is needed if labour market authorities are to know what to do, it may require direct experiments. This is the same as suggesting a market solution to labour market policy in order to overcome the deficient innovative capacity of standardised central management under monopoly market conditions. Trying different labour market experiments for systematic scientific evaluation is not different, in principle, from allowing and providing incentives for a number of private institutions to compete for labour market insurance money through *innovative* product development. Scientific experiments are more conservative and focus on systematic evaluation; the market solution is more innovative but allows the clients of the system to determine what is good or bad. The clients are the participants in the labour market programmes, and an efficient market solution allows them to choose rather than have decisions made through a monopoly.

329. For countries with central government-run policies, like Sweden, the efficient solution that maximises welfare for the participants in the programme would be to break up the centralised policy apparatus into a number of independent, competing producers of labour market services, including labour market insurance, that can initiate, develop and try out different solutions to labour market intermediation, education, etc. in competition with one another. Such a solution is probably the only way for government to learn to organise the institutions of the labour market so that the enormous resources currently provided even under normal circumstances are efficiently used.

18. a conclusion that may not be correct (Skedinger, 1994).

Table 5.1. Distribution of labour according to quality in the United States and Sweden

	United States 1986	Sweden 1985
Level I: High-level jobs Executive, professional, natural scientists, computer scientists	25	15
Level II: Middle-level jobs Skilled workers, supervisors, mechanics, maintenance workers, middle management	41	47
Level III: Low-level jobs Service workers, machine operators, helpers, labourers	34	38
Total	100	100

Source: Eliasson (1990a, pp. 76-77).

Table 5.2. The old Swedish policy model

1. <i>No central policy involved</i> in production and investment decisions
2. <i>Open economy</i> , subject to competition (free trade, free introduction of new technology in firms, free entry)
3. <i>Active labour market policy</i> , including solidarity wage policy; move people to the jobs
4. <i>Fair distribution</i> , occasioned through taxes and public sector growth

Source: Eliasson (1986b, 1992a, p. 162).

Chapter 6

What Can be Done? Is there Still a Policy Role for Government?

330. The economies of the industrial world are currently facing a dramatic transformation of their production systems. The technology of their industrial base, which is almost 150 years old, is rapidly being mastered by the non-industrial world and the recently liberated Eastern European economies, making large cadres of workers and management obsolete. At the same time, despite some exceptions, new industries have been slow to develop. As a result, the Western world risks having continued large-scale unemployment if governments cannot effectively support reorganisation of production and markets.

331. By definition, lack of competence is at the origin of this crisis. If it is not resolved through appropriate competence development and structural adjustment, it will automatically be corrected by inflation, downward adjustments of real wages and, above all, significant adjustment and widening of relative wages. This will create further social problems.

332. Competence development has become a buzz word and is probably also the appropriate political signal, both for the economy and for the individual. However, it is by no means clear what kind of competence is lacking and what politicians can and should do to improve the situation. It is clear that education should not be considered in isolation from the allocation of competence which occurs in the labour market. The efficiency of the labour market furthermore depends on the willingness of the individual to participate in that allocation process; this is to a large extent a question of adequate provision of the social insurance that reduces the individual's exposure to the local hazards of market life. The best such insurance, however, is a good education and a varied job experience. Education, labour market efficiency, and social insurance constitute a triad of interdependent policy issues.

333. In order to develop policies directed at altering the competence characteristics of the working population of a country, *politicians* and their advisors *must themselves* be competent. They have to possess: knowledge of how individuals function in more or less demanding work environments, knowledge of how a dynamic economy operates, and knowledge of which educational and other policy measures will achieve the desired results for growth. This information does not exist today nor, if it existed, would there be any experience of how to use it for policymaking.

334. Considerable economic resources are already devoted to education. The solution to a deficient educational system is likely to be not more public resources but rather a differently organised schooling system, one which cannot be implemented in isolation. It has to be simultaneously supported by a reorganised labour market and an appropriately remodelled social insurance system. For this to be possible, the individual must have incentives to participate in the change. In most economies, a tangled web of institutions and interest groups currently represent the individual and, as they significantly influence the distribution of income, they constitute an important part of the institutions making up the incentive system.

The key policy task is to organise the labour market such that individuals become stimulated and supported in their search for interesting and rewarding work experiences.

6.1 The economic welfare of a nation: labour market ability and insurance

335. GNP is often viewed as a cake to be cut up and consumed. But individual welfare also depends on its distribution, i.e. what one contributes and what part of the total cake one gets. In order to carry economic policy beyond promoting the interests of particular groups at the expense of others, a generalised welfare measure must capture the costs and benefits of political action. If reinterpreted, GNP -- despite its deficiencies -- can offer some information on national welfare.

336. *First* of all, GNP per capita can be interpreted as a productivity measure (how much output a population is capable of producing on average) and as a measure of *resources available*, on average, to each citizen (Eliasson, 1991c, pp. 29 ff.). Thus, per capita GNP measures the resources or opportunities an economy offers its population. Individual welfare then depends on the individual and on political competency for exploiting these resources. The individual's ability to capture economic welfare depends on his or her competence to:

- exploit opportunities, which increases growth of GNP and increases with growth of GNP
- cope with unexpected change associated with growth in GNP.

337. Economic growth is also associated with a steady, and largely unpredictable, change in the composition of GNP, which creates social hardship for some. Unpredictability here means the inability to control the timing and nature of the change and its outcome, even in a stochastic (insurance) sense. The ability of the individual to cope with such unexpected change is part of his or her competence, i.e. his or her ability to retool for a new job (there is of course a considerable element of luck associated with economic success, and random failure is part and parcel of the same process). The faster the economy grows, the greater the change in the labour market. As stagnant mature economies attempt to grow, the hardships of adjustment will be felt before the benefits and the opportunities. Myopic, risk-averse individuals, especially older ones, are likely to find this politically unacceptable.

338. Thus, economic welfare is very much a question of a properly organised *insurance* system (Eliasson, 1992a, 1994b), and unemployment insurance is perhaps its most important aspect. This means that the basic welfare policy of government needs to support both *competence development* and *insurance* for the negative consequences of successful growth. This study is primarily concerned with the first of these tasks, which is new and difficult. The second has a long tradition in European welfare economies. The two tasks are not independent.

339. Educational and insurance institutions operate in the economy as *infrastructure capital* and absorb a significant part of its resources. Once the competence capital that contributes to economic growth is identified, it becomes important to know what *incentives* cause individuals and firms to invest in their own competence development as well as what *insurance arrangements* encourage them to take long-term investment positions in their future. It is also necessary to investigate the efficiency of the infrastructural provisions, which depends very much on the organisation of the production of these services, notably the degree to which the public sector is engaged. Here the policy problem enters directly.

340. Education for competence enhancement and provision of social insurance are related policy tasks, especially since a good education is the best social insurance for the individual in a demanding labour market. Here, the focus is on providing educational services to enhance individual competence. Areas for policy attention can be identified, particularly in the areas of the institutions of the economy that regulate the trade-off between present and future. They concern the *specification of the educational product*, the *incentives to learn*, and the *efficient production of educational services*. Since rewards for competence depend on whether the individual can find the right job in the labour market, an important aspect of policy is to allow for the institutions that *enable* him or her to do so and to *remove those that stand in the way of finding the best match with an employer*. The more efficient this labour market search process, the greater the total economic value created in the production system.

6.2 The nature of human capital: a matter of tradability

341. No product is as complex and heterogeneous as educational output or human capital. In understanding the nature of human capital or competence, one has to recognise two dimensions:

- *Dynamics*: educational output is always an input in some further development of competence.
- *Redundancy*: more than any other type of capital, human capital is characterised by extreme redundancy in any application.

342. Unlike machines, human beings use only a fraction of their competence in a given job application. They are therefore always overeducated and overcompetent. This defines the comparative advantage of human beings and explains their flexibility in the labour market. *Overcompetence should be an objective of the educational process*, since it creates flexibility and ability to respond in a broad range of job contexts. The extreme complexity and redundancy of human capital also makes it impossible to assess it properly. Much of it is tacit, and most of it has not been tried on a job.

343. This observation allows a few strong conclusions:

- *First*, the labour market is a market in human competencies, one that will always be very imperfect and incomplete owing to the nature of the services traded.
- *Second*, the economic value of educational output depends on how it is allocated. The extreme heterogeneity of human capital means that one cannot be sure that it has been optimally allocated. The labour market search process should therefore never end.
- *Third*, the earned returns to competence (salary) compensate solely the competencies employed on the particular job. The market does not pay for redundant knowledge.
- *Fourth*, since redundancies are part of the input in the constantly ongoing, lifetime development of competence, it is natural that the individual should look at redundant knowledge as a return to his personal educational investment.
- *Fifth*, the particular dynamics of human capital suggest that specialisation presents a danger over the long term. Placing all one's competence development into a narrowly specialised range may generate extra rent temporarily and at strongly diminishing returns, but will lower the redundancy of intellectual capacity that makes one flexible in the job market and more able to learn more.

344. As Ysander (1978a, 1978b) pointed out, the heterogeneity of human capital has made it inapt for traditional economic analysis. As a result, homogeneity is assumed, an assumption that removes the most important features of human capital and reduces the educational policy problem to the choosing of the *volume* of resources to invest. This conception, conveyed by economists to educators, explains the huge failure of school policy in the 1960s and 1970s. The current economic situation is too severe to allow such a policy failure to be repeated.

345. However, even if quality educational output has been produced, it will create neither individual welfare nor maximum economic output if the market is not capable of allocating that competence to its best use. Increasing *the tradability* of competence, i.e. improving the efficiency of the labour market, is therefore a critical part of good educational policy.

6.3 Educational product specification

346. The first policy question is: Do we know the specification of educational output demanded in the labour market? The answer is: Not well.

The standard-package student

347. Because of the heterogeneity of output and since they do not know what is learnt at school and how it is used in the labour market, educators have had to specify the educational product by detailing the teaching agenda and by relying on regulation and tests to achieve quality and on subsidies to make enrolment attractive. This approach very much resembles the quality control apparatus of certified production. It is not, however, the best model for education. While components for certified production are exactly defined and identical, the raw material of the educational process (students) is and should be extremely heterogeneous. The school-agenda view promotes standardisation in production (teaching), when tailor-made production should be used and innovative product development encouraged. When such teaching methods are applied to a heterogeneous student material, the consequence will probably be a lowering of the average level of quality. It also means that diversity of the educational process is reduced and that schools will learn little from one another. Privately organised education and training close to jobs, on the other hand, are typically characterised by uncertainty about the desired final product. Firms engage in extensive experimentation to achieve the right improvements in competence, and they make participation in company-provided education a part of career advancement. A business firm with a successful internal training programme will immediately be studied and imitated by others who are concerned about their competitiveness.

348. The empirical evidence suggests that educational choices should be made individually in order to reflect the particular characteristics of the student. If an equal output specification (equal standard competence) is desired, educational input has by definition to be tailor-made. This is exactly what is needed if disadvantaged students with varying problems are to be brought above the minimum educational achievement standards. Homogeneity of educational achievement or knowledge is, however, no desired output of the educational system. This means that different teaching approaches may be necessary to bring all students above the minimum standards required in the labour market and to produce the well-rounded and educated student -- although this may be beyond the intellectual capacity of some.

Individual risk aversion causes educational myopia

349. Although most studies show that education is profitable in comparison with other investments, and that primary and secondary education is both socially and privately very worthwhile, especially in backward economies, risk-averse individuals are considered unlikely to take on the risk of such investments themselves. Hence, countries -- especially those which are wealthy -- spend a great deal on subsidising schooling and/or on operating various institutions of education and learning. Many of these public efforts have been motivated by the ambition to provide education for the disadvantaged, who are unlikely to take on the risks associated with investments in education because they expect private returns to be very low. In order not to stigmatise the disadvantaged, public authorities have typically not provided separate education for them. Yet to run primary and secondary schools with a very heterogeneous student material -- when all costs are subsidised by government, and student incentives to perform are therefore low -- is not an efficient way to organise education production.

350. As public education programmes become more costly and inefficient and at the same time increasingly important for the efficiency of other production, serious concerns are being voiced and there is greater pressure to do something. Studies show that even poor people are willing to pay privately for secondary education, especially if school quality is good and rewards for superior skills sufficiently high. As egalitarian and distributional concerns have weakened, discussion has focused on possibilities of mobilising individual talent and incentives in the educational process in order to increase supplies of economically useful competencies. Research confirms the need for policy to recognise that if incentives to choose the right education and to mobilise enthusiasm and effort at school are not strong and properly directed, the quality of education will be low. Policies will have to work at increasing private financing of schooling *without* creating underinvestment in education.

Can policy play a role in supporting long-term decisions?

351. In the past, government support has been financial and with few strings attached. Such subsidies reduce incentives to learn and may even create a negative educational output, in comparison to a system of entirely private financing. In essence, the underinvestment issue is whether risk-averse and myopic firms and individuals invest too little in education; and how government support can be organised so that effort to learn does not decrease, and increased total investment does not result in a lowering of school output.

Social capital

352. The family and the school transmit the accumulated social capital infrastructure of a country from generation to generation. If people today are concerned about the development of a myopic society, they should also be concerned about which behaviour codes are being passed on to children *through these institutions*. Educational policy cannot be formulated independently of policies that affect the formation and disruption of families. The best educational policy may be nullified by adverse developments in the family sector.

353. An individual's willingness to take a long-term perspective of his or her career is a critical factor for success in the education system. It is developed at home and fostered at school. It is part of the economically useful quality specification that is the concern of this study.

354. The empirical survey in Chapter 4 presents very strong evidence on the economic importance of social capital in guiding students onto the right educational paths. It would (for instance) clearly be economically good for both the individual and society if children were removed from bad family environments. Since Western codes of behaviour do not allow significant authoritarian intrusions into family life, there are few policy remedies for children in families with a low social capital endowment. This gives schools an important corrective role. The empirical evidence suggests that this is much less a matter of promoting good academic learning than it is a question of behaviour and discipline throughout primary and secondary school.

The school agenda and human capital: are there basic competencies for all?

355. Certain subjects have always been considered more important than others. This is partly because school is viewed as a producer of final knowledge capital. Thus, school theoreticians, educational policy makers and school administrators have all asked the same question: What *basic competencies* need to be acquired in school in order to succeed in life?

356. The research evidence is not clear, even though indications are that certain parts of the school agenda are more important a job than others. Three problems have been reported in the previous chapters:

- *Selection* makes it difficult to tell whether difficult mathematics courses upgrade skills or select talent.
- Studies explicitly designed to identify such basic competencies have not been carried out; tests have only been made on existing hypotheses about what was thought, *a priori*, to matter.
- Some evidence does not support the general view that difficult mathematics or science courses or communication skills enhance performance in the labour market.

357. It is surprising that at least exploratory steps have not been taken to resolve these problems. Interviews of different employers could be systematically conducted to learn what competence criteria are used for screening applicants for various tasks. Case studies could be made on the job of what qualities matter for performance. This is different from aptitude tests, on which a great amount of literature exists, which are often conceived as general intelligence tests and may or may not have predictive power for a given job. The idea would be to interview -- on work locations -- workers, foremen, and personnel managers, and to undertake careful case studies aimed at formulating hypotheses, rather than to test hypotheses already formulated in the theoretical literature.

358. Some work of this type has been done in conjunction with this and other ongoing studies conducted by the Industrial Institute for Economic and Social Research (IUI) in Stockholm. Whereas *advanced* intellectual capacity in mathematics and science are seen not to matter critically for job performance, communication skills could, however, be important as a platform for on-the-job-training -- as so-called receiver competence (see Kazamaki Ottersten, 1994b). The ability to work in teams, and discipline, are what are looked for at recruitment. However, these conclusions may vary according to the workplaces selected for the studies, and more research is needed.

Competition improves product quality in business firms -- why not in school?

359. Competition in industrial markets takes place through innovative upgrading of product quality, and rarely -- in sophisticated manufacturing sectors -- through price competition alone. This is even more pronounced in private services, but not in those, whether private or public, that operate under protected monopoly conditions. Yet this is typically the case of educational production.

360. It was argued above (Chapter 3) that innovative production of educational services will not be achieved under the standardised regulatory regimes that characterise Western primary, secondary and (in most countries) higher education. The rationale for regulation is no longer empirically valid, since the quality of educational services is becoming increasingly important and more costly both for the economy and the individual. There should be only one policy option: to deregulate the schooling system and allow experimentation and competition for customers (students) through educational product innovation.

6.4 Incentives

361. While product innovation and efficiency of production play a decisive role in competition, incentives play the critical role in making it happen. The inclination of young people to take a long-term perspective on their future is part of the complex of incentives that determine how much effort students expend. Social indoctrination from home and at school is important. But purely pecuniary incentives are also at work throughout the school- and working life of individuals. Many of these can be controlled through policy, and the most important parameters concern the provision of finance and insurance.

362. The present situation regarding incentives is such that individuals and firms underinvest in their education. However, is the existing competence capital of the country being efficiently used?

Underinvestment in education is a matter of educational output

363. A standard argument runs that without government subsidies, there will be *underinvestment* in education. The research indicates that this may or may not be the case, depending on the assumptions made in the analysis, and there is even an argument for *overinvestment*. Some "underinvestment" may be very costly for society to correct, since a different allocation of resources for education to the disadvantaged would result in less output.

364. The problem of underinvestment is complicated by individual risk aversion, asymmetric information, lack of receiver competence, and low private incentives. There are also a host of market imperfections that contribute to the underinvestment problem. For instance, high wages for the young (typical in the Swedish labour market) make it unprofitable for both individuals and firms to invest in education at the workplace.

365. It is also important to distinguish between resources invested in education and the output of the educational process. *The underinvestment proposition only makes sense in terms of educational output.* No reasonable claim can be made for allocating more public resources to education. There may be a case for too little output. But this reformulation of the underinvestment hypothesis simply restates that the educational process is inefficient.

A different organisation of educational production may produce more competence

366. Who should be made responsible for the competence development of individuals: the *individual*, the *employer*, or *government*? Without strong individual incentives and significant private financing, underinvestment may occur, not because too few resources are invested (by the employer or government) but because lack of personal incentive makes learning inefficient. Because of inefficient organisation of educational production, the output from the resources invested will be too small.

367. Since governments in wealthy western countries already devote considerable resources to education, it may be appropriate to spend less and to reorganise the production of educational services and its incentive structure to promote more student effort. One strategy would be to tilt the *compensation schedule in favour of competence* and to look at private arrangements with public guarantees (insurance) in order to overcome financing constraints and risk aversion.

Wage-setting and the rents from educational investments

368. Many market imperfections prevent the establishment of appropriate supplies of education. The most important concerns the correct pricing of competence. The educational rent to be captured in the market is the most potent incentive for encouraging young people to invest in long-term education. As demonstrated in Chapter 2, the incentives to become more competent, except those for higher education, are not very strong. Above all, the time is longer than persons in their late teens are willing to wait in order to capture educational rents. A strong tilt of the compensation schedule in favour of competence is therefore indispensable. It may even be that other educational policies will not work if private educational rents are too small. Here too, policy options are limited. The tilt in compensation is primarily determined by market demand, where the competencies valued are not school grades but productivity on the job. Except for modifications of the tax system that reduce progressiveness, there are few traditional policy instruments. The large policy potential lies in *changing labour market institutions*, notably by removing price discrimination and other imperfections -- changes that would directly affect the very foundation of union activities.

6.5 Educational production efficiency

369. Emphasis has been placed on product specification and incentive problems, and it is a point that emerges clearly in the literature, which does not, however, offer much advice on changing the educational process. Even without a clear idea either of the needed output or of how to increase incentives to achieve that goal, it is important to look at the efficiency of educational production, for which incentives play a critical role. Since a large share of schooling is provided by government resources, the efficiency issue becomes a government responsibility.

370. The potential area for government policy appears to lie in the *organisation of education*. Many of the deficiencies of the educational system may be traced to government policy and notably to its heavy regulatory involvement in the educational process. This also means that there should be plenty of room to improve the process by allowing for different organisations, especially with respect to the division of responsibility between the public sector and the market and between government and the individual.

371. Since current research in the field gives few guidelines on reorganisation, an efficient way to proceed could be to deregulate the school system gradually, opening it up to experimentation and competition at all levels. This means *instituting competition as an instrument to enhance innovation and efficiency of production in the educational system*. It includes the stimulating of private competition and removing the public financing that discriminates against private initiatives. Research evidence strongly but indirectly supports this measure. Above all, as the first concern of efficiency, educational production should be organised to support the transition from school to gainful work.

Improving school as a path to the labour market

372. Individual success begins with personal talent; talent is improved upon as the individual passes from the family to the school and into the labour market. Existing literature indicates that the organisation of education and of the labour market strongly influences that filtering process. This organisation is, in turn, dependent on a number of institutional characteristics that exist by political design. A policy analysis of the production of educational services must therefore examine these characteristics closely, and the organisation of the transition from school to work should be studied carefully. Until then, little can be said about the educational investment hypothesis.

The efficient mix of public and private education

373. Part of the institutional design of educational organisation and of the labour market is embodied in the mix of public and private solutions to the production of educational services. The family is private. Most primary and secondary education is public; it is regulated by school authorities and publicly financed and run.

374. For higher education, the institutional setting differs in industrial countries. First, there is the separation of those students leaving for the labour market and of others going on to higher education. On-the-job training is largely private and experimental. Higher education, with a few exceptions, is public.

375. Both groups encounter very differently organised environments in all countries, and the differences are very much dominated by the policy hand of government. Thus, the filter characteristics of school and the labour market are strongly influenced by government regulation. But the differences among nations are large enough to make country comparisons of educational and labour market organisation interesting and important.

Paying for school?

376. Government is involved in education in three main ways: it *pays for* education, it *regulates* the educational process, and/or it *operates* schools. It can pay for school partially or cover all direct costs. It can pay by subsidising schools, by *vouchers* or stipends to students, or by *low-cost financing*. Government pays for schooling to overcome risk aversion among students or bad home environments, or simply to promote more education. There is no overriding reason for government to finance all education, even though it traditionally pays for almost all primary and secondary education and regulates the rest. For higher education, practices vary.

377. Research results suggest that there is a social value to subsidising education, especially primary and secondary; but there is also a private value to stimulating individual effort and enforcing more discipline. Results reported in previous chapters indicate that a high subsidy level coupled with heavy regulation removes both incentives and possibilities for individuals to improve their private competence at school. This causes apathy on the part of both students and parents.

378. There are thus strong efficiency reasons for establishing better private connections between the payer and the receiver of educational services, in order to make students (and/or their parents) more responsible for education. Perhaps a specially designated family tax-sheltered educational investment account should be instituted from which children can draw funds. They might also be able to decide which school to attend. There could be a subsidy element in the early years, which would gradually decrease and be replaced by guaranteed loan arrangements as the student entered higher levels of education (see Eliasson, 1992d, 1994b). Such privatised schooling could be tailored to achieve a combination of incentives and equity and overcome the constraints associated with risk aversion and myopia. A proposal of this sort, from the Swedish committee for labour market training (see Box, p. 16), is currently in the political process.

Financing school

379. Paying for the schooling of individuals blunts incentives. Financing part or all of schooling through *guaranteed loans*, in order to overcome financing constraints, will retain some of the incentives of private financing without discouraging students from engaging in educational activities. Again, a family financing arrangement through a family tax-deferral account might help here, even though differences in family income might make it necessary to arrange for some direct subsidies. Alternatively, students reaching school age could be given an account from which to draw resources, up to a limit, for various educational activities (Eliasson, 1992e, 1994b; Fölster et al., 1993; and Box, p. 16).

Running school

380. Why should governments operate schools? What particular competence resides in a publicly controlled educational system? No convincing argument could be made against a school if its financing system were appropriately organised; and there would definitely be no good reason for not allowing competition among schools and for making them monopoly institutions. Yet the question is rarely raised. Current literature seems to take it for granted that a public authority is operationally responsible for educational institutions. Private schools and universities are looked upon as exceptions, or with suspicion.

381. As education becomes increasingly important for overall economic performance and for the well-being of the population, and as the performance of the public school system is increasingly criticised, the dominance of public education will also be questioned.

382. There is one argument in favour of publicly run schooling but its relevance is unclear. If students can choose freely and schools compete unrestrictedly, selection effects will appear in the long run and good teachers and able students will tend to cluster. In a privately organised market, of course, ineffective schools, like ineffective firms, will eventually go out of business. This happens in factories and shops on the basis of expressed consumer preferences. Why not schools? The standard answer is that most people are not sufficiently competent to be entrusted with such demanding decisions as school choice. Yet even

with government-run schools, quality selection occurs although through indirect channels such as choice of housing (Fernandez and Rogerson, 1993). Some parents do take the education of their children seriously, an attitude that should be respected and not hampered by regulation.

Regulating school

383. Whether paying for, financing, or allowing schools to be private, government has always had a heavy hand in the schooling business through regulation. Many reasons have been given: to provide for equal opportunity, to standardise quality, to ensure that tax money is not wasted, etc. Perhaps the most far-reaching regulation -- compulsory schooling -- concerns the individual, but its enforcement depends on the existence of schools. Since schools did not spring up everywhere spontaneously, government stepped in and required local communities to open institutions. Later, regulation was modified to make it difficult or impossible for private schools to operate.

384. Compulsory primary and secondary schooling is perhaps the most important reason for more than a century of school regulation and public schooling. Schools have to be available everywhere if universal education is to be possible. Most of the evidence presented here suggests the value of an open and rather experimentally organised educational system at all levels, so that individual incentives and talents can be exploited efficiently. Mandatory primary and secondary schooling will make a government regulatory presence unavoidable, notably in order to operate schools where private incentives and the market fail.

Making schools innovative

385. The problem with regulation is that it requires standards; standards reduce the variation allowed in solutions and discourage innovation. If, instead, customers (students and parents) decide what is good quality for them, there is the possibility of innovation, competition, variation and efficiency, *on the basis of customer rather than administrative standards*.

386. Most educational administrators are hesitant to hand over such responsibilities to the "customers". As noted above, however, there is no support for the view that school experts and administrators are more competent to choose schools than the customers themselves, since there is no generally accepted and precise definition of what good education means for the student. Rather, the "customers" who try to sell the competence they have acquired (at school) in the market should know best and be most concerned. Under a free experimental regime, a good innovative school will provide a wealth of positive welfare effects for other schools to learn from. Bad schools will eventually go out of business. The customers will be the judges of quality.

6.6 Distributional considerations

387. Governments have also regulated both educational production and the labour market in order to achieve certain redistributive objectives. Most education problems discussed above have their roots in distributional policy objectives. These policies are based on a misunderstanding of the role of education in the production process. Empirical evidence rejects the simple human capital analysis that generates these policy conclusions.

388. If economic growth is the objective, a strong tilting of compensation schedules and an educational resource allocation heavily in favour of competence accumulation would optimally support this aim. It is of course difficult to advocate such an extreme policy, because standard economic analysis would predict a skewed income distribution. However, it is also possible to design micro-based models in which competence development is stimulated and existing competence more efficiently allocated where such extreme results do not necessarily follow. The outcome of economic analysis too often depends on the design of the models and their specific assumptions (see Box 5.1).

389. If individual economic incentives and a person's capacity to retool intellectually are incorporated into the analysis, the theoretical conclusions on educational policymaking change radically and become critically important for the economic success not only of the individual but also of the firm and the whole country. The emphasis shifts to the early years of schooling, along with family social capital, to "teaching" good work habits and to ensuring that certain basic intellectual competencies are acquired.

390. Research shows that school efficiency and success in the labour market depend on how both the school and the labour market are organised. Existing organisations are, however, very much the result of government regulation. Given present concerns about provision of competence in the labour market, it is clear that government should prepare the way for significant changes in the organisation of both educational production and the labour market. *Less* regulation and more reliance on local experimentation and market incentives will contribute positively to economic growth and most likely also to a more equitable distribution of lifetime income. However, this requires finding an adequate solution to the labour market insurance problem.

6.7 The organisation of the labour market and the social insurance system

391. Educational policy has traditionally been discussed in isolation from other policy activities. The bulk of the theoretical and empirical evidence indicates that this is inappropriate and inefficient from the point of view of understanding and achieving desired effects.

392. Educational output is largely directed towards, devised for, and enhanced in the labour market. Most human capital used and valued (compensated) in the labour market has also been developed and finally shaped on the job. If the labour market is badly organised for further developing and better allocating human knowledge and talent, the economic returns to education will accordingly be reduced.

393. The overwhelming evidence is that the highly regulated and price-rigged labour markets of the industrialised countries are not well organised for these purposes and that *deregulating the labour markets would lead to a major rise in educational achievement*. This is an unavoidable extension of the allocation argument, since the issue here is one of finding educational solutions to the problem of jobless growth and the fact that there can be no solution without labour market policies aimed at changing the institutions of the market.

394. A labour market that is organised to enable easy mobility between jobs will support individual competence development and a growth-promoting allocation of labour. This requires overcoming people's inherent aversion to risk, through an appropriate social insurance system. Most current systems place significant constraints on incentives to move, since benefits are usually lost with job changes.

395. The inefficiencies in the social insurance system can be explained by the fact that it is financed by employers and/or through taxes and the public sector. Employer-based social insurance will always be biased towards employers' needs. And publicly based insurance systems will be heavily weighed down by regulation, if only to prevent parasiting (moral hazard). Individuals (the customers) will need to be able to make their own insurance decisions, to finance a significant part of their insurance themselves, and to link benefits to incentive schemes to prevent moral hazard. The most rational and efficient of incentive schemes is based on a lifetime consumption/retirement-financing scheme of the individual in which a significant part of the benefits drawn for education, unemployment, etc. is charged to the individual's private retirement funding (see Box, p. 16). This is not the place to elaborate the insurance question, since it has already been stressed earlier in this chapter that the social insurance problem is an important part of overall educational policy, and figures significantly in labour market retraining and in improving human capital as efficient protection against labour market risks.

396. The labour market problem of the OECD countries has both an immediate and a long-term dimension. The long-term problem, which is the primary issue here, concerns an integrated reform of the institutions of education, the labour market, and the social insurance system. The immediate problem of adjusting the mature, semi-obsolete industrial economies to new growth paths is largely dominated by the social insurance problem. It is necessary to effect a massive transformation of labour across age groups from the public sectors and from obsolete industries to growth areas. This is, however, not possible without causing continued high unemployment and making a significant downward adjustment in compensation for obsolete skills. The weakening of the negative impact depends on the capacity of markets and government to provide efficient retraining and the capacity of the labour market to move people to the right opportunities. This will not occur effectively in a publicly run education, labour market, and social insurance system that is protected from competition.

Table 6.1. The educational policy map

<p>Educational product specification</p> <ul style="list-style-type: none"> -- Competence to relearn -- School as a quality filter -- Social capital (infrastructure) -- Short- and long-term trade-off
<p>Incentives</p> <ul style="list-style-type: none"> -- The lifetime compensation schedule -- Relative compensation -- Who pays for education? -- Risk aversion and insurance provision -- The allocation of competence within the firm, within the economy -- Underinvestment? -- Attitudes
<p>Efficiency of educational production</p> <ul style="list-style-type: none"> - Public or private - Leverage and the importance of early schooling - Infrastructure - School as a filter into the labour market

Chapter 7

What Do We Need to Know? The Research Agenda

397. In several important areas, critical knowledge to support the policy agenda presented in Chapter 6 is lacking, and they are areas in which it is very difficult to conduct research. There are, in particular, gaps in knowledge and understanding that effectively prevent informed policymaking in economically and socially vital domains. The aim of this chapter is to identify those gaps.

398. From a *social point of view*, it is extremely important to prepare individuals in advanced industrial countries for a much more demanding future work environment. It is important for national economic growth to build a viable competence base in the economy and to ensure its efficient allocation. It is also necessary to accept that, using existing technology, the current output of an industrial economy can be produced with many fewer people if the production system is properly reorganised. Competition from newly industrialising economies is increasing the pressure on mature economies to speed up this reorganisation. In this new situation the less educated will not fare well.

399. To achieve a socially acceptable outcome, it is vital for the entire educational process of the economy to be capable of *innovation*. Achieving this goal is likely to require considerable decentralisation and free experimentation in a competitive educational market environment. This will probably not conflict with the social goal of providing the individual with a minimum basic-competence endowment, although an answer to this question requires further research, and the main task of the research agenda presented in this chapter is to find ways to resolve this conflict. But competition in the market for educational services will mean accepting that the quality of educational services will vary and affect individuals unequally. Again there will probably be no difference in principle from before. Even though school regulation and public production of educational services were based on the idea that students should be treated equally, the outcome is nevertheless characterised by significant variation, showing that the possibilities of regulating and controlling a complex production process are limited. Hence, as this report has demonstrated, competition through innovative product development may well produce both better and more equal services for students than before.

400. A second task is to investigate whether policies can overcome the natural unwillingness of individuals and firms to engage in the necessary *long-term competence development*. It is obvious that if a policy is carried out on the basis of unreliable and incomplete information, the risk of mistakes is great. At the same time, a large part of current public involvement in education, labour market organisation and social insurance involves major negative consequences, not only for individuals but for entire national economies.

401. The gaps in knowledge unfortunately occur in areas in which it is very difficult to achieve *holistic understanding* of the social and economic significance of education. Information is especially lacking on long-term issues such as the pre-school origins of student or worker performance (social capital). Reliable evidence on the filter vs. investment hypothesis and on the macroeconomic effects of different educational systems is largely lacking. However, understanding can be significantly enhanced by combining facts with reasonable assumptions. It is also true that fully understanding the filter hypothesis, for instance, may require unconventional research methods such as *experiments* that extend beyond the time horizon of this study.

402. This final section is concerned with the complementary research needed to answer these questions within a reasonable time span. This research has to draw on variations in the organisation of education *in different* countries, since variations in educational production within countries are very small. Given the current organisation of primary, secondary and even higher education as public monopolies, innovative educational product development will not be achieved unless there is extensive learning from the experience of other countries. Present national education systems are not innovative because they have been regulated by government to become non-innovative. Discovering better ways will require opening up the educational system to free experimentation at the school- and classroom level and to competition for students among schools.

403. Studying school systems in other countries is costly. Experience from the United States, Japan, Germany, and Sweden provides a quite rich source of variation that is relevant to advanced industrial economies. It is important, nonetheless, to note that some not yet industrialised nations have organised school systems that appear to perform very efficiently by the standards of industrialised economies -- see, for instance, Stevenson, 1992). The four countries mentioned not only exhibit different characteristics but also have easily available data and research results. The research agenda should emphasize, as does the present study, educational product specification and innovation, incentives and attitudes, and the organisation of educational production. Since a guiding principle of educational policy among the wealthy industrial nations has been to curb market forces in order to achieve a more equitable distribution, country comparisons should investigate not only whether the use of fewer market incentives in the educational process has really produced a more even distribution of lifetime individual incomes, but also to what extent such regulation has lowered school quality.

7.1 A suggested research agenda: micro studies

404. The previous chapter concluded that policies should aim to improve the institutions that guide and control the *individual's lifelong educational experience*, notably those that efficiently exploit a student's own incentives and ability to take initiatives and assume economic responsibility. This will necessitate a radical reorientation of existing educational policy. Above all, it dramatically reduces the possibilities for controlling the *ex post* individual outcome of education. It could be expected that the variation in outcomes would thereby increase, but the analysis presented here suggests that this will not necessarily be the case, at least not in terms of academic achievement. The *variation in differences in output quality* will undoubtedly increase, but a more differentiated educational product is in itself desirable.

405. The research agenda should be designed to achieve better *ex post* evaluation of new educational policies, ideally through controlled educational experiments. However, allowing for reasonably free

experimentation at the school- and classroom level would also provide a rich source of information on innovative learning.

406. The minimum *basic competencies* needed to pursue a reasonably successful labour market career in an advanced economy, and to benefit from opportunities for continued education and competence upgrading, remain to be clarified. It is important to do what should have been done long ago, namely to attempt to identify more precisely and more practically, if less ambitiously, the minimum basic competencies an individual should possess before graduating from the secondary school system. This proposition would appear to contradict the earlier proposal for free experimentation. Nevertheless, improving educational output through a different kind of school organisation and innovative product development naturally requires good and competent students. The basic competencies needed should be produced, if possible, through a compromise between rigorous classroom teaching and innovative experimentation. The rational policy view would be to limit regulation and central policy involvement entirely to guaranteeing the provision of certain minimum communication skills necessary for continued education and the labour market.

407. Evidence reported in previous chapters strongly suggests that new research should focus on three areas:

- i) *identifying* and defining the *minimum communication skills* necessary both at school and when receiving further training at work;
- ii) clarifying the *interdependence of educational and labour market performance*;
- iii) defining the relative importance of *education as an investment and as a sorting (filter) device*.

408. This can be summarised by saying that future research should focus on the *transition from school to the labour market*. The research agenda should seek to identify:

- the competence characteristics that are demanded when young workers are recruited;
- the competence platform needed to participate gainfully in production and to update competence capital successfully throughout the working life;
- the role of primary and secondary school in providing these basic competencies;
- the expected skills required by future production technology;
- the relation between educational achievement and job or firm productivity, using econometric methods.

409. The analytical part of the project could be organised around the following tasks:

A. Specifying the educational product

410. Extensive interviews with employers should be carried out, not to define the educational product, but to understand the intellectual demands of various workplaces. For instance, what is known about the critical elements of competence demanded, and when should the field be left open for experimentation? Who knows best? Can the right educational product and the necessary variation in product design be achieved without more individual experiments and use of market incentives? If the final users of

competence have ideas about what they want, should this be taken as an indication that more experimentation is needed? It should be recalled in this context that the *value of knowledge depends on the match between competence and the job obtained*. This makes the transition from school to work and the efficiency of labour market allocation a critical support for education.

411. It should be observed that primary and secondary education, which are typically publicly run, is non-experimental. Thereafter, education diversifies into higher education and on-the-job training in the market. Primary and secondary education form the competence platforms for further education and training on the job, and exercise strong leverage effects on an individual's economic future. It is therefore important that the competence attributes acquired at primary and secondary school and needed for future competence development be carefully researched.

412. This broad competence specification includes the *redundancy* needed for work at different levels, even though it is not explicitly demanded for a specific job. This is difficult to incorporate in the design of both interviews and econometric inquiries, and in fact does not appear to have been attempted. To advance understanding, it is probably necessary to carry out much more careful investigations of job characteristics, grouping together different jobs that can be done by similarly trained individuals. Preliminary attempts to address this problem at the Industrial Institute for Economic and Social Research (IUI) in Stockholm suggest that the research task is feasible if begun as an exploratory project.

413. For the specification of the basic educational product, international comparisons can help understand to what extent particular variations in primary and secondary education provide competence characteristics that contribute in special ways to economic competence. This means that the same researchers have to be involved in investigations in different countries.

B. Incentives

414. Incentives are defined in the explicit or implicit *contract* that states the conditions of competence service exchange between student/parents and school, and between employer and employee. Under the traditions of the public school system this contract was one-sided, and laid down as rules decided centrally to be followed by students and parents. They had little possibility of changing the rules or opting for better educational services except through political voting or by moving to a neighbourhood with better schools. Until very recently, neither academic research nor educational or labour market policymakers paid any attention to this important part of the individual's school and work life. The contract was taken as read and was changed as part of a central school or labour market reform based on political decision and on principles that denied the efficiency implications of the contract. Special emphasis should be placed on the least understood side of the labour contract, the use made of competence in firms and the possibilities of contracts other than employer/employee relationships. Topics for investigation include:

- B.1 the importance of *social capital* background as an initial condition for determining educational ambitions, pathway through school into the labour market, and labour market success;
- B.2 *demand structure* in the job market, *relative compensation schedules*, and the private costs of education at the three levels (primary, secondary and higher, or on-the-job) to see how investments relate to private benefits;

- B.3 *signalling*, and the nature of *labour market imperfections* that make employers underpay talent and thus reduce incentives among the new entrants into the labour market to acquire competence;
- B.4 the use of other contract forms than the employment contract of wage earners;
- B.5 on-the-job training *incentives*.

415. The *underinvestment* hypothesis should be tested. If it is valid, do restrictions on contract formulation create negative social and economic effects? The policy parameters should then be identified. It is necessary to explore whether *underinvestment is simply the result of rational economic choice*, in the sense that firms do not invest in low-quality labour with low expected returns to education, and that the same individuals for the same reason do not find it economically rational to invest in their own education. This is a *social* rather than an economic problem. A particularly difficult task is to assess long-term vs. short-term implications of such choices. It may be that both the individual and the employer take a short-term view and heavily discount future benefits (profits and incomes). Are there viable government policies capable of achieving long-term positive effects?

C. The organisation and efficiency of educational production

416. To evaluate efficiency of production requires a fairly well-defined output specification. With a product specification very dependent on its use (allocation), which cannot be defined in advance, the study of educational production efficiency is not easily amenable to standard analytical tools.

417. Above all, a study of the efficiency of educational production has to incorporate labour market performance as part of educational output. Since simple human capital assumptions are ruled out, the entire incentive structure at school and in the labour market has to be integrated into the analysis. The educational activities of firms also have to be made part of the analysis. This means that the investigation has to be divided into two parts. The *first* part involves:

- C.1 traditional studies of partial problems, including educational production function analysis. Here, a more detailed analysis of earlier work should complement the analysis presented above. Since the research proposed aims at supporting education and economic policies, new research should be oriented accordingly, playing down the academic interest in method and placing the decision problem in the foreground. As empirical insight is lacking on the difficult links between school and labour market performance and the proper definition of educational output, this means reorienting research efforts towards significantly more data-gathering and costly empirical efforts. Appendix III details what can be done here.

418. The more important part of the inquiry includes:

- C.2 an attempt to link school, the labour market, and the production process through a micro-macro analysis that incorporates the dynamics of the entire selection and investment processes in school, in the labour market, and on the job. This requires using a (micro-to-macro) dynamic simulation method into which other, partial research results are incorporated (a simulation model of the Swedish economy, including the important characteristics of the labour market and the production process, already exists -- see Appendix III). It is particularly necessary in order to quantify the relative importance for

economic growth of *a) incentives* to upgrade individual and firm competence, and *b) the allocation of competence* through school and in the labour market. This analysis will explicitly and quantitatively link the compensation for competence (the competence rent) through competition in the labour market to macroproductivity growth. Understanding these relationships is necessary for designing the educational policies discussed in the previous chapter.

7.2 Summarising the research agenda

419. The most important sub-projects in the proposed research agenda would be:

- i) a large-scale project that attempts to tie the teaching agenda and experience accumulation to job performance. This is by far the largest part of the project. It has five parts:
 - a) *interviews* with firms, and case studies of individual job performance and educational background;
 - b) *econometric* analysis of job performance and schooling and experience background (the scope of which will depend on the data available);
 - c) econometric analysis of vocational training programmes -- on-the-job or in vocational schools;
 - d) econometric analysis linking individual competence characteristics to firm performance;
 - e) *career analysis* relating school and other individual characteristics to job career (panel data needed);
- ii) preparation for *micro-macro analysis* by introducing different competence and organisational learning characteristics into the firm production function;
- iii) modelling of the *diffusion process* through family and school and through the labour market to a job in terms of the results of i) and integration with the micro-macro model;
- iv) *identification of policy parameters* that affect selection mechanisms in the diffusion process to study macro policy effects;
- v) carrying out of a particular inquiry into the nature of *imperfections in the labour market* in its capacity to identify, evaluate and properly reward human qualities and to stimulate endogenous learning in the market; assessing to what extent restrictions in employer/employee contracting create inefficiencies in labour market performance;
- vi) surveying areas in which the *market is failing* and where the provision of public educational services is superior to the market; surveying areas where public interference in educational production is already too large -- beginning in the markets for *vocational training*;
- vii) comparison between different countries of higher education enrolment with the structure and performance of industry.

420. Such a research programme is seen as a necessary background for quantifying (roughly) the school-productivity link, including the labour market selection process that takes place in school. The Industrial Institute for Economic and Social Research (IUI) in Stockholm, having already been engaged in this kind of productivity study, proposes that case studies conducted in Sweden could be part of the first round. International comparisons of teaching agendas, including job and market organisation, could then be made, perhaps in Japan, France, Germany, Sweden and the United States. The more concrete research project specification detailed in Appendix III could be completed within a two-year period and would go far in fulfilling the agenda outlined in this chapter.

421. The research agenda presented here attempts to fill in important gaps and offers an outline of what should optimally be done. Even though the time-scale of the project would only allow for some modest complementary research, it should be possible to design a quantitative method to merge the various pieces of information and informed assumption in order to have a better understanding of the *entire educational growth problem*. This approach reflects the broad definition of the "content" of knowledge and of education presented at the beginning of the report. It would mean that *education, labour market efficiency (flexibility) and labour market insurance would be studied in one and the same context*.

Appendix I

Infrastructure Knowledge Capital Confers Economies of Scale to Other Factors of Production¹⁹

1. Suppose, following Romer (1986, p. 1015), that the production function

$$Q = F(k_i, K, x_i) \quad (1)$$

is concave as a function of measured factor inputs k_i and x_i for any fixed value of K . K is the *level of general knowledge* which improves the productivity of all other factors. K is a capital good with an increasing marginal product. As long as there are diminishing returns in the activities that create K , the static general equilibrium model will have a finite solution.

2. Romer's model for the general equilibrium setting of an entire economy can be translated into a *firm model*, and measured factor inputs assumed to be:

- k_1 = machinery and equipment capital
- k_2 = product-oriented R&D capital
- k_3 = marketing capital items
- x_i = labour input, standard hours, allocated to the various capital items
- $i = 1, 2, 3$

3. K is the general, unmeasured knowledge base *of the firm* that is accumulated as part of the ongoing production process. In so far as some "tacit knowledge" has been compensated in the form of wages to other factors x_i , the K incorporates the knowledge needed to organise all other factors into a team, a firm (Eliasson, 1990b). K has thereby been defined as the recipient of residual profits when all other factors have been paid.²⁰ This is a capital input traditionally associated with the risk-taking of owners, but it can very well be associated with all knowledge (competence) input of the owners (Eliasson, 1988). If top-level managers hold stock in the company, they get paid two ways for their competence input: in the form of salaries and in the form of dividends and capital gains on company stock, if their competence contributions generate excess profits over total costs, or a return to total capital (=R) over the market interest rate (=i). This is the magic epsilon ($\hat{\epsilon} = R-i$) variable in Figure 2.1b that is related to total factor productivity change (see below).

19. This appendix is a modified version of the model in Eliasson (1989).

20. If the marginal product of increased competence accrues to the worker, it is not registered as total factor productivity growth but goes to the individual as increased income.

4. The main point here is that the competence capital K generates increasing returns to all other factors of production of the company, but that it is a scarce resource whose production occurs at diminishing returns. The K factor input is assumed not to depreciate from use, as do other factor inputs.

5. It now only remains to show that K in fact has the "scale" or "leverage" properties that have been postulated. To do that -- following Romer again -- $F()$ can be assumed to be homogeneous of degree one as a function of (k_i, x_i) when K is constant. This is an insignificant further restriction. Given that, for any $\phi > 1$:

$$Q = F(\phi k_i, \phi K, \phi x_i) > F(\phi k_i, K, \phi x_i) = \phi F() \quad (2)$$

F now exhibits increasing returns to scale in K . In the growth process of the firm, K is the know-how created, say from organisational learning that can be exploited by increasing the size of the firm.

6. The proof given in (2) has been in terms of the traditional, static production function. The term "economies of scale" can then be used, although economies of scope may be more appropriate. However, even this is not the right term, since it is an *organisational learning process* that creates tacit competence embodied in the organisation and its people. Some of this know-how gradually leaks out and is imitated by others. As such, the entire production system embodying an enormous stock of diverse knowledge operates as an infrastructure capital.

Appendix II

Connecting Organisational Competence with Total Factor Productivity Growth

1. Competence co-ordination and monitoring is a matter of managing people with competence. It involves not only incentives to contribute but also to stay with the team. In this section, the "unmeasurable knowledge" or innovative competence function is linked to firm objectives (profits), and the creation of economic value over and above the value of resources put in (total factor productivity growth = $DTFP$)²¹. This will be done mathematically in terms of the information and monitoring system of a firm as it appears in the Swedish Micro-to-Macro (M-M) model. The task is to establish a relation between the competence rents ($=\bar{\epsilon}$), firm total productivity change ($DTFP$) and growth in output (DQ).
2. In so doing, the dynamics of competition discussed in the previous section are bypassed. The endogenous growth drive of the macro economy is excluded by assuming perfect competition and making firms prize-takers. *Ex ante* always equals *ex post*.
3. Let it be said, for simplicity, that the only measured inputs needed to produce output (Q) are labour ($=L$) and capital ($=K$). DX stands for the rate of change in X . Defining:

21. The mathematical derivation has been taken directly from Eliasson (1992c).

$$\epsilon = PQ - TC \quad (1)$$

$$\bar{\epsilon} = \epsilon/K \quad (2)$$

$$TC = wL + \left(r + \rho - \frac{\Delta p^K}{p^K} \right) K \quad (3)$$

$$R^{NE} = R^N + (R^N - r) \Phi \quad (4)$$

$$R^N = M\alpha - \rho + \frac{\Delta p^K}{p^K} \quad (5)$$

$$M = 1 - \frac{w}{p} \frac{1}{\beta} \quad (6)$$

it follows immediately that:

$$\bar{\epsilon} = R^N - r \quad (7)$$

$$pQ = TC + \bar{\epsilon}K \quad (8)$$

R^N = nominal rate of return to total assets K

R^{NE} = nominal rate of return to net worth ($E=K-D$)

ρ = rate of depreciation

M = operating surplus per unit value

D = nominal debt

w = cost per unit of labour input ($=L$)

r = interest rate

p^K = capital goods deflator

p = value-added ($=Q$) deflator

Φ = D/E

$\alpha = pQ/K$ (capital productivity, uncorrected for relative (p, p^k) price change)

$\beta = Q/L$ (labour productivity)

4. $\bar{\epsilon}$ is the difference between the rate of return on total assets (R^N) and the interest rate (r) paid by the firm. $\bar{\epsilon}$ can be positive or negative. But a firm will not survive for ever with a negative $\bar{\epsilon}$. A comparison of (1) and (6) will show that $(r+\bar{\epsilon})$ is the equilibrium price for capital services which exhausts total value ($=pQ$) product when $R^N=r$ and $\bar{\epsilon}=0$.

5. $\bar{\epsilon}>0$ arises -- as suggested by McKenzie (1959) -- as a consequence of unmeasured (or not measurable) capital, not included in K . This asset has a time dimension in the sense that returns may come with a delay. Even if $\bar{\epsilon}$ is negative, the corresponding asset might well have a large positive present value. Part of this time dimension can be interpreted as a risk factor that demands a reward (a risk premium).

6. To the extent that $\bar{\epsilon}$ measures value created by a not-measured capital input it must have a connection with economic growth. The following relationship (see below) is therefore proved:

$$DQ = s_1 DL + s_2 D\bar{K} + \frac{\Delta\epsilon}{pQ} \quad (9)$$

s_1 and s_2 in (9) measures labour and capital income shares respectively. Apparently, $\Delta\epsilon=0$ when these shares exhaust total value added.

7. A great number of technologies are compatible with constant income shares s_1 and s_2 , the most well-known being the power function (so-called Cobb-Douglas) specification.

8. After differentiation, the entire class of functions:

$$Q = CL^{s_1}K^{s_2}T \quad (10)$$

becomes (9), where T is a shift factor, usually assumed to represent exogenous disembodied technical change.

9. Apparently, from (9) and (10), total factor productivity change becomes:

$$DTFP = DT = \Delta\epsilon/pQ \quad (11)$$

under the assumption of Cobb-Douglas technology. It has been demonstrated, for one particular production technology, that the estimated -- on specification (9) -- shift factor ($DTFP$) picks up a host of economic influences related to the allocation of resources and the exercising of competence within the firm. As a consequence, the return to that unmeasured capital -- labelled $\bar{\epsilon}$ -- also shows up in the "technical shift factor". This competence input, by definition, also includes the ability to deal with uncertainty (successfully taking on business risks). Hence, the interpretation of $\bar{\epsilon}$ in the modern theory of finance becomes part of this more general formulation.

Proof of (8)

10. From (1) of Appendix I and (1) of Appendix II:

$$PQ = wL + \left(r + \rho - \frac{\Delta p^k}{p^k} \right) K + \varepsilon$$

taking differences -- assuming (p, w, r, p^k) fixed:

$$P \cdot \Delta Q \equiv w \Delta L + [\] p^k \Delta \bar{K} + \Delta \varepsilon$$

thus:

$$\begin{aligned} \frac{\Delta Q}{Q} = DQ &\equiv \frac{wL}{pQ} DL + \frac{[\] \Delta p^k \bar{K}}{pQ} \cdot D\bar{K} + \frac{\Delta \varepsilon}{pQ} \\ DQ &= S_1 DL + S_2 D\bar{K} + \frac{\Delta \varepsilon}{pQ} \end{aligned}$$

$$S_1 = \frac{wL}{pQ}$$

$$S_2 = \frac{\left[r + \rho - \frac{\Delta p^k}{p^k} \right] p^k}{pQ}$$

and $\frac{\Delta \varepsilon}{pQ}$ is by definition DTFP.

Appendix III

The Research Programme in Detail

1. This appendix details a first step in the research agenda proposed in Chapter 7 that is currently (April, 1994) in progress at the Industrial Institute for Economic and Social Research (IUI) in Stockholm. The agenda, which covers two years, intends to:

- *undertake exploratory* analysis to arrive at *preliminary* policy conclusions;
- prepare the way for the more rigorous specification and testing of policy hypotheses.

2. The policy objectives to be initially evaluated are:

- the design of the institutions of a decentralised educational and labour market system, in which considerably enlarged scope for local innovative experiments is allowed;
- the identification of basic economic communication skills, not to be compromised in primary and secondary schooling.

3. This seemingly contradictory research programme aims to enable the pursuit of more precise educational goals, thereby limiting the possibilities for central regulatory intervention in the school agenda. It should also help set the limits beyond which policies do more harm than good by undermining *innovative* product development in the educational system.

4. *First*, the possibility of identifying the minimum competence platform for the labour market needed on leaving high school should be investigated.

5. *Second*, the origin of such competencies and, most importantly, how well an innovative school can create them irrespective of social background, should be clarified.

6. *Third*, the role of the labour market (and the social insurance system) in stimulating and facilitating individual pursuit of optimal education and work career should be studied. This includes the incentive effects of alternative financing arrangements at school and during retraining and alternative contractual arrangements in the labour market. Part of the task should be to clarify to what extent imperfections in the labour market and the lack of insurance create myopia and underinvestment in education.

7. The apparent contradiction is only superficial. The basic proposition is that the educational product cannot be specified in advance. It has to be developed individually through experimentation in the market, using individual incentives, initiatives and competence. There *may*, however, exist some universal

competence base, without which the individual will be handicapped when entering the labour market and for receiving opportunities for further upgrading. The evidence is that this basic competence relates to the individual's receiver capacity to engage in continued lifelong learning. Research should investigate this.

8. The policy approach envisioned here means moving incentives and initiatives to the individual and establishing, through serious empirical research, the limits to central policies. Contrary to the educational policies of the 1950 and 1960s which have fallen into disrepute, this approach is empirically well founded.

9. The following areas will be addressed in the research project about to begin at the IUI. Given available resources, only some of them can be completed in the first phase.

Identify basic competencies

- i) Study relationships between labour quality characteristics (notably formal education) and individual and firm performance econometrically. Swedish and French data will be compared (Ballot and Taymaz).
- ii) Study criteria used when recruiting workers and assigning them to internal training programmes (Kazamaki Ottersten).
- iii) Study competence requirements of most advanced ("future") production technology compared with average requirements. Include private service production in analysis.

Choice of educational path into the labour market (incentives)

- iv) Study family background and other social capital characteristics in determining the choice of educational ambition, school performance, and early choice of labour market career (Meyerson).
- v) Study labour market efficiency in identifying and compensating individual competence, with special consideration of the long-term effects on individual incentives (Eliasson, Kazamaki Ottersten).
- vi) Investigate infrastructure effects on the economy of the structure and size of total knowledge capital in firms and elsewhere.

Educational production efficiency

- vii) Estimate educational production functions in which labour market achievements rather than scholastic efforts define output. This may be possible using data from Swedish retraining programmes (Mellander).
- viii) Conduct an international comparison of school organisation (Eliasson).
- ix) Make overall assessment of filter vs. investment hypothesis, using results from the above empirical studies; micro-macro simulation analysis (Eliasson and Taymaz).

- x) Conclude: Is more or less schooling advisable? At what level? Is there a case for underinvestment in education? How should government policy support long-term competence achievements over and above the preferences of myopic individuals and firms?

Education as a cumulative process

10. One purpose of this research programme is to relate, to the extent possible, the *educational characteristics* of the school agenda with *individual competence capital and work performance* and then to relate *staff competence characteristics with firm performance*. Possibilities on the econometric side seem limited, but exploratory interviews and case studies with the purpose of formulating better hypotheses seem very promising. It is important to observe the *long-run effects* on productivity *and* earnings, and not only on earnings. The productivity effects are most important, and most difficult to capture.

11. The first step aims at uncovering the role of primary, secondary and higher education in the provision of useful competencies for further competence upgrading on the job (the provision of *receiver competence* and the leverage effects) and the cumulative nature of education. There is the particularly important policy problem associated with a primary and secondary schooling system that fails to provide a minimum of basic communication skills to all students, and the costs both to society and the individual if there is an attempt to correct that educational disadvantage later in life. It would also be interesting to test the following hypotheses operationally at the macro level:

- the link between the agendas of national school systems to educational performance indicators;
- the link between educational performance indicators and national economic performance.

12. This would be dealt with in item vi) above, and data from the OECD indicator studies could be used. Some of this analysis could be integrated with the micro-macro modelling part of the project (item ix).

Establish quantitative micro and macro links

13. On the basis of data from this research programme, the IUI micro-based macro model could be reformulated to make possible a study of the macroeconomic consequences of different schooling regimes. This could be a small part of the project when all the prior econometric research had been carried out.

14. The organisation of this proposed empirical inquiry reflects that of the present report: identify the knowledge that operates behind measured economic growth (Chapter 2), evaluate incentives to accumulate this knowledge (Chapter 3), and study the corresponding educational production efficiency (Chapters 4 and 5).

**Economic growth and the incentives and organisation of educational production:
summary of a quantitative micro to macro research project**

15. The micro-macro integration of research should begin with a programme that is feasible today. A project has already been started at the IUI and is well prepared to conduct such a programme.

16. The complex fabric of educational production and the economic growth process prevents a definite answer to the policy question: how should a national education system be organised to increase economic growth? It would seem likely that a five-step approach involving a reasonable work effort could provide significant and fast results.

Econometric analysis

17. The *first* step involves establishing the relationship between *competence composition* of firm knowledge capital on the one hand and the *performance characteristics* of the firm on the other. The relevant parameters of the Swedish model can then be quantified.

18. The *second* step is to establish the links between school characteristics, internal training provisions, and the competence capital of the firm. This step also involves both modelling *the firm as a learning organisation* and the career paths from school through the labour market. There is some theory to draw on but very little in the form of econometric results. The micro-macro model makes it possible to integrate important empirical information as organisational and search characteristics, thereby minimising the need for econometrically established parameter estimates.

Modelling the educational and labour market filters

19. The *third* step involves modelling the public educational system of the (Swedish) economy in terms of inputs and supplies of educational certificates in the labour market. This will have to be rather crudely done, owing to the lack of information on the educational production process.

Infrastructure: the educational system

20. The very fact that the labour market can offer a quality product represents an infrastructure or social capital that confers economies of scale to the regional or national economy. The availability of such infrastructure capital also attracts investment that is important for the economic development of the region. Thus, the modelling approach should involve specifying certain characteristics of the educational system as infrastructure or a provider of social capital.

21. There should be some possibility for modelling this system econometrically. If human capital is seen to be important for firm performance, the availability of such capital in an area would constitute infrastructure capital.

22. Further, as the report has shown, empirical research suggests very definitely that *even if* original talent (at birth) is equal, preschool acquisition of educational receiver competence at home is of considerable significance both for individual performance at school and for later labour market experience.

23. It should be possible to capture some of this selection process by appropriate combinations of fragmented econometric results and assumptions so that the expected cumulative effects can be illustrated through simulations on the Swedish model.

Policy simulation

24. This involves combining the results from the preceding steps and setting up the micro-macro model for policy simulation. With the educational and labour market production and search (filter) model specified, it will be possible to simulate the cumulative impact on economic growth by varying certain policy parameters and particular parameters controlling the search or filtering process through school and the labour market. It will thus be possible to relate simulation results to traditional macro production function analysis through the magic $\hat{\epsilon}$ variable of Appendix II. The $\hat{\epsilon}$ variable will figure as individual educational rents, as firm returns from competence capital, and, at the aggregate level, as the shift factor in the macro production function analysis.

Bibliography

- Abramovitz, M. (ed.) (1988), *Thinking about Growth*, Cambridge University Press, New York.
- Ackum, S. (1989), "Youth Unemployment, Labor Market Programmes, and Subsequent Earnings", Working Paper 1989:10, Uppsala University, Sweden.
- Adams, J.D. (1990), "Fundamental Stocks of Knowledge and Productivity Growth", *Journal of Political Economy*, Vol. 98, No. 4, August, pp. 673-702.
- Albrecht, J. (1981), "A Procedure for Testing the Signalling Hypothesis", in Eliasson, G., Holmlund, B. and Stafford, F. (eds.), *Studies in Labor Market Behavior: Sweden and the United States*, Conference Reports 1981:2, IUI, Stockholm.
- Alchian, A. and Demsetz, H. (1972), "Production, Information Costs and Economic Organization", *American Economic Review*, Vol. LXII, No. 5, December, pp. 777-795.
- Anderson, G.M., Shugart, W.F. and Tollison, R.D. (1991), "Educational Achievement and the Cost of Bureaucracy", *Journal of Economic Behavior and Organization*, Vol. 15, No. 1, January, pp. 29-45.
- Angrist, J.D. and Krueger, A.B. (1991), "Does Compulsory School Attendance Affect Schooling and Earnings?", *Quarterly Journal of Economics*, Vol. CVI, Issue 4, November, pp. 979-1014.
- Aoki, M. (1986), "Horizontal vs. Vertical Information Structure of the Firm", *American Economic Review*, Vol. 76, No. 5, December, pp. 971-983.
- Arrow, K.J. (1962), "The Economic Implications of Learning by Doing", *Review of Economic Studies*, Vol. XXIX, No. 3, June, pp. 155-173.
- Arrow, K.J. (1973), "Higher Education as a Filter", *Journal of Public Economics*, Vol. 2, No. 3, July, pp. 193-216.
- Ashenfelter, O. and Krueger, A. (1993), "Estimates of the Economic Return to Schooling from A New Sample of Twins", NBER Working Paper No. 4143, Cambridge, MA.
- Axelsson, R. (1989), "Svensk arbetsmarknadsutbildning. En kvantitativ analys av dess effekter", *Economic Studies* No. 197, University of Umeå, Sweden.

- Axelsson, R. and Löfgren, K.-G. (1992), "Arbetsmarknadsutbildningens privat- och samhällsekonomiska effekter" (mimeo), University of Umeå, Sweden, March.
- Azariadis, C. (1974), "Stochastic Disequilibrium in a Labor Contracts Theory, prepared for a conference on Equilibrium and Disequilibrium in Economic Theory", Institute of Advanced Studies, Vienna, July.
- Ballot, G. and Taymaz, E. (1993), "Firms' Sponsored Training and Performance: A Comparison between France and Sweden based on firm data", Working Paper No. 387, IUI, Stockholm.
- Barrow, M.M. (1991), "Measuring Local Education Authority Performance: A frontier approach", *Economics of Education Review*, Vol. 10, No. 1, pp. 19-27.
- Bartel, A.P. and Lichtenberg, F.R. (1988), "Technical Change, Learning, and Statistics", NBER Working Paper No. 2732, Cambridge, MA.
- Becker, G.S. (1962), "Investment in Human Capital: A theoretical analysis", *Journal of Political Economy*, Vol. LXX, Supplement, No. 5, Part 2, October, pp. 9-49.
- Becker, G.S. (1964), *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*, Columbia University Press, New York.
- Becker, G.S. (1974), "A Theory of Social Interactions", *Journal of Political Economy*, Vol. 82, No. 6, November/December, pp. 1063-1093.
- Becker, G.S. (1975), *Human Capital. A Theoretical and Empirical Analysis with special reference to Education*, Columbia University Press, New York.
- Becker, G.S. and Tomes, N. (1976), "Child Endowments and the Quantity and the Quality of Children", *Journal of Political Economy*, Vol. 84, No. 4, Part 2, August, pp. S143-S162.
- Behrman, J., Hrubec, Z., Taubman, P. and Wales, T. (1980), *Socioeconomic Success: A Study of the Effects of Genetic Endowments, Family Environment, and Schooling*, North-Holland, Amsterdam.
- Behrman, J.R. and Taubman, P. (1989), "Is Schooling Mostly in the Genes? Nature-nurture decomposition using data on relatives", *Journal of Political Economy*, Vol. 97, No. 6, December, pp. 1425-1446.
- Berg, I. (1970), *Education and Jobs: The Great Training Robbery*, Praeger, New York.
- Berman, E., Bound, I. and Griliches, Z. (1993), "Changes in the Demand for Skilled Labor within U.S. Manufacturing Industries: Evidence from the annual survey of manufacturing", NBER Working Paper No. 4255, Cambridge, MA.
- Berndt, E.R., Morrison, C.J. and Rosenblum, L.S. (1992), "High Tech Capital Formation and Labor Composition in the US Manufacturing Industries, An exploratory analysis", NBER Working Paper No. 4010, Cambridge, MA.

- Bessent, A.M. and Bessent, E.W. (1980), "Determining the Comparative Efficiency of Schools through Data Envelopment Analysis", *Educational Administration Quarterly*, Vol. 16, No. 2, Spring, pp. 57-75.
- Bessent, A.M., Bessent, E.W., Charnes, A., Cooper, W.W. and Thorogood, N.C. (1983), "Evaluation of Educational Program Proposals by Means of DEA", *Educational Administration Quarterly*, Vol. 29, No. 2, Spring, pp. 82-87.
- Bessent, A.M., Bessent, E.W., Elam, J. and Long, D. (1984), "Educational Productivity Council Employs Management Service Methods to Improve Educational Quality", *Interfaces*, Vol. 14, No. 6, pp. 1-8.
- Bessent, A.M., Bessent, E.W., Kennington, J. and Reagan, B. (1982), "An Application of Mathematical Programming to Assess Productivity in the Houston Independent School District", *Management Science*, Vol. 28, No. 12, pp. 1355-1367.
- Bishop, J.H. (1987), "Information Externalities and the Social Payoff to Academic Achievement", Working Paper No. 87-06, CAHRS, Cornell University, Ithaca, NY.
- Bishop, J.H. (1988a), "The Productivity Consequences of What is Learned in High School", Working Paper No. 88-18, CAHRS, Cornell University, Ithaca, NY.
- Bishop, J.H. (1988b), "Commentary: Employment testing and incentives to learn", *Journal of Vocational Behavior*, Vol. 33, pp. 404-423.
- Bishop, J.H. (1989a), "Toward More Valid Evaluations of Training Programs Serving the Disadvantaged", *Journal of Policy Analysis and Management*, Vol. 8, No. 2, pp. 209-228.
- Bishop, J.H. (1989b), "Incentives for Learning: Why American high school students compare so poorly to their counterparts overseas", Working Paper 89-09, CAHRS, Cornell University, Ithaca, NY.
- Bishop, J.H. (1991a), "On-the-Job Training of New Hires", in Stern, D. and Ritzen, J.M. (eds.), *Market Failure in Training. New Economic Analysis and Evidence on Training of Adult Employees*, Springer-Verlag, Berlin.
- Bishop, J.H. (1991b), "The Impact of Academic Competencies on Wages, Unemployment and Job Performance", Working Paper 91, CAHRS, Cornell University, Ithaca, NY.
- Bishop, J.H. (1992), "Schooling, Learning and Worker Productivity", Working Paper, CAHRS, Cornell University, Ithaca, NY, presented at a seminar on Human Capital, ETLA, Helsinki, May.
- Bishop, J.H. (1993a), "Overeducation", Working Paper 93-06, CAHRS, Cornell University, Ithaca, NY.
- Bishop, J.H. (1993b), "Incentives to Study and the Organization of Secondary Instruction", Working Paper 93-08, CAHRS, Cornell University, Ithaca, NY.

- Bishop, J.H. and Carter, S. (1990), "The Worsening Shortage of College Graduate Workers", Center on the Educational Quality of the Work Force, Working Paper No. 90-15, University of Pennsylvania and CAHRS, Cornell University, Ithaca, NY.
- Björklund, A. (1989a), "Evaluation of Labour Market Training Programs -- The Swedish experience" (mimeo), IUI, Stockholm.
- Björklund, A. (1989b), "Klassiska experiment inom arbetsmarknadspolitiken", Research Report No. 37, IUI, Stockholm.
- Björklund, A. (1991), "Evaluation of Labour Market Policy in Sweden", in *Evaluating Labour Market and Social Programmes. The State of a Complex Art*, OECD, Paris.
- Björklund, A. (1992), "The Impact of Family Background on the Returns to and Length of Schooling in Sweden", Working Paper No. 336, IUI, Stockholm.
- Björklund, A. and Åkerman, J. (1989), "Piece-Rates, On-the-Job Training and the Wage-Tenure Profile", Working Paper No. 246, IUI, Stockholm.
- Björklund, A. and Holmlund, B. (1989), "Job Mobility and Subsequent Wages in Sweden", in van Dijk, J., Folmer, H., Herzog, H.W., Jr. and Schlottmann, A.M. (eds.), *Migration and Labor Market Adjustment*, Kluwer Academic Publishers, Boston/Dordrecht/London.
- Björklund, A. and Holmlund, B. (1991), "The Economics of Unemployment Insurance: The case of Sweden", in Björklund, Haveman, Hollister and Holmlund (eds.), *Labour Market Policy and Unemployment Insurance*, FIEF, Stockholm, and Clarendon Press, Oxford.
- Björklund, A. and Moffit, R. (1983), "The Estimation of Wage Gains and Welfare Gains in Self-Selection Models", Discussion Papers 735-783, Institute for Research on Poverty, University of Wisconsin; published in *Review of Economics and Statistics*, Vol. LXIX, No. 1, February, 1987, pp. 42-49.
- Blackburn, N.L., Bloom, D.E. and Freeman, R.B. (1990), "The Declining Economic Position of Less Skilled American Men", in Burtless, G.T. (ed.), *A Future of Lousy Jobs? The Changing Structure of U.S. Wages*, The Brookings Institution, Washington, DC.
- Blanchflower, D. and Oswald, A. (1993), "Entrepreneurship, Happiness, and Supernormal Returns: Evidence from Britain and the United States", NBER Working Paper No. 4228, Cambridge, MA.
- Blau, D.M. (1987), "A Time Series Analysis of Self-Employment in the United States", *Journal of Political Economy*, Vol. 95, No. 3, June, pp. 445-467.
- Blau, D.M. and Robins, P.K. (1987), "Training Programs and Wages. A general equilibrium analysis of the effects of program size", *Journal of Human Resources*, Vol. 22, No. 1, Winter, pp. 113-125.
- Boissiere, M., Knight, J.B. and Sabot, R.H. (1985), "Earnings, Schooling, Ability and Cognitive Skills", *American Economic Review*, Vol. 75, No. 4, December, pp. 1016-1030.

- Borjas, G.J. (1992), "Ethnic Capital and Intergenerational Mobility", *Quarterly Journal of Economics*, Vol. CVII, Issue 1, February, pp. 123-150.
- Boserup, E. (1981), *Population and Technology*, Basil Blackwell, Oxford.
- Bosworth, D. (1992), "Truancy and School Performance", IER Discussion Paper No. 47, April, Institute for Educational Research, University of Warwick, United Kingdom.
- Bowles, S. (1972), "Schooling and Inequality from Generation to Generation", *Journal of Political Economy*, Vol. 82, No. 2, May, Supplement, pp. 57-71.
- Braunerhjelm, P. (1993), "Regional Integration and the Location of Knowledge-Intensive Multinational Firms", Working Paper No. 404, IUI, Stockholm.
- Brenner, M.H. (1968), "Using High School Data to Predict Work Performance", *Journal of Applied Psychology*, Vol. 52, No. 1, pp. 29ff.
- Burris, V. (1983), "The Social and Political Consequences of Overeducation", *American Sociological Review*, Vol. XLVIII, August, pp. 454-467.
- Butler, R.J. and Monk, D.H. (1985), "The Cost of Public Schooling in New York State: The role of scale and efficiency in 1978-79", *Journal of Human Resources*, Vol. 20, No. 3, Summer, pp. 361-381.
- Cain, G. and Goldberger, A. (1983), "Public and Private Schools Revisited", *Sociology of Education*, Vol. 56, October, pp. 208-218.
- Callan, S.J. and Santerre, R.E. (1990), "The Production Characteristics of Local Public Education: A multiple product and input analysis", *Southern Economic Journal*, Vol. 57, No. 2, October, pp. 468-480.
- Cappelli, P. (1993), "Are Skill Requirements Rising? Evidence for production and clerical jobs", *Industrial and Labor Relations Review*, Vol. 46, No. 3, April, pp. 515-530.
- Card, D. and Krueger, A.B. (1992), "Does School Quality Matter? Returns to education and the characteristics of public schools in the United States", *Journal of Political Economy*, Vol. 100, No. 1, February, pp. 1-40.
- Carlsson, B. (1989), "The Evolution of Manufacturing Technology and Its Importance on Industrial Structure", *Small Business Economy*, Vol. 1, No. 1, pp. 21-37.
- Carmichael, H.L. (1983), "Firm-Specific Human Capital and Promotion Ladders", *Bell Journal of Economics*, Vol. 14, No. 1, Spring, pp. 251-258.
- Charnes, A., Cooper, W.W. and Rhodes, E. (1978), "Measuring the Efficiency of Decision Making Units", *European Journal of Operational Research*, Vol. 2, No. 6, pp. 429-444.

- Chubb, J.E. and Moe, T.M. (1990), *Politics, Markets, and America's Schools*, The Brookings Institution, Washington, DC.
- Coleman, J.S. (1988), "Social Capital in the Creation of Human Capital", *American Journal of Sociology*, Vol. 94, Supplement, pp. 95-120.
- Coleman, J.S. (1992), "Social Capital" (mimeo), University of Chicago, August.
- Coleman, J.S. and Coser, L.A. (eds.) (1966), *Equality of Educational Opportunity*, U.S. GPO, Washington, DC.; reprinted by Powell, W.W. (ed.), LC79-6990 (Perennial works in sociology), Ayer Company Publishers Inc., December 1979.
- Currie, J. and Thomas, D. (1993), "Does Head Start Make a Difference?", NBER Working Paper No. 4406, Cambridge, MA.
- Dahlberg, Å. (1972), "Arbetsmarknadsutbildning -- verkningar för den enskilde och samhället", Studier i nationalekonomi, University of Umeå, Sweden.
- Dahlberg, Å. (1978a), "Effects of Migration on the Incomes of Unemployed People", *British Journal of Industrial Relations*, Vol. 16, March, pp. 86-94.
- Dahlberg, Å. (1978b), *Geografisk rörlighet -- sociala och ekonomiska effekter*, SOU 1978:60, Stockholm.
- Dahmén, E. (1950), *Svensk industriell företagarverksamhet, 1919-39*, (Entrepreneurial Activity in Swedish Industry, 1919-39), 2 vols., IUI, Stockholm.
- Dargay, J. (1988), "Factor Demand in Swedish Manufacturing: Econometric analyses", Research Report No. 34, IUI, Stockholm.
- Davis, S. and Haltiwanger, J. (1991), "Wage Dispersion between and within U.S. Manufacturing Plants, 1963-86", NBER Working Paper No. 3722, Cambridge, MA.
- Debreu, G. (1951), *Theory of Value. An Axiomatic Analysis of Economic Equilibrium*, John Wiley & Sons, London; reprinted in 1959 as Cowles Foundation Monograph 17, Cowles Foundation for Research in Economics at Yale University, Yale University Press, New Haven and London.
- Denison, E.F. (1967), *Why Growth Rates Differ*, The Brookings Institution, Washington, DC.
- Denison, E.F. (1979), *Accounting for Slower Economic Growth: The United States in the 1970s*, The Brookings Institution, Washington, DC.
- Dickens, W.T. and Katz, L.F. (1987), "Interindustry Wage Differences and Industry Characteristics", in Lang, K. and Leonard, J.S. (eds.), *Unemployment and the Structure of Labor Markets*, Basil Blackwell, New York, pp. 48-89.
- Edin, P.-A. (1989), "Individual Consequences of Plant Closures", Acta Universitatis Upsaliensis, Studia Oeconomica Upsaliensia 15, University of Uppsala, Sweden.

- Eliasson, G. (1976a), *Business Economic Planning -- Theory, Practice and Comparison*, John Wiley & Sons, London.
- Eliasson, G. (1976b), "A Household Investment Funds System -- A proposal", *Industrikonjunkturen*, Ekonomisk Utredningsrapport nr 21, Federation of Swedish Industries, Stockholm.
- Eliasson, G. (1980), "Elektronik, teknisk förändring och ekonomisk utveckling", *Datateknik, ekonomisk tillväxt och sysselsättning*, Data och Elektronikkommitteen (Computer and Electronics Committee), Stockholm.
- Eliasson, G. (1984a), "Informations- och styrsystem i stora företag" (Information and control systems in large firms), in Eliasson, G., Fries, H., Jagrén, L. and Oxelheim, L., *Hur styrs storföretag?* (How are large business groups managed?), IUI, Stockholm.
- Eliasson, G. (1984b), "Micro Heterogeneity of Firms and the Stability of Industrial Growth", *Journal of Economic Behavior and Organization*, Vol. 5, Nos. 3-4, pp. 249-274.
- Eliasson, G. (1985), "Nya institutioner, förändrad marknadsorganisation och modifierade samhällsvärderingar -- Horisont 2000, Chapter IV in Eliasson, G., Björklund, A., Pousette, T. et al., *Att rätt värdera 90-talet -- IUIs långtidsbedömning 1985*, IUI, Stockholm.
- Eliasson, G. (1986a), *Kunskap, information och tjänster, en studie av svenska industriföretag*, IUI, Stockholm.
- Eliasson, G. (1986b), "A Note: On the stability of economic organizational forms and the importance of human capital, in Day, R.H. and Eliasson, G. (eds.), *The Dynamics of Market Economies*, IUI, Stockholm; and North-Holland, Amsterdam.
- Eliasson, G. (1987a), "Technological Competition and Trade in the Experimentally Organized Economy", Research Report No. 32, IUI, Stockholm.
- Eliasson, G. (1987b), "The Knowledge Base of An Industrial Economy", Chapters I-IV in Eliasson, G. and Ryan, P., "The Human Factor in Economic and Technological Change", OECD Educational Monographs No. 3, Paris.
- Eliasson, G. (1988), "Schumpeterian Innovation, Market Structure and the Stability of Industrial Development", in Hanusch, H. (ed.) (1988), *Evolutionary Economics. Applications of Schumpeter's Ideas*, Cambridge University Press, Cambridge, MA.
- Eliasson, G. (1989), "The Dynamics of Supply and Economic Growth -- How industrial knowledge accumulation drives a path-dependent economic process", in Carlsson, B. (ed.), *Industrial Dynamics*, Kluwer Academic Publishers, Boston/Dordrecht/London.
- Eliasson, G. (1990a), "The Knowledge Based Information Economy", Chapter I in Eliasson, G., Fölster, S., Lindberg, T., Pousette, T. and Taymaz, E., *The Knowledge Based Information Economy*, IUI, Stockholm.

- Eliasson, G. (1990b), "The Firm as a Competent Team", *Journal of Economic Behavior and Organization*, Vol. 13, No. 3, June, pp. 275-298.
- Eliasson G. (1991a), "Modeling the Experimentally Organized Economy: Complex dynamics in an empirical micro-macro model of endogenous economic growth", *Journal of Economic Behavior and Organization*, Vol. 16, No. 1-2, July, pp. 153-182.
- Eliasson G. (1991b), "Financial Institutions in a European Market for Executive Competence", in Wihlborg, C., Fratianni, M. and Willets, T.D. (eds.), *Financial Regulation and Monetary Arrangements after 1992*, Elsevier Science Publishers B.V., Amsterdam.
- Eliasson G. (1991c), "Produktivitet, vinster och ekonomisk välfärd -- hur ser sambanden ut?", IUI, Stockholm.
- Eliasson, G. (1992a), "Arbetet -- dess betydelse, dess innehåll, dess kvalitet och dess ersättning" (Work -- its importance, its content, its quality and its compensation), IUI, Stockholm.
- Eliasson, G. (1992b), "Business Competence, Organizational Learning and Economic Growth -- Establishing the Smith-Schumpeter-Wicksell (SSW) connection", in Scherer, F.M. and Perlman, M. (eds.), *Entrepreneurship, Technological Innovation, and Economic Growth: Studies in the Schumpeterian Tradition*, University of Michigan Press.
- Eliasson, G. (1992c), "The Economics of Technical Change -- The macro economic consequences of business competence in an experimentally organized economy", IUI Working Paper No. 349b, Stockholm; to be published in *Revue d'économie industrielle*.
- Eliasson, G. (1992d), "Marknaden för yrkesutbildning" (The market for vocational training), Working Paper No. 359, IUI, Stockholm.
- Eliasson, G. (1992e), "The Markets for Learning and Educational Services -- a micro explanation of the role of education and competence development in macro economic growth", Working Paper No. 350b, IUI, Stockholm; to be published in Asplund, R., *Human Capital Creation in an Economic Perspective*, Springer-Verlag, Berlin.
- Eliasson, G. (1993a), "Företagens, institutionernas och marknadernas roll i Sveriges ekonomiska kris", *Nya villkor för ekonomi och politik*, SOU 1993:16, Stockholm.
- Eliasson, G. (1993b), "Marknaden för yrkesutbildning -- håller Sverige på att förlora yrkeskompetensen?" (The market for vocational training -- has Sweden lost its comparative advantage in worker skills? -- being translated), Chapter 5 in *Den långa vägen*, IUI, Stockholm.
- Eliasson, G. (1993c), "Den högre utbildningens ekonomiska villkor och betydelse", *Agenda 2000*, Rapport Nr. 2, Utbildningsdepartementet, Ds 1993:94, IUI, Stockholm.
- Eliasson, G. (1994a), "The Theory of the Firm and the Theory of Economic Growth -- an essay on the economics of the institutions, competition, and the capacity of the political system to cope with

unexpected change", in Magnusson, L. (ed.), *Evolutionary and Neo-Schumpeterian Approaches to Economics*, Kluwer Academic Publisher, Boston/Dordrecht/London.

- Eliasson, G. (1994b), "An Individual Educational Investment Account -- A Swedish proposal"; to be published in *Journal of Vocational Training*, No. 2/94.
- Eliasson, G. and Kazamaki Ottersten, E. (1994), "Om förlängd skolgång", Working Paper No. 412, IUI, Stockholm.
- Eliasson, G., Rybczynski, T. and Wihlborg, C. (1994), *The Necessary Institutional Framework to Transform Formerly Planned Economies: With special emphasis on the institutions needed to stimulate foreign investment in the formerly planned economies*, IUI, Stockholm.
- Eliasson, G. and Taymaz, E. (1992), "The Limits of Policy Making: An analysis of the consequences of boundedly rational Government using the Swedish micro-to-macro model (MOSES)", Working Paper No. 333, IUI, Stockholm.
- Eliasson, G. and Ysander, B.-C. (1983), "Sweden: Problems of maintaining efficiency under political pressure", in Hindley, B. (ed.), *State Investment Companies in Western Europe*, Trade Policy Research Centre, London.
- Eurich, N.P. (1985), *Corporate Classrooms*, The Carnegie Foundation for the Advancement of Teaching, Princeton, NJ.
- Fama, E.F. (1980), "Agency Problems and the Theory of the Firm", *Journal of Political Economy*, Vol. 88, No. 2, April, pp. 288-307.
- Färe, R. and Grosskopf, S. (1990), "A Distance Function Approach to Measuring Price Efficiency", *Journal of Public Economics*, Vol. 43, pp. 123-126.
- Färe, R., Grosskopf, S. and Lovell, C.A.K. (1988), "An Indirect Approach to the Evaluation of Producer Performance", *Journal of Public Economics*, Vol. 37, No. 1, October, pp. 71-89.
- Fägerlind, I. (1975), *Formal Education and Adult Earnings -- A Longitudinal Study of the Economic Benefits of Education*, Almqvist & Wiksell International, Stockholm.
- Farrell, M. J. (1957), "The Measurement of Productive Efficiency", *Journal of the Royal Statistical Society*, 120, pp. 449-460.
- Fernandez R. and Rogerson, R. (1993), "Keeping People Out: Income distribution, zoning and the quality of public education", NBER Working Paper No. 4333, Cambridge, MA.
- Feuer, M.J., Glick, H.A. and Desai, A. (1987), "Is Firm-Sponsored Education Viable?", *Journal of Economic Behavior and Organization*, Vol. 8, No. 1, March, pp. 121-136.
- Feuer, M.J., Glick, H.A. and Desai, A. (1991), "Firm Financed Education and Specific Human Capital Investments: A test of the insurance hypothesis", in Stern, D. and Ritzen, J.M. (eds.), *Market*

Failure in Training. New Economic Analysis and Evidence on Training of Adult Employees, Springer-Verlag, Berlin.

- Fölster, S., Barkman, C., Meyerson, E. and Pyddok, R. (1993), *Sveriges systemskifte i fara?*, IUI, Stockholm.
- Gertler, P. and Glewwe, P. (1990), "The Willingness to Pay for Education in Developing Countries: Evidence from rural Peru", *Journal of Public Economics*, Vol. 42, No. 3, August, pp. 251-275.
- Glick, H.A. and Feuer, M.J. (1984), "Employer-Sponsored Training and the Governance of Specific Human Capital Investments", *Quarterly Review of Economics and Business*, Vol. 24, No. 2, pp. 91-103.
- Goodland, J. (1983), *A Place Called School*, McGraw-Hill, New York.
- Gottfredson, L.S. (1985), "Education as a Valid but Fallible Signal of Work Quality: Reorienting the old debate about a functional basis of the occupational hierarchy", *Research in Sociology of Education and Socialization*, Vol. 5, JAI Press, Greenwich.
- Griliches, Z. (1977), "Estimating the Returns to Schooling: Some econometric problems", *Econometrica*, Vol. 45, No. 1, January, pp. 1-22.
- Griliches, Z. (1988), *Technology, Education and Productivity*, Basil and Blackwell, New York.
- Griliches, Z. and Mason, W.M. (1972), "Education, Income and Ability", *Journal of Political Economy*, Vol. 80, No. 3, Part II, May/June, pp. S74-S103.
- Grosskopf, S., Hayes, K., Taylor, L. and Weber, W. (1991), "Allocative Inefficiency in Education", Research Paper No. 9118, Federal Reserve Bank of Dallas.
- Grosskopf, S., Hayes, K., Taylor, L. and Weber, W. (1992), "Budget Constrained Frontier Measures of Fiscal Equality and Efficiency in Schooling", Working Paper No. 335, IUI, Stockholm.
- Grossman, H. (1977), "Risk Shifting and Reliability in Labor Markets", *Scandinavian Journal of Economics*, Vol. 79, No. 2, pp. 187-209.
- Grubb, W.N. (1991), "The Varied Economic Returns to Post Secondary Education: New evidence from the class of 1972" (mimeo), School of Education, University of California, Berkeley.
- Hansen, W.L. (1983), "Impacts of Student Financial Aid or Access", in Fromkin, J.T. (ed.), *The Crisis in Higher Education*, Academy of Political Science, New York, pp. 84-96.
- Hansen, W.L. (1991), "Non Market Failure in Government Training Programs", in Stern, D. and Ritzen, J.M. (eds.), *Market Failure in Training. New Economic Analysis and Evidence on Training of Adult Employees*, Springer-Verlag, Berlin.
- Hanushek, E.A. (1979), "Conceptual and Empirical Issues in the Estimation of Educational Production Functions", *Journal of Human Resources*, Vol. 14, No. 3, pp. 351-388.

- Hanushek, E.A. (1986), "The Economics of Schooling", *Journal of Economic Literature*, Vol. 24, No. 3, pp. 1141-1177.
- Hanushek, E.A. and Taylor, L.L. (1990), "Alternative Assessments of the Performance of Schools", *Journal of Human Resources*, Vol. 25, No. 2, Spring, pp. 179-201.
- Harris, M. and Holmström, B. (1982), "A Theory of Wage Dynamics", *Review of Economic Studies*, Vol. XLIX(3), No. 157, July, pp. 315-333.
- Hashimoto, M. (1991), "Training and Employment Relations in Japanese Firms", in Stern, D. and Ritzen, J.M. (eds.), *Market Failure in Training. New Economic Analysis and Evidence on Training of Adult Employees*, Springer-Verlag, Berlin.
- Hauser, R. and Sewell, W. (1986), "Family Effects in Simple Models of Education, Occupational Status, and Earnings: Findings from the Wisconsin and Kalamazoo studies", *Journal of Labor Economics*, Vol. 4, No. 3, Part 2, July, pp. S83-S115.
- Hirschleifer, J. (1971), "The Private and Social Value of Information and the Reward of Inventive Activity", *American Economic Review*, Vol. LXI, No. 4, September, pp. 561-574.
- Hirschleifer, J. (1973), "Where Are We in the Theory of Information?", *American Economic Review*, Vol. LXIII, No. 2, May, pp. 31-39.
- Holmlund, B. (1984), *Labor Mobility. Studies of Labor Turnover and Migration in the Swedish Labor Market*, IUI, Stockholm.
- Holmqvist, H. and Jarrå, U. (1990), "Lärande och utveckling i arbetslivet, Inventering och bedömning av utvecklingsområden" (mimeo), Trygghetsrådet-SAF-PTK, Stockholm, November.
- Holmström, B. and Milgrom, P. (1991), "Multitask Principal-Agent Analyses: Incentive contracts, asset ownership, and job design", *Journal of Law, Economics, & Organization*, Vol. 7, Special Issue.
- Holmström, B. and Ricart i Costa, J.E. (1986), "Managerial Incentives and Capital Management", *Quarterly Journal of Economics*, Vol. CI, Issue 4, November, pp. 835-860.
- Hunter, J.E. and Hunter, R.F. (1984), "Validity and Utility of Alternative Predictions of Job Performance", *Psychological Bulletin*, Vol. 96, No. 1, January, pp. 72-98.
- Hunter, J.E. and Schmidt, F.L. (1982), "Fitting People to Jobs: The impact of personnel selection on national productivity", in Dunnette, M.D. and Fleishman, E.A. (eds.), Vol. 1, *Human Performance and Productivity: Human Capability Assessment*, Erlbaum, Hillsdale, NJ, pp. 233-284.
- Hutchens, R.M. (1987), "A Test of Lazear's Theory of Delayed Payment Contracts", *Journal of Labor Economics*, Vol. 5, No. 4, Part 2, October, pp. S153-S170.
- Jencks, A. et al. (1972), *Inequality*, Basic Books, New York.

- Jensen, A.R. (1969), "How Much can we Boost IQ and Scholastic Achievement?", *Harvard Educational Review*, Vol. 39, Winter, pp. 1-123.
- Jimenez, J.E. (1986), "The Structure of Educational Costs: Multiproduct cost functions for primary and secondary schools in Latin America, *Economics of Education Review*, Vol. 5, No. 1, pp. 25-39.
- Jones, E.B. and Jackson, J.D. (1990), "College Grades and Labor Market Rewards", *Journal of Human Resources*, Vol. 25, No. 2, Spring, pp. 253-266.
- Jorgenson, D.W. (1984), "The Contribution of Education to U.S. Economic Growth, 1948-73", in Dean, E. (ed.), *Education and Economic Productivity*, Ballinger, Cambridge, MA.
- Jorgenson, D.W. (1993), "Education and Productivity Growth in a Market Economy", Word Production Congress (WPC), Stockholm, May.
- Jorgenson, D.W. and Fraumeni, B.M. (1989), "The Accumulation of Human and Non-Human Capital, 1848-1984", in Lipsey, R.E. and Tice, H.S. (eds.), *The Measurement of Saving, Investment and Wealth*, Chicago University Press, Chicago, pp. 227-282.
- Jorgenson, D.W. and Fraumeni, B.M. (1990), "Investment in Education and U.S. Economic Growth", in Walker, C.E., Bloomfield, M.A. and Thorning, M. (eds.), *The U.S. Savings Challenge: Policy Options for Productivity and Growth*, Westview Press, Boulder, CO, pp. 114-143.
- Jorgenson, D.W. and Fraumeni, B.M. (1993), "Education and Growth" (mimeo), Harvard University and Northwest University, May.
- Jorgenson, D.W. and Griliches, Z. (1967), "The Explanation of Productivity Change", *Review of Economic Studies*, Vol. XXXIV, No. 3, July, pp. 249-283.
- Jovanovic, B. (1979a), "Job Matching and the Theory of Turnover", *Journal of Political Economy*, Vol. 87, No. 5, October, pp. 972-990.
- Jovanovic, B. (1979b), "Firm-Specific Capital and Turnover", *Journal of Political Economy*, Vol. 87, No. 6, December, pp. 1246-1260.
- Jovanovic, B. and Rob, R. (1989), "The Growth and Diffusion of Knowledge", *Review of Economic Studies*, Vol. 56(4), No. 188, October, pp. 569-582.
- Juster, F.T. and Stafford, F.P. (1991), "The Allocation of Time: Empirical findings, behavioral models, and problems of measurement", *Journal of Economic Literature*, Vol. XXIX, No. 2, June, pp. 471-522.
- Kandel, E. and Lazear, E.P. (1992), "Peer Pressure and Partnerships", *Journal of Political Economy*, Vol. 100, No. 4, August, pp. 801-817.
- Kang, S. and Bishop, J.H. (1989), "Vocational and Academic Education in High School: Complements or substitutes?", *Economics of Education Review*, Vol. 8, No. 2, pp. 133-148.

- Kazamaki Ottersten, E. (1993), "Produktivitet och anställningsskydd", Working Paper No. 399, IUI, Stockholm.
- Kazamaki Ottersten, E. (1994a), "Hur stort är sysselsättningsproblemet?", in Andersson, Th., Brauenhjem, P., Carlsson, B., Eliasson, G., Fölster, S. and Jagrín, L., *Den långa vägen. Den ekonomiska politikens begränsningar och möjligheter att föra Sverige ur 1990-talets kris* (The long road. The limitations and possibilities of economic policy to preserve Swedish welfare by reducing the welfare state to manageable proportions), IUI, Stockholm.
- Kazamaki Ottersten, E. (1994b), "Trends in Worker Recruitment Practices in Swedish Companies", *Journal of Vocational Training*, No. 1/94.
- Kazamaki Ottersten, E., Mellander, E., Meyerson, E. and Nilson, J. (1994), "Pitfalls in the Measurement of the Return to Education: An assessment using Swedish data", Working Paper No. 414, IUI, Stockholm.
- Kirzner, I. (1973), *Competition and Entrepreneurship*, University of Chicago Press, Chicago.
- Knight, F.H. (1921), *Risk, Uncertainty and Profits*, Houghton-Mifflin, Boston.
- Knight, F.H. (1944), "Diminishing Returns from Investment", *Journal of Political Economy*, Vol. LII, March, pp. 26-47.
- Kosters, M.H. (1990), "Schooling, Work Experience and Wage Trends", *American Economic Review, Papers and Proceedings*, Vol. 80, No. 2, May, pp. 308-312.
- Kostiuk, P.F. and Follmann, D.A. (1989), "Learning Curves, Personal Characteristics, and Job Performance", *Journal of Labor Economics*, Vol. 7, No. 2, April, pp. 129-146.
- Lang, K. and Kropp, D. (1986), "Human Capital Versus Sorting: The effects of compulsory attendance laws", *Quarterly Journal of Economics*, Vol. CI, Issue 3, August, pp. 609-624.
- Lazear, E.P. (1977), "Academic Achievement and Job Performance, Note", *American Economic Review*, Vol. 67, No. 2, March, pp. 252-254.
- Lazear, E.P. (1979), "Why is there Mandatory Retirement?", *Journal of Political Economy*, Vol. 87, No. 6, December, pp. 1261-1284.
- Lazear, E.P. (1980), "Family Background and Optimal Schooling Decisions", *Review of Economics and Statistics*, Vol. LXII, No. 1, February, pp. 42-51.
- Lazear, E.P. (1981), "Agency, Earnings Profiles, Productivity and Hours Restrictions", *American Economic Review*, Vol. 71, No. 4, September, pp. 606-620.
- Lazear, E.P. and Moore, R.L. (1984), "Incentives, Productivity and Labor Contracts", *Quarterly Journal of Economics*, Vol. XCIX, Issue 2, May, pp. 275-297.

- Lazear, E.P. and Rosen, S. (1981), "Rank-Order Tournaments as Optimum Labor Contracts", *Journal of Political Economy*, Vol. 89, No. 5, October, pp. 841-864.
- Lindbeck, A. and Snower, D.J. (1988), *The Insider-Outsider Theory of Employment and Unemployment*, MIT Press, Cambridge, MA.
- Ljungqvist, L. (1991), "Economic Underdevelopment: The case of missing market for human capital" (mimeo), Department of Economics, University of Wisconsin, October.
- Ljungqvist, L. (1992), "Economic Development, Wage Structure and Implicit Insurance on Human Capital" (mimeo), Department of Economics, University of Wisconsin, January.
- Lucas, R.E., Jr. (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics*, Vol. 22, No. 1, pp. 3-441.
- Lundquist, R. (1942), "Yrkesutbildning och teknisk undervisning i Norrland" (Vocational training and technical education in the Northern part of Sweden) (mimeo), IUI, Stockholm.
- Lynch, L.M. (1990), "Private Sector Training and the Earnings of Young Workers" (revised version of NBER Working Paper No. 2060-88, June, to be published in *American Economic Review*).
- Lynch, L.M. (1991), "The Role of Off-the-Job vs. On-the-Job Training for the Mobility of Women Workers", *American Economic Review, Papers and Proceedings*, Vol. 81, No. 2, May, pp. 151-156.
- Lynch, L.M. (1992a), "Differential Effects of Post-School Training on Early Career Mobility", NBER Working Paper No. 4034, Cambridge, MA.
- Lynch, L.M. (1992b), "Young People's Pathways into Work: Utilization of Post Secondary Education and Training, A report submitted to the National Academy of Sciences Committee on Postsecondary Education and Training for the Work Place", MIT Sloan School of Management, March 18.
- Manski, Ch.F. and Wise, D.A. (1983), *College Choice in America*, Harvard University Press, Cambridge, MA.
- Markowitz, H.M. (1959), *Portfolio Selection*, Yale University Press, New Haven.
- McKenzie, L.N. (1959), On the Existence of General Equilibrium for a Competitive Market, *Econometrica*, Vol. 27, No. 1, January, pp. 54-71.
- McPherson, M.S. and Shapiro, M.O. (1991), "Does Student Aid Affect College Enrolment? New evidence on a persistent controversy", *American Economic Review*, Vol. 81, No. 1, March, pp. 309-318.
- Milgrom, P. and Roberts, J. (1992), *Economics, Organization and Management*, Prentice Hall, Englewood Cliffs, NJ.
- Mincer, J. (1974), *Schooling, Experience and Earnings*, Columbia University Press, New York.

- Mincer, J. (1991), "Job Training: Costs, returns, and wage profiles", in Stern, D. and Ritzén, J.M. (eds.), *Market Failure in Training. New Economic Analysis and Evidence on Training of Adult Employees*, Springer-Verlag, Berlin.
- Mincer, J. and Jovanovic, B. (1981), "Labor Mobility and Wages", in Rosen, S. (ed.), *Studies in Labor Markets*, University of Chicago Press, Chicago.
- Miyazaki, H. (1977), "The Rat Race and Internal Labor Market", *Bell Journal of Economics*, Vol. 8, No. 2, Autumn, pp. 394-418.
- Modigliani, F. and Miller, M.H. (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", *American Economic Review*, Vol. XLVIII, June, pp. 261-297.
- Morrison, C.J. (1990), "Market Power, Economic Profitability and Productivity Growth Measurement. An integrated structural approach", NBER Working Paper No. 3355, Cambridge, MA.
- Mueser, P. and Maloney, T. (1991), "Ability, Human Capital and Employer Screening: Reconciling labor market behavior with studies of employee productivity", *Southern Economic Journal*, Vol. 57, No. 3, January, pp. 676-689.
- Murnane, R.J. (1984), "A Review Essay -- Comparisons of Public and Private School: Lessons from the uproar", *Journal of Human Resources*, Vol. XIX, No. 2, Spring, pp. 263-277.
- Murnane, R.J. and Nelson, R.R. (1984), "Production and Innovation when Techniques are Tacit: The case of education", *Journal of Economic Behavior and Organization*, Vol. 5, Nos. 3-4, September-December, pp. 353-373.
- Nelson, R.R. (1959), "The Simple Economics of Basic Scientific Research", *Journal of Political Economy*, Vol. 67, No. 3, June, pp. 297-306.
- Nerlove, M., Razin, A. and Zadka, E. (1984), "Investment in Human and Nonhuman Capital, Transfers Among Siblings, and the Role of Government", *Econometrica*, Vol. 52, No. 5, September, pp. 1191-1198.
- OECD (1986), "World Competitiveness Report for 1982", OECD, Paris.
- OECD (1992), *Adult Illiteracy and Economic Performance*, OECD, Paris.
- OECD (1993), "World Competitiveness Report for 1990", OECD, Paris.
- Ohlsson, H. (1988), *Cost-Benefit Analysis of Labour Market Programmes -- Applied to a temporary program in Northern Sweden*, Economic Studies No. 182, University of Umeå, Sweden.
- Okamoto, K. (1992), *Education of the Rising Sun -- An introduction to education in Japan*, Sun Printing Ltd., Tokyo.
- Okun, A.M. (1975), *Equity and Efficiency: The Big Tradeoff*, The Brookings Institution, Washington, DC.

- Orazem, P.F. and Mattila, J.P. (1991), "Human Capital, Uncertain Wage Distributions, and Occupational and Educational Choices", *International Economic Review*, Vol. 32, No. 1, February, pp. 103-122.
- Osterman, P. (1983), "The Mismatch Hypothesis and Internal Labor Markets: A study of white-collar employment", *Proceedings of the IRRA, 35th Annual Proceedings*, Industrial Relations Research Association, University of Wisconsin, Madison, WI, pp. 436-446.
- Pelikan, P. (1989), "Evolution, Economic Competence, and the Market for Corporate Control", *Journal of Economic Behavior and Organization*, Vol. 12, No. 3, December, pp. 279-303.
- Pencavel, J. (1990), *The Contribution of Higher Education to Economic Growth and Productivity: A Review*, CEPR Publication No. 191, Center for Economic Policy Research, Stanford University, CA.
- Pencavel, J. (1991), "Higher Education, Productivity, and Earnings: A review", *Journal of Economic Education*, Fall, pp. 331-359.
- Psacharopoulos, G. (1985), "Returns to Education: A further international update and implications", *Journal of Human Resources*, Vol. XX, No. 4, Fall, pp. 583-597.
- Psacharopoulos, G. (1991), *The Economic Impact of Education -- Lessons for Policy Makers*, International Center for Economic Growth, ICS Press, San Francisco.
- Rehn, G. (1983), "Individual Drawing Rights", in Levin, H. and Schütze, H. (eds.) (1983), *Financing Recurrent Education*, SAGE Publications, Beverly Hills/London/New Delhi.
- Reich, R.B. (1988), *Education and the Next Economy*, National Education Association, Professional and Organizational Development/Research Division, Washington, DC.
- Reich, R.B. (1991), *The Work of Nations*, Simon & Schuster Ltd, London.
- Ricart i Costa, J.E. (1987), "On Managerial Contracting with Asymmetric Information", EARIE Conference, Madrid, August.
- Ricart i Costa, J.E. (1988), "Managerial Task Assignment and Promotions", *Econometrica*, Vol. 56, No. 2, March, pp. 449-466.
- Ritzen, J.M. (1991), "Market Failure for General Training, and Remedies", in Stern, D. and Ritzen, J.M. (eds.), *Market Failure in Training. New Economic Analysis and Evidence on Training of Adult Employees*, Springer-Verlag, Berlin.
- Romer, P.M. (1986), "Increasing Returns and Long-Run Growth", *Journal of Political Economy*, Vol. 94, No. 5, October, pp. 1002-1037.
- Rosen, S. (1972), "Learning by Experience as Joint Production", *Quarterly Journal of Economics*, Vol. LXXXVI, Issue 3, August, pp. 366-382.

- Rosen, S. (1982), "Authority, Control and Distribution of Earnings", *Bell Journal of Economics*, Vol. 13, No. 2, Autumn, pp. 311-323.
- Rothschild, M. (1979), "Social Effects of Ability Testing" (unpublished paper).
- Rumberger, R.W. (1987), "The Impact of Surplus Schooling on Productivity and Earnings", *Journal of Human Resources*, Vol. 22, No. 1, Winter, pp. 24-50.
- Sah, R.K. and Stiglitz, J.E. (1985), "Human Fallibility and Economic Organization", *American Economic Review. Paper and Proceedings*, Vol. 71, No. 2, May, pp. 292-297.
- Salop, J. and Salop, S. (1976), "Self-Selection and Turnover in the Labor Market", *Quarterly Journal of Economics*, Vol. XC, Issue 4, November, pp. 619-627.
- Schou, P. (1991), *Arbetsmotivation -- en studie av ingenjörer*, IMIT, Handelshögskolan, Stockholm.
- Schumpeter, J. (1942), *Capitalism, Socialism and Democracy*, Harper & Row, New York.
- Sharpe, W.F. (1964), "Capital Asset Prices, A Theory of Market Equilibrium under Conditions of Risk", *Journal of Finance*, Vol. XIX, No. 3, September, pp. 425-442.
- Shephard, R.W. (1953), *Cost and Production Functions*, Princeton University Press, Princeton, NJ.
- Shephard, R.W. (1970), *Theory of Cost and Production Functions*, Princeton University Press, Princeton, NJ.
- Shephard, R.W. (1974), *Indirect Production Functions*, Verlag Anton Hain, Merschheim.
- Simon, H. (1955), *Administrative Behavior*, Macmillan, New York.
- Skedinger, P. (1994), "Arbetsmarknadspolitik -- ingen garanti för låg arbetslöshet", *Årsbok och Verksamhetsberättelse*, IUI, Stockholm.
- Smith, A. (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations*, republished as *The Wealth of Nations*, Random House, Inc., New York, 1994.
- Smith, P.K. (1993), "Welfare as a Cause of Poverty: A time series analysis", *Public Choice*, Vol. 75, pp. 157-170.
- Solow, R.M. (1957), "Technical Change and the Aggregate Production Function", *Review of Economics and Statistics*, Vol. 39, pp. 312-320.
- Solow, R.M. (1959), "Investment and Technical Progress", in Arrow, Karlin, and Suppes (eds.), *Mathematical Methods in the Social Sciences*, Stanford.
- Solow, R.M. (1988), "Growth Theory and After", *American Economic Review*, Vol. 78, No. 3, June, pp. 307-317.

- Solow, R.M. (1990), *The Labor Market as a Social Institution*, Basil Blackwell, Cambridge, MA.
- Soskice, D.W. (1993), "Social Skills from Mass Higher Education: Rethinking the company-based initial training paradigm", *Oxford Review of Economic Policy*, Vol. 9, No. 3, pp. 101-113.
- SOU (1992), "Ett hav av möjligheter", Förslag från kommittén för AMU-gruppens bolagisering, SOU 1992:123, Stockholm.
- Spence, A.M. (1973), "Job Market Signalling", *Quarterly Journal of Economics*, Vol. LXXXVII, Issue 3, August, pp. 355-375.
- Stafford, F.P. (1987), "Women's Work, Sibling Competition and Children's School Performance", *American Economic Review*, Vol. 77, No. 5, December, pp. 972-980.
- Stafford, F.P. and Stobernack, M.O. (1989), "Manufacturing Wages and Hours: Do trade and technology matter?" (mimeo), Department of Economics, University of Michigan.
- Stevenson, H. (1992), "Learning from Asian Schools", *Scientific American*, December, pp. 70-76.
- Stevenson, H., Lee, S. and Stigler, J.W. (1986), "Mathematics Achievement of Chinese, Japanese and American Children", *Science*, Vol. 231, February, pp. 693-699.
- Stiglitz, J.E. (1972), "Education as a Screening Device and the Distribution of Income" (mimeo), Yale University, New Haven, CT.
- Stiglitz, J.E. (1975), "The Theory of 'Screening', Education, and the Distribution of Income", *American Economic Review*, Vol. LXV, No. 3, June, pp. 283-300.
- Svennilson, I. (1964), "Economic Growth and Technical Progress. An essay in sequence analysis", *The Residual Factor and Economic Growth*, OECD, Paris.
- Tsang, M.C. (1983), "The Impact of Overeducation on Job Satisfaction: Empirical evidence" (mimeo), The Spencer Project on Education and Productivity.
- Tsang, M.C. (1987), "The Impact of Underutilization of Education on Productivity: A case study of the U.S. Bell companies", *Economics of Education Review*, Vol. 6, No. 3, pp. 139-254.
- Tsang, M.C., Rumberger, R.W. and Levin, H.M. (1991), "The Impact of Surplus Schooling on Worker Productivity", *Industrial Relations*, Vol. 30, No. 2, Spring, pp. 209-227.
- UNCTAD (1985), *Handbook of International Trade and Development Statistics*, UNCTAD, New York.
- von Weizsäcker, Ch. (1986), "Rights and Relations in Modern Economic Theory", in Day, R.H. and Eliasson, G. (eds.), *The Dynamics of Market Economies*, IUI, Stockholm; and North-Holland, Amsterdam.

- Wahlberg, H.J. and Fowler, W.J., Jr. (1987), "Expenditure and Size Efficiency of Public School Districts", *Educational Researcher*, October, pp. 5-13.
- Waldman, M. (1984), "Job Assignments, Signalling, and Efficiency", *Rand Journal of Economics*, Vol. 15, No. 2, Summer, pp. 255-270.
- Westerman, J. (1768), *Svenska Naringarnes Undervigt emot de Utlandske formedelst en trogare Arbets-drift* (The inferiority of the Swedish compared to foreign manufacturers because of a slower work organization), Salvius, Stockholm.
- Wicksell, K. (1905), *Socialstaten och Nutidssamhallet* (The Socialist State and Modern Society), Albert Bonnier, Stockholm.
- Wise, D.A. (1975), "Academic Achievement and Job Performance", *American Economic Review*, Vol. LXV, No. 3, June, pp. 350-366.
- Ysander, B.-C. (1978a), "Homogeneity in Education -- A comment on economic theories of education", in Bowman, M.J., Sohlman, . and Ysander, B.-C., *Learning and Earning*, National Board of University and colleges, Liber Tryck, Stockholm; reprinted in Ysander, B.-C. (1991), *Truth and Meaning in Economics -- Selected Essays on Economic Theory and Policy*, IUI, Stockholm.
- Ysander, B.-C. (1978b), "Homogeneity in Education. Appendix (The meaning of human capital)", *ibid.*

Subject Index

ability tests: 4.6
 assumptional drift: Box 5.1
 basic competences: 3.10; 6.3; App. III
 business experiments: 4.3; Box 5.1
 career: 3.11; 3.12; 6.3
 certification: 3.8
 communication skills: 4.4; 4.7
 compensation of competence: 6.4
 competence and total factor productivity change: 6.3; App. II
 competition in markets for education: 2.6; 6.3
 compensatory schooling: 4.6; 4.8
 cumulative process (education as): 3.10; 5.3; App. III
 drop out: 4.7; 4.10
 (the) disadvantaged: Box, p. 9; 5.3
 educational production functions: 4.9
 educational selection: 4.6
 educational myopia: 6.3
 ethnic environment (background): 4.7
 experimentally organised economy: 2.3; Box 2.1; 3.2
 experimentally organised schooling: 6.5
 filter vs. investment controversy: 4.6; 4.8
 financing education: 4.8; 6.3; 6.4
 head-start programmes: 4.7
 heterogeneity of human capital: 6.2
 higher education: 4.8; 4.12
 incentives: 6.4
 innovative (educational) product development: 6.3
 insurance (labour market) internal: 5.2
 internal firm insurance: 5.2
 internal training (education): 5.2
 (the industrial) knowledge base of a nation: 2.7
 labour market deregulation: 3.10; 5.2
 labour market search: 6.1; 6.2
 leverage of basic education: 5.3
 lifelong learning (experience): 7.2
 made investment (in education): 6.3; 6.4
 market for competence: 1.1; 2.8; 3.3; 3.11
 micro-based macro analysis: 2.1; 2.2

minimum communication skills: 7.1
motivation: 4.8
on-the-job learning: 4.11
organisation of education: 4.11
organisational learning: 6.5; 7.2; App. I
overeducation: 3.7; 6.2
overinvestment (in education): 6.2
parental apathy: 4.7
path into the labour market (school as): 4.7; 6.5
path-dependent: 2.1
receiver competence: 3.10; 4.3; 5.2
recruitment: 2.3; 2.4; 2.5; 3.2; 3.5; 3.8; 4.4; 4.5; 6.3
redundancy: 2.5; 6.2
regulating school: 6.5
returns to schooling: 4.8
shirking: 3.2; 3.3; 3.13
social capital: 4.7; 6.3
sorting: 4.6
stigma: 4.3; 5.2; 5.3; 5.4; 6.3
student motivation: 4.7; 4.11
tacit knowledge: 2.1; 2.7; 3.13; 4.2; App. I
tradability of competence: 6.2
transition from school to work: 6.5
underinvestment (in education): 6.3; 6.4
universal education: 2.7
vocational training: 5.2
willingness to pay: 4.8