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THE MARKETS FOR LEARNING AND EDUCATIONAL SERVICES – a micro explanation of the role of education and competence development in macro economic growth

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THE MARKETS FOR LEARNING AND EDUCATIONAL SERVICES
- a micro explanation of the role of education and competence development in macro economic growth

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Paper prepared

for **THE OECD DIRECTORATE FOR EDUCATION, EMPLOYMENT, LABOR AND SOCIAL AFFAIRS - the Centre for Educational Research and Innovation.**

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FOREWORD

This version is finally complete. The language needs some pruning and the text should be shortened here and there. Furthermore, recent (late 1992 and 1993) literature has not yet been fully incorporated. I will do that for the very final version. Nothing so far changes anything.

Stockholm July 7, 1993
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EXECUTIVE SUMMARY

The old industrial world is currently facing a radical transformation of its dominant production technology. Its manufacturing knowledge base, developed some 150 years ago, is rapidly becoming economically obsolete. As workers and managers in new, semi-industrialized economies, not in the least in the East European countries, are learning to make the same things better and much cheaper, it is becoming increasingly difficult for workers in the West to produce sufficiently high value added expressed in international currency to cover their high wages. The large companies are responding by going international to gain economies of scale in international marketing, focusing on product development and outcontracting manufacturing.The new technologies to replace the old industrial base and to sustain economic growth and employment at high wages into the future are not being introduced fast enough. Above all, they require different economic and social organization and different, high-level competences among workers. A massive reallocation and retraining of labor will be necessary to restore fast growth. This means that the source of high and growing relative wages for relatively unskilled labor, a trend established some 150 years ago, with the introduction of the large-scale factory organization, has been reversed. Since a decade or two, a trend towards relatively lower wages for unskilled workers seems to have been established among the industrialized countries. And evidence on new technologies being introduced is that this trend against low-skill labor will continue. Competence development will become the economic political focus.

The adjustment currently taking place in the labor market does not fully reflect this change in supply and demand for labor. Underpaid competent labor and overpaid low-skill labor is slowing competence development and growth and causing increased and sustained unemployment among those workers who have their skills shaped around the old knowledge base. On the other hand large rents accrue to the few who have developed the right competences. This international income distribution game is driven by very strong economic and technological forces that cannot be countered by policy

or regulation. One such strong force is at work on income distribution as high value (rent) production is being shifted away from raw material production, basic industries and large-scale factory organization of low-skill production towards small-scale higher competence production in the service end of private industry. Raw material rents have been fairly easy to redistribute through policy, not so rents created by competence capital in small-scale production.

Attempting to avoid letting wage adjustment clear the labor market and to reduce unemployment, politicians are looking to educational solutions to upgrade the competences of the labor force. This is a new and unconventional type of policy and not well researched by economists, neither theoretically nor empirically. This book is about the economic and social potential of educational policies for saving the European mature industrial economies from the specter of job-less growth.

It will be shown that education cannot do it alone. Policies directed towards *competence development,* the *structure of the labor market* and the *organization of its social insurance system* have to be enacted simultaneously to take the mature industrial economies through, and out of their ongoing clinch with new competition in their home markets, with a minimum of social hardship. The exact formulation of such policy, however, still requires further research and new policy competence is required, not yet existing either in the policy or the academic community. Even more difficult to cope with is the fact that the new policies needed will affect the institutions controlling income distribution, being heavily vested with particular interests.

The policy program will not be of the conventional means and objectives type. Evidence on the economics of institutions and dynamic economic systems analysis rejects such notions of policy control of an economic system. Successful policies aim for the institutions of the market, the efforts of individuals and firms generated by incentives, innovation through competition and the disciplining forces of markets.

While competence capital moves economic growth, it won't be developed and won't be efficiently allocated without a proper, market-based *incentive system.* This goes for the formal educational system as well as for the labor market.

The main thrust of the policy argument is that the overall educational system has to be organized not only to produce the right educational services but to constantly improve (innovate) these services. This has to be done even though there is no reliable way to tell the specification of that product prior to its use. It thus 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. This theme is overwhelmingly supported by empirical evidence and runs through the whole book.

The policy possibilities are of seven kinds:
First of all, we conclude that educational policies will not work unless supported by strong economic incentives, that make it worth while for individuals to invest in their own competence development. This means that the performance of the labor market and the social insurance system has to be improved in support of educational reform. This is no easy political task to achieve since it requires coordination of different, and often differently minded political authorities.

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

Third, this means that the financing of education should be shifted away from the educational institutions (the suppliers) to the individuals (the users).

Fourth, the long gestation period of competence development means that incentives will have to be strong enough already in primary and secondary school to stimulate myopic students to build the critical *receiver competence platform* for profitable continued education. A bad start in the early

educational career is very difficult to correct later in life. The problem is that individuals have to wait very long for the monetary rewards of their investment.

Fifth, to achieve that imperfections of the labor market have to be removed, notably restrictions on mobility and wage rigging, such that the individual will more easily search out his or her comparative advantages and such that significant competence-based wage differentials are established.

Sixth, we find that public support of formal schooling is already so large among western industrial nations that one cannot argue for more public support. Improvements are to be looked for in a different organization and orientation of school, which might well produce a better education at lower costs. The point is, however, that this won't be achieved without allowing for new educational solutions to be developed through market experimentation and selection.

Seventh, all of these desired changes rest on the appropriate organization of the institutions that provide the incentives to individuals to educate themselves and to search the labor market for jobs that suit them and that contribute maximum value to the economy at large. Paradoxically, perhaps to many, this improved incentive system requires significantly increased *freedom of contractual arrangements* in the market for educational services, the labor market and the social insurance market than is currently available in most industrialized countries. This freedom has to be allowed to create the individual flexibility and adaptability that a complex demand and supply situation for competence requires.

We find no clear economic case for *underinvestment* in education. One can easily produce an equally reasonable case for overinvestment. The point, however, is that if educational service production and the labor market process are improved, as suggested above, the most credible economic cases for underinvestment vanish and we are left with a *social* problem of

underinvestment, namely that part of the population and workforce who do not possess the necessary receiver competence to benefit from educational investments. Hence, they will pass through a non-demanding formal schooling system without developing the receiver competence required to become recipients of further educational investments on-the-job. This problem, which is social, has to be attended to very early at school, preferably before school.

The policy conclusions are entirely formulated in terms of institutional change aimed at activating students, workers and employers through appropriately formulated incentives. Significant decisions and public resources should be removed from central authorities to authorize and enable individuals to take responsibility for their own competence development, their labor market contracts and their social insurance arrangements. This requires deregulation and decentralization of the educational system, the labor market and the social insurance system. There is no empirical support for elaborate policy instruments aimed at preset targets. There is powerful empirical evidence suggesting that if these reforms are not enacted the economy won't be politically capable of reorganizing itself for the demands of new technology and competition beyond horizon 2000. It would, of course, be very nice to be able to credibly formulate more powerful and precise policies involving smaller labor market risks for the individual. Such ambitions stumble on lack of information in three areas;

- a precise identification of the *basic competences* that will set students on the right competence platform for the job market.

- a credible assessment of the *underinvestment* hypothesis to be able to say something on the need for more public support for schools or differently directed public support.
- lack of empirical insight into the *selection versus investment* function of education.

If the basic competence package could be identified, which may be possible, then the minimum output of primary and secondary schooling can be more precisely defined.

If the underinvestment hypothesis can be restated in terms of sufficient public *inputs* into schooling, but too small educational service *output,* then the educational agenda can be ridded of a detracting debate and refocused on the efficiency of the educational process.

All educational policy is based on some prior assumption about the importance of talent selection in educational process. Much research on which policies were earlier founded tended to downplay the importance of selection mechanisms and overstate the investment hypothesis, a prior position that simplified educational policy making to the task of providing more public money for schooling. This position is not backed by empirical evidence. Most evidence takes us all the way into family life to understand the bad performance of students and workers. This means that the *social capital* that the student carries with him from the family may be what really matters for both school and work performance, making the sorting out of the filter vs. investment hypothesis even more important.

The proposed research agenda of chapter 7 focuses on these three questions. And they require an answer to make possible decisive and fast steps towards solving the unemployment problem of mature industrialized countries.

CHAPTER 1

THE NATURE, THE CREATION AND THE ALLOCATION OF ECONOMICALLY USEFUL KNOWLEDGE – AN INTRODUCTION

The most outstanding quality associated with man is diversity. Human qualities are acquired through upbringing at home, at school, through experience and on-the-job. These improved qualities make innovative behavior possible and create skills that command rents in the labor market. Where human beings team up firms are formed (Eliasson 1990b). Firms generate even larger rents by combining individual qualities innovatively through organizational technique.

The diversity of human capital and the multiple goals of education

We will always have great difficulties identifying the exact nature of human quality and in particular the specification of human competence that contributes to economic growth and individual economic welfare. *This study is based on the assumption that such human knowledge is what matters for the economic wealth of industrial nations.* We conclude that without intelligent coordination (management) machines and man-hours will not create any output. The task is to *identify the economically valuable competences that contribute to economic growth as measured,* to be as precise as possible about the "educational" process that builds the same knowledge, and to identify the parameters through which this process can be influenced by policy. The reader should remember that in carrying out this task much attention will be paid to the fact that education as run and regulated by Government may have other objectives than contributing to economic growth and individual economic

welfare. Besides the (1) teachning *economic competence*, educators often mention (2) *fostering socially responsible citizens* and (3) supporting *individual fulfillment*. The analysis, however, is sufficiently broad as it is. It has to be kept within limits. When economically useful education conflicts with other objectives of schooling this has, however, to be recognized. And this conflict is often very obvious. For instance, the agenda of primary and secondary education in some countries is so fragmented and overburdened with particular and conflicting objectives that it is hardly compatible with the efficient accumulation of economically useful competences.

The ability to cope with change

When heterogeneity is sufficiently manifest the complexity of the vast number of possible combinations of individual and firm competences makes it impossible to achieve a perfect evaluation of all the rent creating knowledge capital in labor and financial markets. The total value of the competence capital of an individual, a firm or an economy depends on its allocation and there are thousands of possible allocations. Hence, the outcome of the educational process cannot be assessed without taking the allocative performance of the labor market into account. Education and labor market policies thus have to be seen in one context, and the institutions of the labor market are critical for the success of labor market policies. With extreme heterogeneity and an imperfect labor market process the economy will (1) always be operating far below its current capacity level and (2) constantly be subjected to unexpected change through competition and improved allocation. This improvement potential is further increased by innovative activity, which is defined as an unpredictable activity. Unpredictability at all levels will therefore be a significant characteristic of what I will call the *experimentally organized economy*. This organization of the economic system will also determine the nature of the competences at all levels that contribute to individual and societal welfare. Part of this competence specification has to do with the ability of individuals and firms to cope with unexpected change in

their local economic environments. This also explains why individuals are being thought of as risk averse and why the competence capital of individuals that matter for economic growth has to embody the qualities that make them capable of coping with change. In designing the market environment of individuals that is efficient in facilitating the change necessary to accommodate the growth processes of an economy, the provision of insurance services to cover the hazards of labor market life become important.

Competence development depends critically on the individual

The creation and allocation of competence in production, hence, is a genuine micro process most importantly taking place at the very fine individual levels, rapidly losing measurable content at higher levels of aggregation. Hence, the study of human embodied competence, including that of new technologies as they figure in economic growth, has to include an explicit representation not only of how they have been created, but also of the dynamic links between micro and macro levels, through firm hierarchies (organization), and through markets. To do that and to identify the policy parameters that can be reset to influence growth and employment three areas have to be studied especially carefully and in one context; namely *the educational process,* broadly defined, the *institutions of the labor market* and the *organization of the social insurance* system.

The educational process that concerns us here builds the competence capital that contributes to productivity growth[1] at the macro level. We will show that this includes the efficient allocation of competence, or the institutions of the labor market and a positive attitude of individuals to participate in this allocation process, that is heavily influenced by the conditions of the social insurance system.

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[1] or more exactly *total factor productivity change.* See Appendix II.

The labor market is a market for competence

The labor market is a *market for competence* and the efficiency of this market in assessing and pricing competence very much is the core of the incentive system that stimulates competence development and economic growth (Eliasson 1992a).

1) Why is *education* in a narrow and a broad sense important for economic growth? What is the specification of the desired educational product? This is the *theoretical* Chapter 2.
2) What do we know about the quantitative relationships involved, and the incentives that promote competence development? This is the *empirical* Chapters 4 and 5.
3) What can Government do? Are there well defined parameters? What knowledge is required to achieve political ambitions? This is the *policy* Chapter 6.
4) What else do we have to know to design the best school organization. This is the *research agenda* of Chapter 7.

Competence development is much more than school

Even though not well recognized in academic literature until recently, educational production of the same order of magnitude as the resources used in the regular schooling system has long occurred in the private production sectors of the very advanced industrial economies. In the private sector it has always been recognized that the *efficiency of production depends on how it is organized* and there is no difference in this respect with educational service production. Its organization and the way incentives are designed to achieve effort on the part of students matter enormously for educational output, when organized privately in conjunction with production. Altogether, education broadly defined engages considerable resources, in Sweden, including the

opportunity cost of lost output (Kazamaki Ottersten 1993) at least 17 percent of GNP. This is almost as much as value added of manufacturing industry (NA code 3000). To warrant such resource use the investment has to be awfully good. As currently organized it probably isn't and the natural starting point for a policy discussion on education in the industrialized world is not to allocate more resources, but to radically change the educational product and reorganize its production.

Educational output not well defined

This study addresses educational production in its entirety, in so far as it contributes to economic growth and recognizes that the incentives and organizational problems determining the efficiency of education come before discussing the amount of resources needed to achieve certain educational output results. It is, in fact, very unclear what the desired composition of the educational product should be. Even firms that carry on significant internal educational activities keep up extensive experimentation in order to improve an educational product the content of which evades analytical definition. It can only be valued from observation in use. In addition, the very large resources spent on public educational production in Western societies, with no clear definition of the product specification aimed for, make an assessment of the *product specification, the incentives to acquire it* and *the educational efficiency in producing it,* the priority concern in a study like this.

The content of the analysis will therefore also include these four parallel steps;

(A) *Define the national Growth objective* and identify the *educational product* that contributes to that objective. This is done in Chapter 2.

(B) *Incentives:* How are the markets for competence organized? How is competence development stimulated? How is the firm organized to build

and use knowledge? Is there a case for underinvestment? This is done in Chapter 3?

(C) The *efficiency* of educational investments or educational production. This is done in Chapter 4.

(D) The role and efficiency of *the labor market and the social insurance* system in making educational policy effective. Chapter 5 identifies the entire policy problem.

(E) *Welfare analysis* including educational policy. The policy Chapter 6 outlines the options for the policy makers.

(F) As we will learn, policy makers have to know much more, to know what they are doing. The policy agenda, hence, requires the ambitious prior *research agenda* of Chapter 7.

<u>The organization of the entire educational process offers an immense number of unexplored possibilities</u>

An important dimension to consider is the organization of the educational process. It occurs in the family, at school and on-the-job and the existing organization is never the best. To understand the importance of education for economic growth *we have to assess alternative organizations of the educational process*. These alternative organizations include more or less of institutions set up by Government, and the efficiency of monopolized public schooling institutions in most industrial countries. Such assessments can only be achieved through experiment or international comparison. But there is also the important task to study the continuing and completely unregulated educational process on-the-job designed and implemented through experiments to make firms more competitive. It is instructive to recall how we reasoned at the IUI when planning interviews of firms and schools on their educational service production. It was implicitly assumed that a very large number of firms had to be interviewed to capture all the variation in

approaches. On the schooling side we decided that a few interviews would be sufficient, but immediately realized the implication of this decision. The heavy regulated schooling systems of western industrial nations with few choices left for students and parents not only create uninformed and passive "customers". The absence of variation means that schools cannot learn from each other as competing firms do in the market. Such an organization of production is never innovative. The only way *for us* to learn will be through interviews in different countries, and understanding educational production is both important and difficult. The economics of the family as well as of the firm is included.

The nature of relevant policy hypotheses

This may look as an overwhelmingly ambitious book to write, considering all the specialties to be covered, *or* is the ambition to write a disconnected survey of literature? It is neither. The ambition is to merge existing evidence on education and economic growth into an wholistic hypothesis for policy makers. This policy hypothesis will never be fully verified, but it is very well empirically founded. It will be compatible with existing empirical evidence, internally consistent and in other respects based on reasonable conjectures. Critics to be taken seriously will have to reject *significant* evidence as unreliable and/or come up with an alternative poplicy hypotheses, also compatible with all evidence and internally consistent, but with different policy implications. The policy hypothesis of this book will not only suggest what policy makers can do, but also be sufficiently rich in content to outline the risks for and of policy failure.

Policy making requires wholistic understanding, and very good theory, indeed, is required to link education broadly defined to economic growth. Only simplistic versions of such economic theory exist, but we can use these theories as a consistent accounting framework for our analysis and as a method to merge the fragments of available partial knowledge into a whole.

The traditional researcher may nevertheless not feel at home with this complex synthesis, neither will he always be able to explicitly recognize in detail all the ways I have reinterpreted fragmented knowledge as contributions to the whole. I have therefore taken care to make references to the theoretical and empirical sources used. The task of this book has been to organize fragmented knowledge to support certain broad policy decisions; what to do with competence accumulation to enhance private and societal economic welfare, not to focus on a particular well defined problem. The objective of this book is to make these decision formation processes explicit, something that normally takes place rather anonymously in the heads of decision makers.

Micro-macro analysis allows us to study the dynamics of competence allocation in economic growth

With the growth objective in focus the knowledge capital that drives economic growth will be very broadly defined. This is the first important point. Above all we cannot restrict ourselves to competence embodied in individuals. Competence embodied in teams, in the organization of firms and of markets and of the entire economic system will have to be accounted for. Here the micro-to-macro model of IUI has been a useful intellectual tool and will be a useful empirical tool in the research project outlined in chapter 7. We will find that the ways diverse 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 labor market. Hence, the (labor market) allocation process and the incentives that guide this allocation become very important.

Once the *incentive* problem is allowed in, and the imperfections of markets for competence accepted, the analysis is taken down to the micro level. The argument will be that the dynamics of agent behavior and of markets matter for macro. More specifically, the efficiency characteristics of markets will include the *capacity of markets and firms to take decisions down to locations*

where the appropriate competence resides. Are there alternative organizations of markets and firms that achieve better results? This is the important *second* point.

How do competence rents, economic organization and macroeconomic growth interact?

There is a need to perform this argument strictly. The technically interested reader should therefore be warned about one "magic" variable that will run through the entire analysis; the rate of return to invested capital over the interest rate, or the temporary entrepreneurial rent that the individual or the firm captures in the market. I will call it $\hat{\varepsilon}$, and define it exactly in the next chapter. This variable is an important incentive variable in capital markets. It stimulates innovations, and successful innovations give rise to positive $\hat{\varepsilon}$. Firms strive to keep their $\hat{\varepsilon}$ high. New innovations in firms compete the rents ($=\hat{\varepsilon}$) of old innovations away. Within the firm each individual commands a similar rent. The expected rent $\overline{\varepsilon}$ allocates investment over the firms in the Swedish micro-macro model that will be used as an analytical design for the presentation. The present value of future expected such rents of the firm is evaluated in the stock market. In finance theory this rent is normally interpreted as a risk premium. Most important of all, as I will demonstrate in the next section, there is a direct relationship between measured change in this competence rent and the rate of total factor productivity change, or the shifting of the macro production function. *With the help of this "magic variable" we will be able to mathematically tie the growth, the incentive and the educational problems together.*

Firms and individuals apply *innovative* competence to create private rents, *learning* (receiver competence) to capture rents and *adaptive competence to cope with change* and avoid losing rents. In fact, a growing, experimentally organized economy is properly recognized by the universal keyword *change*. The economic system itself has to be capable of embodying certain

competence characteristics related to the accumulation of competence (education) and the social capacity of the economic system to cope with change (social insurance). Sometimes the institutions of markets are capable of providing educational and insurance services, sometimes not. In the latter case Government has a policy role. As a consequence three concepts will carry us through this book; *economic organization*, *competence accumulation* and *social insurance*.

CHAPTER 2

MODELING COMPETENCE DEVELOPMENT AND ECONOMIC GROWTH

– the identification of economic competence

The importance of knowledge for the economic wealth of a nation has been discussed in literature for centuries. To connect education with growth, and to define the content of knowledge contributing to growth - which is the purpose of this chapter - we need appropriately formulated growth theory. It will be shown that without explicit recognition of the extreme heterogeneity of the human competence endowment there will be no useful theory of economic growth. This requires that macro economic growth be modeled at the micro, agent level with explicit recognition of the organization of very imperfect markets. It also forces an explicit recognition of the educational processes.

2.1 Different theories of growth

For the purpose of this theoretical overview it is convenient to keep four different theoretical approaches apart.

a) Pre-quantitative times.
b) Neoclassical analysis.
c) The "new" growth theory.
d) Micro based macro analysis

a) Early thinking about education – pre-quantitative times

Most early treatises in economics recognized the importance of knowledge, competence and skills. Such recognition was not so demanding in times when quantification was not required for "proper" analysis. In fact, in 1768[1] - before *The Wealth of Nations* - the Swedish economist Johan Westerman was very clear about the importance of skills and knowledge for the international competitiveness of Swedish production. He traveled to England and to Holland to learn about superior production techniques, and he observed that labor productivity in the British shipyards was twice that in the Swedish shipyards. He concluded (already in 1768) that the new machines were good to have, but what really mattered was the know-how to use them, and how to organize work around them. Awareness of the nature and importance of education and of production organization was by no means as explicit among the academic economists of these days, but it was there at least until John Stuart Mill (1848). But then it mysteriously disappeared, a disappearance in literature that lasted about 100 years (Abramovitz 1988).

The reason for the disappearance of this awareness should be sought in the nature of this particular capital item. Knowledge is the most complex of all capital items. It is not only difficult to measure, but also difficult to represent analytically in the kind of mathematical models that began to appear with the marginalist revolution. Knowledge is vested in human beings and acquired through the educational process (broadly defined). It applies differently, depending upon use. It is embodied in its carrier, and it doesn't depreciate from use as ordinary capital.[2] The easiest way was to disregard it. Heterogeneity is the frustration of capital theory. The most heterogenous capital item one can think of is knowledge (Ysander 1978b).

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[1] Westerman, J., 1768, *Svenska Näringarnes Undervigt emot de Utländske, förmedelst en trögare Arbets-drift (On the Inferiority of the Swedish Compared to Foreign Manufacturers because of a Slower Work Organization)*, Stockholm.

[2] Literature does not recognize depreciation of knowledge capital (see, e.g., von Weizsäcker 1986, Romer 1986). It is rather thought of as a relative price change (Griliches 1988).

b) Neoclassical analysis

Neoclassical analysis is a natural extension of classical Ricardian analysis of the late 19th century. In the period immediately following world war II it took on a very concrete shape, as more and more statistical data were brought together. Input output analysts created the notion of a macro production function, which was ultimately refined by Solow, Johansson and others. But the neoclassical production function is a very deceptive design, indeed. While early Keynesian production explanations made output growth depend altogether on investment, neoclassical production function analysis makes output growth totally independent of investment, only on relative prices, including capital user costs.[1] An extension of the concept of investment does not change this, unless knowledge capital is superimposed on all other factors of production as an organizing device.

As macroeconomic developments of postwar Western economies surpassed past benchmarks, the profession began to worry whether they had gotten their numbers properly organized. The Ricardian-Marxian notion of a production system fed with machines and manual labor hours, and possibly land, was not sufficient to explain observed, rapid productivity growth. Many researchers (Solow 1957, 1959, Denison 1967, Jorgenson–Griliches 1967 etc.) began to look for *quality* dimensions of factor inputs, that could explain measured productivity growth. They all, however, stayed within the equilibrium framework of neoclassical economics, and notably Jorgenson-Griliches (1967), who designed a sophisticated method of correcting factor inputs, one by one, for quality change, using the implicit price structure of an equilibrium system. In doing so they more or less removed the residual, unexplained technical or productivity factor. This, however, tends to be the result by virtue of the method used.[2] It can be demonstrated (see Eliasson 1987a, pp. 90ff, 1990c,

[1] This is true only for so called disembodied technical change, not for the vintage production function.

[2] If the method of price correction completely corrects prices for market imperfections this result will be tautologically true.

and below) that unaccounted for factor inputs, or factor inputs not paid the equilibrium price, will nevertheless contribute to the market value of production, and hence, also to a residual value to the owner of capital. Since this residual profit has been created by factor inputs not measured, or measured, but not properly paid, it will exhibit itself as an unexplained residual growth factor in macro production function analysis. If you correct factor inputs for errors of measurement in price statistics, you remove the corresponding unexplained production factor by definition. Jorgenson (1984) and Jorgenson-Fraumeni (1989, 1990, 1993), and others have used that method recently to demonstrate the importance of education in macroeconomic growth. In doing this they find that education matters economically very much, since pay differences, whether being the result of education, original underlying talent or some market imperfection, explain a large part of total factor productivity growth.

As a consequence they also find that the decline in relative compensation for education since the middle 70s, and the strong increase in relative compensation for education thereafter (Blackburn-Bloom-Freeman 1990), also explains a large part of (or much of) the mystic disappearance in the 70s, and "the return", equally mystic in the 80s of total factor productivity growth. The method guarantees such results, and even though they are plausible, they have to be more carefully researched before any firm conclusions on educational policy can be drawn. In a 1985 article, and later in a book Psacharopoulos (1985, 1991) concludes on the optimal allocation of educational resources that for underdeveloped countries at least, it would be optimal to reallocate educational resources away from higher education to upgrade the average level of education from below. The marginal output contribution of labor input would increase significantly. In a 1993 paper, using his method as described above, Jorgenson produced even more challenging results, that very much addressed the problem of this monograph. He observes that educational investments are not properly measured in the national accounts. The bulk of it is produced in the non-market sector under monopolistic conditions and, hence, grossly underestimated. Furthermore analysis of education tends to

miss the crucial time dimension of investment, the time it takes for the outlays for education and the emergence of human capital embodied in individuals. Jorgenson furthermore is highly critical of the standard macro economic approach of assuming (as in Solow 1988) homogeneous capital and labor inputs. He breaks both physical and human capital down into many categories and estimates substitution effects between different capital items. His conclusions are: when properly measured, including opportunity costs in the labor market, educational investments dwarf investments in tangible forms of capital. Despite the long gestation periods investments in education are considerably greater in magnitude than the economic value of time spent at work. Furthermore, taking the different categories of human capital into account Jorgenson sets up two educational scenarios; one *elitist* and one *populist*. The elitist approach, increasing expenditure with no further enrollment of students generates a large welfare (output) loss. The populist scenario, on the other hand, increasing enrollment at unchanged expenditure, accepting a lowering of educational quality generates an output increase 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 very intriguing, impinging, indeed, on the ongoing educational debate. They may be reasonable conjectures as formulated. But as we shall see below, one has to be very careful in drawing conclusions on policy from these results, since their policy implications hinge critically on the definition of educational expenditures and quality used by Jorgenson.

It is important to keep in mind that if Jorgenson's method was applied to Swedish data, with more compressed wage differences than in the US, and longer lasting, large divergences between marginal productivities and compensation[1], because of Swedish distributional policies, one will find that slow production growth will be explained by a slow increase in educational investments, which are small compared to those in the US, because of the low

[1] Such a study is currently underway.

return to such investments. Hence, stagnation will be explained by the egalitarian wage policies pursued in Sweden. Also this is a very plausible explanation, but different dynamic analysis is required for policy advice. To this I return in the micro section below.

The macro production function approach establishes one-to-one links between labor qualities and the corresponding output. It, however, misses important characteristics associated with imperfectly informed markets and changes in the organization of production within firms, and in markets. Such organization embodies technology of various kinds within firms and in the organization of the institutions of markets. Notably contract technology in the labor market, (which will be the theme of the next section) begins to matter importantly for macro productivity growth. Changes in such technologies normally violate standard aggregation assumptions of macro production function analysis. If the contribution of organizational change to economic growth is disregarded, too much weight will be given to individual factor quality change and education. Hence, such change has to be made explicit. Thus, it becomes natural to discuss what changes in *industrial structure* mean for the demand for particular labor qualities. It also becomes natural to discuss what more education at different levels will mean for output growth. As I will argue later this is, however, the wrong way to ask the question.

The increased demand for highly educated labor in the US (Blackburn-Bloom-Freeman 1990, Kester 1990 and Bishop-Carter 1990) being accompanied by a matching increase in the return to education has become something of a "puzzle" for economists. On this Berndt-Morrison-Rosenblum (1992) find that these increases are related to growth in highly technical (office and information technology) capital. Cappelli (1993) concludes for the U.S. 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 state production jobs. There is, however, no reported positive relationship between growth in such competence or in

highly educated labor on the one hand, and labor productivity on the other. The problem is to capture the nature of technology change and the interaction of supply and demand of human capital. As we will see, such answers require that we step down to the micro level. First, however, a few additional variations on the macro theme.

c) The "new" growth theory

The so called "new" growth theory originated in Lucas (1988) and Romer (1986). It has generated a cascade of variations on the theme. The reason for its popularity probably is its close mathematical connection with the above standard neoclassical production theory. The mathematics is the same, and some members of the old neoclassical school, like Dale Jorgenson, would argue that the "new" is no more than a modification of the "old" macroeconomic growth theory.

The idea is simple. Romer (1986) introduces an "infrastructure" knowledge competence as an externality in his model economy. This knowledge factor confers scale economies to all other factors of production. Since Romer's model is essentially the old static general equilibrium model his problem is to obtain an internal solution, despite the existence of increasing returns. His trick is to assume strongly diminishing returns to knowledge accumulation ("education"). The only difference between Romer's model and the classical (or neoclassical) model, hence, is that he has shifted the exogenous productivity, or 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 makes it more natural to introduce all kinds of externalities in the analysis of productivity advance, notably know-how created in other sectors. Thus, for instance, Government sponsored education, health care and insurance carry

spill over effects to private firms. The notion of the infrastructure knowledge capital of the new growth theory is mathematically elaborated in Appendix I.

If both traditional economies of scale and unspecified, embodied knowledge accumulation are present, the two normally cannot be econometrically separated in macro production function models. And if the tacit knowledge capital - whatever it is - is perfectly correlated with "scale", a prior scale formulation will reinterpret improvements in organizational competence as originating because of scale and vice versa. The acquisitions of Zanussi (Italy) and White Consolidated Industries (US) by Swedish Electrolux provide an illustration. Obviously the acquisitions enlarged the scale of Electrolux in physical terms. There should be mechanical scale benefits to exploit. However, the success of Electrolux over the years has to do with more than that in the sense that top management in other firms doing exactly the same thing would not necessarily have created the same successful results, because they lacked the particular experience the Electrolux management team had obtained over the years. Even though one can give several examples of pure, physical economies of scale with economic implications (e.g. the natural laws controlling electricity transmission, see Smith 1966), the notion of scale becomes the wrong concept if the exploitation of economies of scale requires technology, i.e., knowledge. The question, then, is how to represent the dominant competence input in the production process mathematically. The production function representation of an individual firm in Appendix I, borrowed from Romer (1986), is a step in that direction, but it does not take us out of the static neoclassical world, since it does not explain the accumulation of the competence. This has to be done simultaneously with the explanation of production if competence, or knowledge capital, is "tacit" and can only be "learned" through participation in production. Perhaps the attempt by Braunerhjelm (1993) to model the scale effects on all factors of production in the divisions of a firm, emanating from a centrally available unique knowledge base, is a fruitful approach to take us beyond the physical, volume scale economics associated with standard production function analysis, and down to the micro level. Then dynamics is created in the form of a "path-

dependent" economic process moved by organizational change (Eliasson 1989a). To this we now turn.

d) Micro based macro analysis

There are two problems to deal with. *First,* neoclassical, theory and the "new" growth theory are no theories of growth. They describe measured economic growth in terms of measured inputs, but since these measured inputs include a heavy component linked up with time or some other exogenous input, the growth engine is essentially exogenous. In particular, these theories don't capture the importance for economic growth of competition among agents in dynamic, "imperfect" markets, and of organizational change within firms and between firms. One result that clearly emerges from the survey of literature to follow is that the market for labor or rather competence is extremely imperfect, a circumstance that invalidates a large part of the traditional human capital literature. These imperfect market mechanisms have to be captured in a model attempting to link competence development to economic growth, i.e. in a theory of economic growth. So let us start again. The growth process of a market based, experimentally organized economy (Eliasson 1992 d) includes four mechanisms:

- entry
- reorganization of existing agents
- rationalization of existing agents
- exit,

that all operate in different time dimensions, require different competence characteristics and have to be in a certain balance over time to generate stable sustained growth at the macro level. Two of these mechanisms work through selection among firms, and one through organizational change within existing firms. Classical economic theory restricts itself to *the remaining* rationalization mechanism. This imposed limitation of insight of course gives

rise to erroneous conclusions and this is especially so when studying the labor market consequences. The macro economic growth process is composed of all four mechanisms. The bulk of structural adjustment, when seen over the medium and long term occurs through the exit and entry or reorganization process. For the labor market this means that reallocation of labor to a large extent occurs over the open labor market, rather than on internal firm labor markets. The total growth process, furthermore, can never be perfectly coordinated and constantly subjects market agents to unexpected change in their local markets. The ability to cope with such unexpected change at the micro level is an important element of the competence specification of individuals and agents.

Second, knowledge and competence are human embodied "factors" that occur as micro phenomena. To understand them, one has to begin with the behavior of micro agents. Once we have accepted economic growth as the policy objective, and defined the circumstances of the production system that contribute positively to growth, we can derive certain tangible (definable) characteristics of the competence capital that we want to increase. This is necessary in order to say something on the organization of educational production. To identify the knowledge factor behind microeconomic growth at the macro level it is necessary to begin with each of the three different agents involved,

- the *firm,* the employer
- the *individual,* the employee (incentives)
- the *policy maker* (macro and distribution).

Each of these agents operate in an economic environment called:
the *market*

The way individual behavior 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 policy maker affect competition. Hence, there are two aggregation problems to recognize; *within* the hierarchies of the firm and *through* markets.

Classical or neoclassical theory assumes the market environment to be given. The implicit assumption of macro economic production function analysis is that firms are price takers. This is of course a not acceptable assumption. Darwinism or Schumpetarian economic analysis (Winter 1964, Schumpeter 1942) describes how agents react to an exogenously changing environment, through organizational adjustment changing the character of firms and of industries. Micro-macro theory takes us one final step further (Eliasson 1991c) making the market environment dependent on the ongoing adjustment process of agents to itself. Only through this final step will the properties of the *experimentally organized economy* become manifest i.e. genuine unpredictability in the local environment of agents and individuals. Without this theoretical understanding labor and educational economics will miss the important links between education, the labor market and social insurance and be incapable of theoretically grasping the critical economic characteristics of human capital.

Since competence or knowledge are inherently heterogenous capital items (this proposition will be elaborated in the next section) and since knowledge can confer strong economies of scale where it applies (here I buy the idea of the "new" growth theory) it matters very much for growth whether knowledge is efficiently allocated. The combined proposition of this paper (to be stated already here, see also Eliasson 1992 a,c) is that *macroeconomic growth critically depends on the capacity of the economic system to take decisions down to the levels where the appropriate competence resides*. This is the task of the market for competence, or the labor market. This means that relevant growth theory *has* to be micro (firm, individual) based and that the competence or knowledge endowment of a nation includes the particular organizational knowledge that makes this allocation possible.

2.2 The nature of learning and the market process in the experimentally organized economy

The nature of the firm, or the individual as they appear in economic theory depends on the theory of the markets in which they are supposed to operate. The classical model offers little help here, since it is totally silent on the dynamics of competition and of firms, as well as on the significance of knowledge, except as it appeared in macro production function analysis above. New theory is needed as background to make the individual, the family and the firm look like their real counterparts and to understand their use of competence in production (Eliasson 1990c).

The experimentally organized economy

To understand the nature of the knowledge base of an economy that contributes to economic growth we need an alternative to the classical model; a model of live firms that compete in dynamic markets that never clear, where structures develop as part of an ongoing evolutionary process, moved by ex ante inscrutable entrepreneurial initiatives, and by a steady flow of mistaken decisions. I have called this the *experimentally organized economy* (1987, 1988a, 1991c), since it thrives on a certain amount of local uncertainty caused by individual agent behavior, and loses performance from the imposition of *too much* order to reduce the same uncertainty.

The experimentally organized economy does not only allocate given resources on given uses. It also creates new resources through innovation and entry, and force obsolete resources to move, or to exit. In the experimentally organized economy also the institutions that define the current order of the system evolve through time. In the labor market innovative activity takes on particular forms since it concerns human beings that are both creative and capable of upgrading and changing their ability characteristics. Education and

experience accumulation in a broad sense is part of the selection and allocation processes that move economic growth.

Economics and pedagogics have been caught over a couple of decades in a long winding controversy over the relative importance (for economic growth and individual proficiency) of *selection* on the one hand, and *educational investment* on the other. The classical economic model which reallocates given resources to given and known uses is by its very assumptions limited to the analysis of educational investments only (human capital theory) and its representatives tend to push this particular view hard as an empirical phenomenon, by assumption. It is obvious that the theory of the experimentally organized economy allows a much broader view of the educational process, which explicitly allows for innovative and educational selection phenomena. In fact, studies on the Swedish micro-to-macro model - an approximation of the experimentally organized economy (Eliasson 1990c, 1991c) - suggest that the selection component of total factor productivity growth may be the by far most important one (Eliasson 1991a, Carlsson 1991).

The ability of the individuals of the economy to cope with the unexpected change of the selection dominated experimentally organized economy, constitutes part of the human capital of the economy. As will become apparent this ability depends on the capacity of the economic or political system to provide adequate *insurance* (see further Eliasson 1992) for individuals subjected to the consequences of business mistakes, the latter constituting a normal cost of economic growth.

The limits to learning

New competence can be acquired through internal education, or in the market through recruitment and through the acquisition of competent firms or parts of firms (Eliasson 1991d). At some rate such acquisition of new competence is perfectly reliable, but the economic value of the competence is reduced to

the extent that competitors acquire the same, or better competence faster. If, on the other hand, the firm tries to acquire competence very rapidly it often incurs a cost in the form of a business failure. When seen at the aggregate level of a sector or the entire industry, *business mistakes constitute a standard cost of economic development*. The more rapid (everything else the same) the competence accumulation of a firm, a group of firms or a whole industry, the larger the incidence of failure, but also the larger the probability of major business success. Since the economic value of acquired know-how depends on what other competitor firms do, *strongly diminishing returns to learning* or the acquisition of knowledge should be exhibited because of the rapidly increasing rate of business failure (Eliasson 1990c). This means that no individual firm will be able to raise its knowledge capital dramatically through temporarily allocating all its resources on learning to the extent that it forever outcompetes its competitors through the consequent gains in economies of scale. The same results should hold for a country.

An increased failure rate disrupts the stability and coordinating capacity of the price system of the economy and makes learning more difficult, illustrating the limits of capacity of a decentralized economy to cope with massive innovative behavior.[1]

2.3 The Agents of Change

To identify the nature of the competence capital in production both the firm and the individual have to be characterized in terms of the market environments in which they operate. As will become clear, the mainstream economic model takes us along the wrong track, since it does not allow for the relevant characteristics of the firm.

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[1] It should be noted for the record that this does not mean that a hierarchical order (central planning) will do it better. Under the relevant conditions of the experimentally organized economy, the necessary conditions for transparency (perfect information) are not upheld.

The firm, employer

The business firm is characterized by its capacity to organize people with competence into a team, capable of satisfying financial (profit) targets. This involves recruiting people, coordinating people and upgrading their competence. This process is controlled by a top level *organizational competence* [vested with the top competent team, (Eliasson 1990b)] that also has to learn to make superior organizational decisions. This human competence capital dominates other capital in the firm.

The firm of the mainstream model makes no mistakes. All *information* is available (in principle at a cost) from the market or the auctioneer to arrange an equilibrium, full information solution. Such firms exhibit no life. They rest in equilibrium, which they have found through optimization to be the best place to be in, and the assumptions of the model make sure that they can rest there in peace. Conditions have to be *assumed* to be such for the aggregation assumptions of the above macro approaches to human capital based growth theory to be upheld. Modern industrial organization (IO) theory, allowing for asymmetric and costly information arrives at the same result, provided the market is free from various kinds of selection phenomena, notably the lemons problem (Akerlof 1970, Greenwald 1986). I will demonstrate below that these problems are typical of markets, notably the labor market and, hence, necessitate the micro based macro analysis presented here. The lemons problem is also the key troublemaker of the incentive system (see next section).

The firm of the experimentally organized economy has to cope with far more unpredictability than the agent in the asymmetric information model of industrial organization theory. It frequently makes mistakes, and its basic learnable competence consists of the ability to cope with unexpected change. This also defines the nature of its competence. There is no stable and lasting competence capital. New environmental demands steadily require a new competence base, that can rarely be built through learning, but requires

restaffing and the hiring of people. Table 2.1. specifies the competence capital of the firm. It consists (first) of the innovative business intuition needed to set up a viable business experiment. There are few formal, observable routines that describe this innovative process; except an organizational design able to select the best projects (Eliasson 1990a, b). Learning at this level is through experience and selection of original talent. The second level of decision making in a firm is analytical, its task being to efficiently identify and correct business mistakes. This function of the firm organization is observable and constitutes a large part of its management hierarchy (Eliasson 1976, 1984, 1990b).

Learning at this level is through proper organization and reorganization of staff, establishing efficient teams. The third operational level is responsible for the management of a repetitive production process. Practically all theory and empirical investigations of firms have focused on this part of the firm.

Since the competitive market situation of a firm sooner or later will change, sometimes suddenly and dramatically the content of the necessary intellectual capacity at the top, business hypothesis formulation level will change. Hence the recruitment of 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.

The organization of the firm, defines how individuals combine and recombine into competent teams to cope efficiently with varying competitive circumstances (Eliasson 1990b) and constitutes an important part of the technology or competence of the firm. It determines the firm´s need for various types of human embodied qualities, the relative importance of specific and general knowledge. All these capabilities are merged through various forms of implicit and explicit incentive contracts, regulating compensation for productive behavior. These matters are so important for firm performance that they will make up a large part of the next chapter.

The rules of the market economy spell out that the firms cope with change on their own, or perish.

The individual in the imperfect markets for competence

The firm looks for competence in the labor market, not for labor hours. The individual supplies the same qualities.

The individual is, however, at a disadvantage and will not accept the same market conditions. It can make its voice heard politically through collective action. The individual is risk averse by mental design (and assumption) and it commands no resources, except its talent and knowledge (= competence). The firm looks for the competence of the individual in the labor market, not for labor hours. The individual supplies the same qualities. Competence is, however, difficult, perhaps impossible to assess prior to inspection. A certain market or contract technology is needed to establish the trade in human competence that eventually moves economic growth.

There is a market for investments in education, that increases earnings capacity and reduces risk exposure in the labor market. There is a separate insurance market to cover those risks over the individual's life cycle. The failure of the market to create such markets for social insurance, or the political destruction of already functioning such markets through regulation, may be sufficient causes for reducing the efficiency of the allocation of competence in the economy, and hence of macroeconomic growth.

The necessity of efficient insurance

The experimentally organized economy thrives and grows on innovative behavior of its agents, moving the economy, in unpredictable directions, and causing hardship on those agents not capable of adapting to new

circumstances. Firms have to cope with this on their own. People, however, do not accept the same rules. To create the necessary viable environment for growth, hence, a complementary institution - an insurance system - has to be created, in the market or through collective action. The purpose of this insurance system is to make individuals overcome their natural aversion to risks when it comes to investments in their own long term competence development and to move on to occupations that may suit and pay them better (Eliasson 1992a). There are many ways to organize this insurance system. The efficiency of economic growth of different economies is very much related to the efficiency of this insurance system.

2.4 The content of economically valuable knowledge

Apparently, the content of economically valuable knowledge is a complex composite, that has to be described at different levels of aggregation. It is multidimensional, and beyond comprehension from a single point of assessment. Only parts of it are applied on each occasion. Individuals also embody human capital of very different qualities. Firms organize individuals into competent teams, contributing through their organizational technology something in addition to the component individual qualities. Also firms form similar interrelations that may contribute to value creation, or reduce value through the establishment of monopolies.

Part of the competence capital of a nation resides in the organization of its economy

The economy as a whole merges - through its organization (the economic system) -individuals and firms to generate economic value (output). The most efficient such coordination is through markets. But the units to be coordinated all have larger than atomistic dimensions. Thus the question arises, what is the optimal size distribution of agents. By our previous account it is the

organizational competence of the firms to coordinate through, and to innovate in a hierarchy that sets the size limits of the firm in competition with other firms in the market. The only thing we can state theoretically is that a completely centralized economy (the other extreme), that is a non-market economy is inferior to anything less central (Pelikan 1989) because it fails to allocate competence efficiently. The number of possible organizational combinations, if we start from the level of the individual and move up, is enormous and in totality beyond everybody's comprehension. This is the "basic fact" of the experimentally organized economy. Each "merge" has been achieved through experimentation in markets and hierarchies. The key to macro economic performance, hence, is to organize the economy such that the mass of heterogenous human and firm based competence residing in an industrial economy is optimally exploited. This, first of all, means organizing the economy such that decisions *can be* taken down, and the incentive system such that they are taken down to levels where the appropriate competence resides, i.e. in general to the level of firms and individuals, and away from central hierarchies.

But this is only part of the organizational, "tacit" knowledge capital of a national economy. The enormous complexity of this organization means that there exists no simple optimal point. There are several "high levels" and even though the economy may be temporarily close, nobody in the system will be aware of it. The economy, hence, is constantly in a flux, being moved by agents striving to reach better positions, pushing other agents out of their established positions (Eliasson 1991e). In this process of organizational change innovation, competence development and the allocation of competence in the labor market play the critical roles.

Heterogeneity and redundancy

Competence is complex and heterogeneous, much more complex and heterogenous than any other capital item. Extreme heterogeneity means that

the competence of an individual normally is extremely redundant in each application. Each human being can do much more by employing other characteristics of her human capital endowment to other tasks. This creates flexibility and defines the comparative advantage of the human being over machines. It is the task if the educational system to create such redundancies to prepare the individual for the unpredictable demands of the labor market in the experimentally organized economy, not vice versa, producing preprogrammed specialists. To this important redundance property of human capital I will return below. It implies important things for education. It means that markets for competence will always be grossly imperfect, thus creating a faulty incentive system.

It also means that the labor market is replete with latent competences, that have never been tried. It probably also means that most people really are not on the job that fit them best, a conclusion that underlines the importance of the institutions of the labor market for welfare creation. For one thing redundant competences are not compensated on the job. *Secondly,* competences will therefore only be properly compensated if matched by the right job. *Third,* redundant competences is an insurance for unpredicted change in the job market. The implication is that education, labor market organization and insurance should be part and parcel of the same policy package.

The general learning problem

The ability of agents to compete successfully through innovation is in principle a "learning" phenomenon, as is the ability of agents to cope with unexpected change.

The continuing flux of the competitive market process means that the exact nature of firm or individual competences required for success will change. There is no stable specification of the characteristics of optimal knowledge at

each allocation (organization). Since the requisite knowledge is not a well defined item that can be replaced, when needed, knowledge capital, as all other capital has to be depreciated, and increased through new investment (education).

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 cumulated value of investments in "education" of a firm or of an individual. The reader should take note of a particular distinction here. Human capital theory assumes the existence of stable earnings functions, implying the existence of perfect markets, being perfect in terms of their capacity to evaluate the human capital embodied in an individual. Such measures will always be biased by the imperfections of the labor market.

At the same time the standard method in capital theory is to accumulate investments in machines, buildings and inventories, assuming a certain depreciation rate, thus obtaining a measure of capital stock. Even though I say that competence capital, due to its complex and varying specification, is not directly measurable, what I propose to do is to apply the standard capital measurement method in economics to measure competences. The only distinction to add, is that it may be possible to measure certain simple capital items, like machines, directly through explicit specification of performance characteristics, which is done in engineering contexts, but rarely in economics.

The firm of my market reference model, *the experimentally organized economy* (see Eliasson 1991a) makes plenty of mistakes, because of the general non-transparency of its local market environment and the unpredictability of the responses of its competitors. The firms are, however, supposed to be capable of coping with such a competitive market environment, or go bankrupt and exit, even though firms frequently try to protect themselves from market competition, thus creating market imperfections. Hence, unique but transient knowledge and the competence to identify and correct decision errors early

dominate firm success (Eliasson 1990b). *Individuals,* on the other hand, being assumed to be normally risk averse, cannot be expected to be able to cope with their experimentally organized market environment alone, and, hence, have to be treated specially.

The recruitment problem

Since the unique knowledge base of the firm is constantly exposed to competitive peril threatening the firm with sudden obsolescence, coping with change also dominates firms' recruiting.

The recruitment problem of the firm is, hence, schizophrenic. At each point in time the firm needs a particular package of competence characteristics. But firm management does not know, and will not be able to predict with any accuracy the nature of that package. It will have to develop the required characteristics through experimentation, and suffer from repeated failure along the way. This means that a firm will be as concerned with getting rid of people with the wrong competence as it is with acquiring people with the right competence (in expectation) provided internal retraining programs, that are also profitable, cannot be organized.

This behavior on the part of the firm also determines the local environment of its employees. Employees, typically characterized as being *risk averse* do not like this environment. As a consequence, labor directly and indirectly, through unions or through the political process, has exercised a demand on the firm for *insurance* for the vagaries of market life.

Even though knowledge capital cannot be directly measured and its content still remains more or less a mystery, we can say that besides *education,* broadly defined, individuals as well as firms require the *additional ability to cope with unexpected change*. This is partly a capacity acquired through experience in the market. For individuals this means that a *functioning labor market* is part of

their educational experience. It also requires that appropriate and efficient *insurance* markets exist to make individuals overcome their innate risk aversion that otherwise keeps them from moving on in search of occupations that suit and pay them better and contribute to their accumulated experience.

2.5 Competence, competition and economic growth

At this junction we may make a choice. We can (1) tell a *neoclassical* story about exogenous technical change, which will be partly untrue and misleading and (2) we can do micro-macro analysis and also explain technical change. I will do both and begin with the micro-macro analysis and then simplify it in the next section through imposing some strong aggregation assumptions, such that the outcome looks very neoclassical, and derive (in Appendix II) the content of growth generating economic knowledge.

Technical change creates more competition

The micro-macro analysis will be done verbally in terms of what may be called a Salter curve analysis.

In this section the magic variable $\bar{\varepsilon}$ will be defined. Its presence in my story - besides being a useful tool both to tie the different chapters together and to derive neoclassical macro analysis as a distilled version of dynamic micro-macro analysis - becomes a natural part of a nice chronology of economic doctrines.

Since the marginalist revolution diminishing returns have been needed to secure internal solutions in economic models. But diminishing returns have constantly failed to show up in empirical studies, which has been a source of constant concern. Knight (1944) suggested that observed increasing returns must be the result of an unmeasured knowledge input.

McKenzie (1959) came back to the same problem, observing that measured factor payments constantly failed to exhaust total production value. This difference, again, when divided through by employed capital, constitutes - as we shall see – the epsilon value. And McKenzie suggested that this difference must be the return of (the rents from) some unmeasured knowledge capital that can be associated with individuals or firms.

At the micro level such rents are both positive and negative signifying business success or failure. Hence, in the computable risk environment of modern finance theory the epsilon constitutes a risk premium only, since finance theory being shaped in the classical model without selection does not recognize the presence of unmeasured competence capital.

In the experimentally organized economy of our analysis, uncertainty, as distinct from risks, prevails (Eliasson 1990b,c) and Knight (1921) already suggested that the competence to convert uncertainty into ex ante computable risks constituted the rational foundation of a firm. So the two devices come together naturally in a world where both uncertainty and risks prevail, and then allow an empirically better founded explanation than that of finance theory alone.

The story will therefore be nicely concluded if the competence rent, that I have called $\hat{\varepsilon}$, can be demonstrated to be related to the shift factor in production function analysis.

Competition creates technical change

With competence being the ultimate, dominant capital input of a firm, its incentive system has to be organized such that returns to the competence to coordinate inputs to the benefit of the owners of the firm are satisfactory. At the firm level, however, such competence has to be much more broadly defined than technological competence. It resides in the people of the

organization and how they have learned to work together in teams. And the top competent team of the firm is instrumental in achieving this coordination through integrating the three dimensions. Exploiting market imperfections is an important business activity and eliminating the results of such imperfections from productivity measurements may be directly misleading. Competence is, however, human or team embodied and not subject to the same contractual property rights as physical goods. It is acquired through experimental learning in the market. It is not easily tradable and difficult to learn or imitate by outsiders, if they lack the requisite receiver competence. Failures are, hence, frequent, both when learning is through imitation and when innovative and bold. It follows that "lost competence" or "obsolescent" competence can rarely be replaced by crash learning or innovation programs, especially on a broad industry-wide basis. Strongly diminishing returns to learning rapidly set in, due to frequent failures.

A Salter Curve analysis of economic growth

The dynamic competition story on the allocation of educational knowledge services can be nicely formulated in terms of so-called Salter distributions of epsila, or the rents from competence. (See Figure I.1). I will discuss this market in terms of competing firms but it is equally valid for competition among individuals in the labor market.

Firms are lined up from the left in terms of their ability to generate rents or a return above the market interest rate (= ê). The size of the rent is measured vertically and the size of the firm (its capital in per cent of total capital of all firms) is measured horizontally. There is a layer of ex ante such distributions at each moment of time, depicting the ex ante perceived rents of all existing firms, of all firms including entering firms and excluding exiting firms, and (very important) the corresponding expected distributions as anticipated by each firm. All these distributions change as decisions taken are

ultimately realized ex post, reflecting over time the dynamics of competition in financial markets, being driven by the organizational competence of firms.

Let me briefly go through the dynamics of competition in the capital market as it occurs in the Swedish micro-to-macro model (Eliasson 1991c). Each firm in the model is represented in each market by a ranking on the vertical axis on the epsilon distribution, the width of the column measuring the size of the firm in percent of all other firms. (Fig. 2.1 shows that even though the firm indicated has increased its rate of return between 1983 and 1990 it has lost in ranking).

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

There is a third set of Salter curves that tell how *each firm sees itself positioned relative to other firms*. The real world of the experimentally organized 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 in paying a higher interest rate.

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, or through entry. No firm is ever safe under these market circumstances, and constantly has to take action to better its position. This moves the entire economy through a selfperpetuated,

growth creating competitive process. The other side of this growth process that concerns us, is the steady change in the environment of the employees, as each firm tries to outcompete its competitors. Large opportunities are created for everyone capable of capturing them. For others change simply pushes them around. During the 60-s and part of the 70-s it was thought that better planning would replace this experimentally organized, competitive process, and measures were taken that slowed it down, decreased competitiveness of firms and lowered economic growth, eventually causing even more hardship on the people. Currently economic political sentiment seems to be moving in the contrary direction, as more and more sectors are deregulated, and even the most hard core of all protected production, the public sector is gradually opened up to competition. The a priori position of this text (and an earlier book, Eliasson 1992a) is that the preferred policy is to make people accept and learn to cope with the volatile environment of the experimentally organized economy. This is essentially an *argument for improved insurance* in the labor market. In this insurance policy education plays a fundamental role.

Connecting organizational competence back to competition and economic growth

The excess returns over the market interest rate (the $\hat{\varepsilon}$) which firms strive to keep as high as possible reflect the temporary rents from top level management competence. In the profit accounts these rents reflect economic value created above payments for inputs. In the production accounts, correspondingly, these rents reflect economic value created with no measured factor inputs. By definition this means a shifting of the production function. Hence the rents in the profit accounts have been related to the shift in the production function or to total factor productivity (TFP) change. They represent, respectively payments for and the production results from an unmeasured production factor, that we call competence. The mathematical proof of this relationships is not very complicated and can be found in Eliasson (1987, 1992c) and in Appendix II. The problem is to give economic

meaning to this particular competence capital, and the important thing to consider is that it reflects both the technical competence of improving the technical characteristics of the production organization and the business competence of choosing the right products, the right markets, the right technology and the right people to run the business. It furthermore reflects the top level (ownership and executive) competence of dealing with uncertainty, or as I prefer to formulate it in Knight's (1921) terms; the ability to convert uncertainty into computable risks.

The technology factor, however, also picks up the contribution of the entrepreneur, or trader from exploiting market imperfections, for instance to successfully hire talented people at lower wages or salaries than their marginal productivities. Also capital gains will appear in $\hat{\varepsilon}$. Since capital gains 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 through the formation of synergistic teams, in which individual contributions are magnified through the exercising of top entrepreneurial competence.

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 through 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 and Färe-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 modeling. The a priori production technology chosen usually demands a particular price index to leave the shift factor (DTFP) invariant to such adjustments.

The preceding discussion, however, raises a much more profound question. If imperfections in markets are fundamentally due, not to asymmetrically distributed information or slow learning or adjustment behavior, 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 that at each point in time represent the productivity characteristics of the firm or the economic system, that in turn shape future ex ante perceptions of what is to come and so on. The path the economy takes will spin off ex ante/ex post realizations that will be reflected in the shift factor in the production function since they represent positive or negative value contributions to output.

2.6 The industrial knowledge base of a nation – what is to come?

Competence and competition have now been made key elements in the macro economic growth process moved by innovative knowledge creation in individuals and firms. The next chapter will discuss the situation of the individual in this context. Before that it is interesting to summarize what we think we know about the knowledge creation process and its possible future course of direction. This may give some substance to the preceding and the immediately following theoretical sections.

While it is universally acknowledged that knowledge matters in economic growth, and models on what knowledge matters abound, economics has been notoriously bad in giving empirical substance to the same proposition.

The education of engineers has been routinely associated with technical change and the industrial revolution, and there are some correlations to support the proposition that engineers figure importantly in economic growth (Ahlström 1982), but a simple historical comparison fails to give any definite support. The French started the first engineering school (Ecole Polytechnique 1794) to build road and bridges to beat the English at war. There was no industrial revolution for a long time. The British had no statistically visible engineering education for a very long time, and nevertheless the industrial revolution started in England (Eliasson 1990a, p.27f).

The Swedish kings brought in all kinds of industrial skills during the 17th and 18th centuries, and supported the immigrant skilled workers with generous privileges, but no industrial revolution started until a market economy had been established through a complete deregulation of the craft system (see Eliasson 1986, pp. 46ft, 1991a), taking off the lid, such that innovative competitive entry was set free. The inability to visualize statistically the creation and application of knowledge in the economic growth process has to do both with lack of data and with lack of analytical imagination.

The British did not organize any formal engineering schools until very late. They did, however, have a long tradition in applied natural sciences, dating back to Sir Francis Bacon, being carried by the so-called Gresham College, the core of the Royal Society, and running very counter to scholastic, philosophical or theological thinking elsewhere (Frängsmyr 1977). The professors of Gresham College were very practically oriented and worked together with the industrialists. Hill (1965) argues that the importance of Gresham College has been disregarded by historians, who have overestimated the influence of Oxford and Cambridge. As Hill (1965) also observes, the areas of England first to become industrialized to an increasing extent built their advance on a population - if I may use the word - of "consultants", that specialized in diffusing, for a profit, the growing knowledge base of natural science, through small booklets and handbooks or through direct consulting,

publishing or activities that demanded a significant receiver competence in physical and mechanical science. The industrial revolution started in England.

Perhaps the best way of understanding the knowledge creation process at work in economic growth is to use the taxonomy developed in Eliasson (1987, 1990a, chapter I) in which all economic activities can be classified as innovation, coordination, selection or learning (op. cit, p. 73). This taxonomy maps right into the competitive mechanisms of a market economy. Without innovation and selection we are in the classical model. All knowledge consists of information.

Add innovation and selection and we enter the experimentally organized economy, whose knowledge becomes tacit and difficult or impossible to communicate. Putting on these glasses we find that major technological advances in the past have been heavily geared towards communication techniques, affecting both the *use of information and physical transports.*[1] Information technologies related to communication and transports have a common property, namely to be very general (generic) in application, and contributing to the coordination and filtering processes of the economy. Hence, they exercise leverage effects on the entire economic system and form the basis for building so-called development blocks (see Dahmén 1950). These advances in information and communication technologies have in turn completely reshaped the organizational forms (NB!) in those societies where they have been adopted and accommodated. The most general example of such social technologies is the organization of markets. Joseph Schumpeter (1942, p. 123) mentions double entry bookkeeping, an accounting control device invented in medieval Italy, as a revolutionary improvement in the technique of rational cost and profit calculations, that makes large business entities manageable.

[1] The following few pages are more or less directly taken from chapter 2 in Eliasson (1990a).

Among the more well known clusters of new technologies from the text books, we have;

- the printed word
- the steam engine
- electricity
- standardization
- automobile transport
- financial institutions
- electronics based information technology
- general education.

To this I want to add:
- the art of managing large business organizations.

Several of these "innovation blocks" that concern us have been instrumental in moving economic development in industrial nations. Let me discuss some of them, that are directly dependent on a corresponding development of communicative skills among the population.

The printed word

Communication through the printed word is perhaps the most basic technology of a market economy. This innovation of 500 years ago[1] is not only a way of passing on a coded message. It is also a technique of documenting agreements (contracts), of standardization etc. Studies of historic, long-run growth processes have generally neglected the printed word as a form of (information) production technology and concentrated on the diffusion of technical innovations. The diffusion of information for hundreds of years

[1] The invention is in fact much older than that (Macioti 1988), even though Gutenberg´s invention seems to have started the information revolution in Europe ascribed to the printing press.

through the printed word, however, tells a different story. The printing technique was a path-breaking production technology. It made it possible to pass on large volumes of knowledge in the abstract form of written information, which is a technology in itself. The use of that information required, however, a knowledge base in the receiver. He or she had to be able to decode the messages, be literate. Eisenstein (1979, Ch. I) calls printing "the unacknowledged revolution". She goes on to point out that the contribution of the printed word to the development of an industrial society has been a matter of many centuries and it may never be possible to realize the full extent of society´s debt to this information technique.

Parker (1984), on the other hand, passes over "printing" in the traditional way: the importance of communications techniques before 1850 has to do with physical transport of people and goods. In the second half of his section on communication, the economic "effects of the telegraph and the telephone" are discussed in passing. Economic growth is typically propelled by physical innovations that move the goods producing machine called "industry". Parker fails to observe, however, that none of the innovations he mentions would have been discovered or applied with success were it not for the ability to pass on coded information through the printed word. In fact, a money based market economy cannot be conceived of without a complementary, extensive use of information techniques based upon this fundamental discovery.

Braudel (1972, p. 764) emphasizes that "one of the great borrowings of Mediterranean civilization was undoubtedly the printing press which German master-printers introduced to Italy, Spain, Portugal and as far away as Goa".

Later Braudel (1981, pp. 397ff) refers its contribution to the development of more efficient techniques of warfare ("artillery") and ocean navigation and the printed word as a vehicle for transforming and transmitting the mathematical revolution of the 17th century into practical applications. These two techniques helped propel Europe to military and commercial dominance in the world for a long time.

But the capitalist market economies that began to develop in stages used novel information techniques - and since the 16th century the printed word - as an integral part of innovative, productive and distributive activities. Eisenstein (1979, p. 8) also notes how the abundance of written records "affected" ways of learning, thinking and perceiving among literate élites. It affected the ways tradition was passed on from generation to generation. Barriers to the spread of information and knowledge were efficiently broken down and the way was paved for the age of enlightenment. Eisenstein also underlines that "standardization was a consequence of printing". Standardization and improved taxonomies are requisites for improved measurement techniques and, hence, an integrated part of scientific and industrial development. The coded message is the first stage in the development of theory, measurement and quantification techniques. The development of mathematics certainly depended on the technique of printing, as is still the case for the diffusion and transfer of sophisticated skills of industrial society.

On the other side of the coin, the potential importance (indeed danger) of this was officially recognized as long ago as the early 1600s when the Vatican attempted to suppress all printed references to the unwelcome conclusions of Copernicus and Galileo.

Standardization

A language is a standard for communication. Specialization of work processes to achieve economies of scale in the small was the new organizing and coordination technology of the early industrial revolution. The design of standardized, interchangeable parts defined the second phase in the industrial revolution, especially enhancing the process efficiency of American industry (Carlsson 1986). Both phases of development made it possible to design standard machine tools for repetitive, standardized, and precise machining sequences (cutting, drilling, etc.). Configurations of these standard machine

tools since almost 150 years in fact still define the design of the bulk of engineering production. Standardization is a typical scale technology, and is currently becoming important for the universal applications of the new electronics-based information technology in the form of standardized operating languages, communication protocols and compatible networking designs.

One could argue that standardization represents an important information technology in itself. The main point is to decide on a standard to achieve the desired generic effects; a standard operating system to make data communication possible; a standard language to make people communicate.

But hastily conceived standards may produce a long-term inefficiency even though there are significant short-term productivity improvements. If the standardization task is complex enough a concerted effort under the auspices of an appointed standardization commission might produce the wrong standard; you get Esperanto instead of English. There are optimality properties associated with the choice of standard, and the best standard can perhaps only be obtained, if it is allowed to be freely filtered through the market through experimentation and competition, very much as it is currently happening with operating systems of Personal Computers.[1]

The development of the US electricity generating and distribution system offers a challenging example. It developed in the market as a result of trial and error, and competition. Edison, that was originally locked into a direct current technology eventually realized that the alternating current was the winner, and bailed out, in fact profitably. The alternating current network offered a host of efficiency improvements, especially cheap long distance, high voltage distribution. But, David (1989) argues, direct current transmission required a battery system for efficient use, which was a handicap at the time.

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[1] The so-called UNIX war is very instructive as is the ongoing competition between IBM´s OS/2 and Microsoft's Windows. See Business Week, March 27, 1989 p. 54f.

Imagine what could have happened to battery technology, and the automobile engine, if Edison had decided to stay on and compete Westinghouse´s alternating current solution out of the market.

The electronics revolution

The modern electronics-based information technology is a recent parallel to the printed word. Both technologies are extremely general as to their applications potential. The use of both technologies requires a correspondingly broad-based receiver competence. The economic implications were and are (respectively) formidable, and the gestation periods very long.

Generalized and efficient taxonomies, standardization and mathematical thinking are key notions in the new, digitally based information and communication technologies. For purposes of our further analysis of the commercial implications of information techniques, we will reformulate a distinction that Eisenstein (1979) carefully makes. The spread of printing first profoundly affected and altered the nature of communications within the already literate élite; i.e., where the required receiver competence existed. Second, however, the advent of printing also encouraged the spread of literacy, although the latter has been a very drawn-out process. Printing both lowered the costs of communication per se, the costs of teaching its use as well as the costs of further improving the same technology. If we generalize this observation to information technology in general, and modern computer technology in particular, we can say that the change in the nature of communication among those already "literate" corresponds to improvements in productivity experienced in already existing firms, while the spread of literacy corresponds to the widening of the base for such improvements. Even though this means stretching the argument a bit too far, modern electronics-based communication technology would have been impossible without the help of coded information exchange through the printed word.

The latter is what matters in the longer run. It explains why nations and individuals have experienced a tremendous variation in success, and why the economic effects can be profoundly negative if a "nation is unobservant" and negligent. Hence, each individual, each firm and each nation at each point in time face a demanding "education" problem.

The importance of universal education

Education and scientific research are the catch words for achieving success in the knowledge-based economy. Hence, the creation of a competent receiver system for complex information must be a "generic" growth-producing factor. Thus, the creation of a universal education system has often been referred to as a necessary infrastructure for a wealthy industrial economy. Evidence is overwhelmingly in favor of high levels of literacy being correlated with high levels of industrialization and economic wealth, and vice versa (see Boserup 1981, Eliasson 1988a, p. 19). In principle it is easy to accept the idea that universal education is one of the key "information technologies" upon which western industrial growth has been built. Sweden spends about 6 percent of total labor input on education and research, as measured in the national accounts, and the US more than 8 percent. The figure is lower for the OECD world on average. But such figures only give a partial picture of the enormous differences in human capital that distinguish the rich from the poor nations, 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 training on-the-job, and a proper estimate or output lost is made the Swedish figure will be increased to at least 17 percent of GNP (Kazamaki Ottersten 1993). The operational content of human capital and the production of useful educational output furthermore remain to be clarified. The design an efficient educational system is still a matter that can only be solved through trial and error (see Eliasson 1986a).

A large part of the knowledge base of a nation is embodied as tacit knowledge in the individuals that participate in the production process. The bulk of that knowledge is user specific or limited to some expert groups and thus difficult to communicate due to lacking receiver competence in other individuals and groups of individuals. While the stock of knowledge is expanded through innovation and additions of new tacit knowledge, the increased diffusion of knowledge also converts previously tacit knowledge on to communicable form. The perhaps most important *task of education, is to provide a code or a language for converting tacit knowledge into communicable information.*

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

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

The costs in the past in the form of lost physical work input to educate, or train the population is what modern, industrial nations derive their wealth from. Since educating and training the people of advanced industrial nations require the presence of "teachers" that possess the competence needed - and much of this competence 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 programs. And the competence endowment of a nation appears to be "durable". Not even the devastation of the Second World War destroyed the industrial human capital endowment of Germany and Japan, only physical capital. But in a historic perspective the human capital of a country, by degrees and through political and institutional arrangements, can be made both to deteriorate and improve in quality and quantity. The problem is that science currently provides few guideline as to how.

The postwar period, has witnessed the growth of giant multinational firms that for several countries have replaced basic industries as the backbone of their industry, 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, which have seen a shrinking in the size and importance of the large firms in the 80s, giant multinationals surged ahead in Sweden and became even more dominant through becoming more internationalized. This is in fact a cause for concern since it makes industrial structures more narrow and vulnerable, and by definition means that the share of small firms is small in an international comparison. Is the large manufacturing corporation really the efficient future organization of industrial production? A firm by definition derives its existence from a "team" or "hierarchical" competence to coordinate production that is superior to the market. This coordination competence is one of the most important, knowledge-intensive economic activities in the advanced industrial nation. Apparently administrative techniques in Swedish firms have beaten the market over the last ten to twenty years, in coordinating production. Will these firms be capable of repeating that superior performance into the next millennium?

We see an interesting paradox in the historic development of the giant firm. The specialization of work, so well presented by Adam Smith, was made possible through the development of a viable market economy. However, in some dimensions physical size turned out to be exactly what made a difference, namely large volume production of standardized products ("automobiles"), finance and risk handling (banks, insurance, conglomerate organization), etc.

Sometimes a hierarchy substituted for the absence of a market, as was the case in the provision of risk capital in the early industrialization process. In recent years capital markets are becoming increasingly efficient compared to hierarchies in profitably managing scarce funds. Raiders are threatening to

take over the very large U.S. corporations. And there are often good reasons for it.[1]

The larger the organizations the more complex the coordination problems. As a rule the large business organizations are all afflicted with various forms of scale diseconomies when it comes to coordinating the hierarchy (see Simon 1957, Eliasson 1976, 1984b). In each case some specific scale economy or synergy makes all the difference. Many of these synergy effects have been documented in literature. The wealthy industrial nations have succeeded over the last 100 or so years to exploit large, in some cases global economies of specialized scale, through the ability of their firms to organize and coordinate large business hierarchies. The coordination technologies have been efficient enough to overcome the 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 (see Eliasson 1988d).

Let us take stock of the current situation, and look at a few clear trends in industrial development and ask the question; where will technology, competition and international market development take us?

2.7 Is radical technological transformation challenging mature industrial nations?

Strong technological forces generate radical change in some mature industrial nations from within firms. Very strong external forces challenge existing old technologies in mature industries in markets, as competitors develop new and better technologies and, as other nations' managers and workers learn the

[1] See *Expansion, avveckling och företagsvärdering* (Expansion, exit and valuation of firms), IUI, Stockholm 1988.

mature technologies of the old industrial nations. This process appears to be speeding up.

Where will technology and markets take us?

The last couple of decades have witnessed the breaking of three trends in development having their origin in the industrial revolution. The three trends are; (1) the increasing relative wage of unskilled labor (2) the growing importance of economies of scale in private production and (3) the share of wage contracts in employment.

While a combination of finance and crude processing scale ("steel") characterized the early industrialization, scale on the assembly line took over as engineering industry grew in importance, giving way in the postwar period to distribution and marketing and in more recent years, to the appropriation of technology rents through controlling the market outlets ("buying market shares"). Recent developments (*first*), however, show an emerging profitability of small scale production, being particularly manifest in the private service sector, but also in traditional large scale manufacturing (Carlsson 1989). The moving force is technology, making small scale economically feasible, and a change in demand towards customized products with a higher knowledge content. The result has been a growing fragmentation of manufacturing industry into smaller production units with a higher knowledge content. In this development US industry appears to be leading. Swedish industry was a deviator during the 80s. Sweden saw the emergence, during the 80s, out of the distressed 70s, of a group of successful giant manufacturing corporations, a development just opposite to what happened in the rest of the industrialized world, where tendencies were towards smaller scale (Carlsson 1989) and the production of customized products requiring a high knowledge and skill content.

Parallel to this development of manufacturing industry, (*second*) a more rapid expansion of private service production occurred, again notably in the knowledge intensive segment. On the whole smaller scale, and higher skill and knowledge content of production dominated development, meaning fewer jobs for low skill production workers, and an increasing demand for educated people. The US seems to be leading this development, and there are all reasons to expect that it will continue into the next Millennium creating, if educational production of human quality does not lead the development a persistent mis-match between skill supplies and skill demands.

Third, large manufacturing firms have been a haven for low skill workers, offering them a pay that they would never catch in a more demanding labor market. The reason is (See Eliasson 1986 p. 88f, and 1990a, on the unintended internal welfare system of large firms) the difficulties of maintaining productivity related wage differences within workshops.[1] It means that large firms, when carefully investigated would show significant parts of production being unprofitably operated, being staffed with highly paid, low skill production labor. Increased global competition is putting pressure on the large firms to shed such internal welfare systems, and making it politically acceptable to outsource production.

This development (*fourth*) is hastened by a parallel increase in financial market efficiency, putting even harder pressure on firms to do something about it, or shut down unprofitable parts of their production.

Fifth, 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, not only making low quality labor earn

[1] This was possible in earlier days when manufacturing in many countries had piece work reward systems.

less, but also making it increasingly difficult to carry on production staffed with overpaid low quality labor.

A complementary development (*sixth*), moved by global financial markets, is the increased internationalization of production, shifting production out of high cost areas, which is a benefit for poor, low wage countries, if they provide the required political and institutional environment for international firms, that will even more increase the pressure on low skilled, overpaid workers in the advanced industrial countries.

The educational system deprives simple production of human capital

There is one further phenomenon to observe in this context. Education not only operates as a filter in the sense that it puts quality labels on students, it also operates as a filter in the sense of allocating people on jobs. The most prominent part of this filter shifts students from skill based manufacturing jobs to knowledge based jobs, to a large extent located outside manufacturing. Manufacturing to be a viable, competitive industry 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 skilled workers in the next generation go to college and increasingly engage in privately more rewarding professional service jobs, manufacturing industry may be loosing not only its critical talent reserve, something that will eventually make it uncompetitive. It will also have to replace the skills lost through training lower quality workers. This may be difficult, costly or even impossible. The rapid increase in the demand for highly educated labor in the US supports this conclusion. It is possible (Eliasson 1990a, pp. 42 ff., 1991d, 1992) that this is an important part of the distress of US manufacturing industry, high level talent being lured into a viable private service industry. This change process is not equally visible in hardware, manufacturing based economies like Japan, Germany and Sweden. This particular possibility makes it important and interesting to especially investigate the educational and industrial systems of these four

countries. In doing that it is also important to reassess the traditionally conceived role of manual workers and manufacturing production in the welfare of a nation.

The radical industrial transformation ahead

The industrial world is currently facing a potentially dramatic technology change and reorganization. Western European and North American industries are based on the same principal organization of production around a collection of machine tools developed during the industrial revolution, some 150 years ago. That mechanical engineering technology is rapidly being learnt by other, earlier not as advanced nations, forcing change on the high wage European and North American industries and a massive reallocation of labor from low competence to high competence industries. Since the bulk of structural changes takes place through exit and entry rather than through reorganization (see table on p. XXX) a very large part of the reallocation of labor takes place over the labor market forcing the responsibility of upgrading unemployed labor on the individuals and/or public authorities. It is instructive to observe that the competence that still keeps Western firms ahead in the race is organizational, and not based on the actual manufacturing of goods (see Eliasson 1985b, 1990a). The giant multinationals in mechanical engineering industries that dominate Western markets have shifted their base of competitive performance away from production towards product development, global marketing and manufacturing in combination. The actual making of the goods increasingly takes place outside the mature industrial economies, making cadres of skilled workers in the West redundant, and unemployable in the new type of competence intensive production. The distress of automotive manufacturing is a case in point. And the interesting thing to consider is to what extent the mature industrial countries will be able to successfully enter the new production organization of the service based, highly competence intensive production structures now evolving around new information technology and science based production (electronics,

pharmaceuticals, fine chemicals etc). The entrepreneurial competence needed, and the incentives may not be around and the political system may not be willing to accommodate the necessary social adjustment.

The socio-economic situation of the industrial revolution, i.e radical change of the organization of an economy and the difficulties of coping with it politically is not all that unusual. During the industrial revolution modern democratic Government was unknown and organizational change was reasonably slow. Political power could not be mobilized to stop the process. Currently such radical reorganization processes, forcing drastic change on people can be effectively countered and slowed by vested interest groups working through the political process (Eliasson 1986a).

The serious political challenge, however, is educational. The people losing their jobs when firms shut down or shift production out of high wage industrial countries are made redundant in their own fields and incompetent for the new production. They will be forever out of work, or will have to be satisfied with a very low wage, if an efficient educational retooling method cannot be devised.

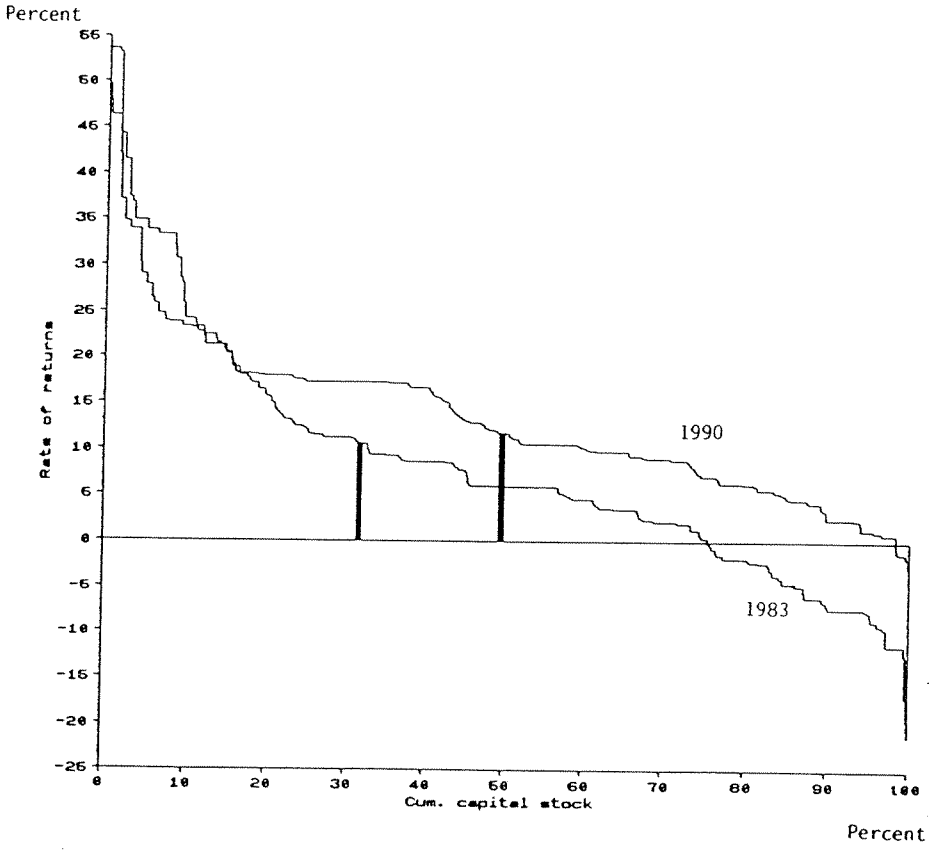
More change and higher labor market risks shifted back to the individual

Structural change has always been a necessary element in rapid economic growth. The global situation we are constantly witnessing, includes also a restructuring of the production system of advanced industrial nations, forced by increased competition based on the diffusion of industrial competence to less advanced industrial countries. The change component of economic growth will increase, forcing change downstream onto risk averse, unprepared individuals that may have thought for years that this would not happen to them.

This development will be coupled by an increased fragmentation of industry threatening the jobs of an increasing number of earlier protected labor. The result will be an one sided shift against the lower end of the labor competence distribution forcing a more uneven wage distribution and/or unemployment, and larger labor market risks on the disadvantaged and unskilled. If relative wages are not adjusted downward and/or the skill level of the lower quality end of the workforce is not radically increased job-less growth will follow. When discussing labor market incentives (for education) and the employer employee contracts in the next chapter this fact has to be recognized.

The second chapter of this paper has been devoted to showing that the use of economic knowledge embodied in the organization of the firm or the economy, notably the organization of human talent, determines the character of this value contribution of individuals . The ultimate organizational technology of a nation then becomes the art of organizing itself - through experimental learning - such that these value added contributions are steadily positive. Then economic growth occurs. Hence, an analysis of the macroeconomic effects of competence also requires (1) an analysis of the capacity of markets to stimulate (reward) competence development and allocate competence and (2) the capacity of firms and schools to organize training efficiently. To this I now turn.

Figure 2.1 Epsilon distributions (Salter curves)



Source: Eliasson (1991c, p. 164, Figure 2a).

Table 2.1. The intellectual structure of the firm

1. **Innovation**	Creating the business hypothesis (setting up the experiment)
2. **Analysis**	Monitoring performance against the hypothesis - identification of mistakes - correction of mistakes
3. **Operations**	Managing physical production, once business viability has been established under (2)
4. **Learning**	Experience feed back to (1)

Source: Eliasson (1990b, p. 283).

CHAPTER 3

INCENTIVE CONTRACTS, THE ORGANIZATION OF THE FIRM, PRODUCTIVITY, AND THE MARKET ALLOCATION OF COMPETENCE

Economic growth occurs through the creation of new industries and new jobs, forcing old industries to contract or close down, laying off labor with obsolete skills. At each point in time, and increasingly so during recent years, the labor market is characterized by an undersupply of competent labor and an oversupply of low quality labor, given established relative wages. The undersupply of competent labor retards growth. The oversupply of obsolete labor also holds back growth, if their presence means that old industries do not contract sufficiently fast and relative wages are sticky.

3.1 The mis-match problem and incentives to invest in competence

This mis-match problem, as it has been called (Osterman 1983), is serious both for economic performance and from a social point of view. In principle there are two policy solutions, a *negative* allowing the mis match to clear through wage adjustment, and a *positive* relying on education and retraining. The problem with *flexible wages* is that a full scale wage adjustment will make a significant part of the working population so badly paid that it won't be politically accepted. The problem with *educational policy* is that we don't know how to do it. One thing, however, has to be recognized. If relative wages do not reasonably well reflect the value of individual contributions at the work place, no educational policy with work. *First* of all, a wage difference in favor of competence is both an incentive to further competence development and an allocator of competence over the labor market and within firms.

Disconnecting this incentive-allocation mechanism means making educational policy ineffective. *Second,* the quality or competence of labor in a dynamic economy is no permanent fixture that can be acquired for life. The demanded specifications of competence change all the time. That is why *redundancy* and constant intellectual retooling, discussed in the previous chapter, are so important. As we will see (*third*), using the price mechanisms will also further socially desired ends.

Let us look at the policy problem like this.

Within each firm, or workshop within a firm, a large spread in individual worker productivities is practically always matched by a much smaller spread in individual worker compensation. This means that the classical conditions for market equilibrium (MP=w) are not satisfied. Accepting this as an empirical fact we would also expect strong incentives to be at work to release such tension in the economy. Firms would like to increase the reward spread and to fire low quality, overpaid workers. And low quality workers should be concerned about upgrading their competence, while high quality, underpaid workers should be looking for better paying jobs.

To some extent this is constantly occurring but much less than is predicted by economic theory. The answer should be looked for in the explicit and implicit contracts that regulate employment and wages in the labor market. One question is whether new industrial technology on the way to be introduced will force a break-up of old contracts. The answer is yes, and the question, our problem (in the next chapter) is whether this problem can be solved by education.

If markets are not perfect then wages will not properly reflect labor quality. Neither will existing competence be efficiently allocated, investment in competence accumulation optimally stimulated nor educational services in a broad sense efficiently produced. All these circumstances may lead to an undersupply of competence in the economy. It is very easy to compose a set

of assumptions that will logically constitute a case for underinvestment in knowledge. The interesting possibility, however, is that on these assumptions (or rather different sets of assumptions) using the analytical tools of industrial organization theory (IO), the possible remedies (policies) will not be Government subsidies. We may have a case of market failure, but the solutions will have to be to create institutions that allow for better contract technology with more potent individual incentives, not for Government to step in and take responsibility for educational production or paying for (subsidizing) the same production. Not surprisingly, this may involve removal of institutions, often institutions of Government and unions that prevent the development of efficient contracts.

Hence, both *positive* educational measures have to be enacted and adjustments in relative wages have to take place to correct the mis-match problem in the labor market. Competence development has to be stimulated. For this to be effective private incentives have to be achieved through the tilting of the compensation schedules in favor of competence. This has already occurred to some degree in the US economy, but not so much yet in Europe.

But tilting the compensation schedules means influencing the wage setting process in a way that will also reallocate the existing competence to the benefit of the entire economy. Low quality labor will be forced to accept relatively less pay for their services (the *negative* policy), but incentives to upgrade competence and/or to increase effort will also be increased.

3.2 The efficient incentive contract

In the earlier chapter I identified the competence or knowledge capital that contributes to economic growth. This chapter is concerned with the *incentives* to invest in knowledge accumulation among individuals and firms. Do imperfect markets cause *underinvestment* in knowledge?

Human capital theory assumes that the present value of the wage stream of the worker will tend towards equality with the present value of productivity on the job. For the firm (described above) of the experimentally organized economy, this assumption is totally wrong, even as a rough approximation.

The survival capacity of the firm 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 the lemons problem. Firm management constantly faces the problem of retraining, or getting rid of people with the wrong specifications. Employees resist such treatment, demanding "insurance" on top of their pecuniary compensation. Part of the solution that satisfies both employer and employees *may* be in the form of internal education, but it is an open empirical question what internal education can achieve with obsolete labor. This interaction of employer and employees is excessively complex due to the extreme heterogeneity and instability of competence demands and supplies. The organization of this interaction, hence, will never be perfect. It is, however, amenable to improvement through experimentation if experimentation is accepted or allowed. The outcome at each point in time is the state of organizational knowledge among firms.

The firm as a hierarchy of competent work teams is thus a useful notion for a firm model (Eliasson 1990b). In this model the recruiting, training and firing of people with heterogenous competence attributes and the choice of organization to perform these selections become the critical task, since competence, or talent is largely tacit and difficult to communicate and evaluate. Choice is after inspection in use. Hence, choice of incentive contract to monitor and compensate labor becomes a critical organizational technology. These problems have been the subject of a wave of recent analytical literature. The problem with analytical model approaches, however, is that so many factors have to be considered simultaneously in a job contract, and that flexibility is a desired work place property. Hence optimal contracts have to be rather loosely structured resting largely on informal agreements. A large

number of recent articles using very simple partial models explore partial aspects of such job contracts, one aspects at a time. Controlling for (1) *shirking* through *deferred wage payments* is typical of many of these theoretical studies (as in Lazear 1979, 1981). Grossman (1977) studied deferred, but high pay as a way to prevent good workers from quitting, and Salop-Salop (1976) in a similar model use offered wage profiles as a criterion for screening quitters from non-quitters. With risk averse labor, deferred wage payments can also be interpreted as a form of *insurance* for unstable income streams. A particular insurance aspect is studied in Harris-Holmström (1982) who make the employer charge a premium, in the form of a lower wage, for offering downward rigid wages. This premium diminishes with seniority or age and Harris-Holmström (1982) can thus demonstrate the existence of a tilting of the wage schedule with age, over and above what is warranted by productivity. In general, Harris-Holmström (1982) conclude, implicit long-term contracts will emerge that protect risk averse workers from wage changes induced by fluctuations in perceived productivity. Such contracts would be even more likely to occur, I would argue, if the job market is characterized by constant and unexpected shifts in the required type of competences, making earlier productive labor less productive on the new types of tasks demanded. Such contracts would be expected also to include provisions for retraining. Feuer–Glick–Desai (1991) pursue this possibility. Firms, they argue, offer trained workers the expectation of long-term employment, which workers buy at a lower pay, even though they have received a general, firm financed training that has increased their tradability in the market. F-G-D explain that in terms of a lowered bargaining position in the internal labor market. I would restate that proposition by saying that risk averse employees become hostages to their informed employer (about their new capacity) and the less informed external market.

The standard explanation for the upward tilting of the pay schedule, however, is productivity improvement through on-the-job training (as in Mincer 1974 and other studies).The job-matching models of Mortenson (1975), Jovanovich (1979a) and others were originally designed to study turnover phenomena, but

give interesting insight into the consequences of *employer learning* and the *allocation* of people on tasks. With seniority the employer can learn about the skills of their employees and match their skills better with jobs, hence increasing their productivity. This is another explanation of the tilted wage schedule.

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-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. Indeed, a relevant discussion of labor market efficiency should include the whole range of contracts between regular employment and self-employment, especially partnership and profit-sharing arrangements, but also the importance of all kinds of endogenous, implicit contracts operating through peer pressure of various kinds (Kandel-Lazear 1992). They conclude that *peer pressure* helps controlling the free rider problem in firms when profits are shared. If such peer pressure cannot be organized free-rider problems increase with the size of the partnership. Norms of behavior that develop in firms should be looked at as an equilibrium phenomenon, they conclude. But peer pressure can also work against the interests of the employer, if labor teams 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.

It is easy to think of many more aspects on the job contract to study. But they cannot all be dealt with analytically in the same model. Neither can they all effectively be dealt with explicitly in the same contract. To study them all in one context, non-analytical simulation models will have to be used. I will therefore discuss some of these partial models in more detail in which the competence and incentive problems are discussed simultaneously to illustrate

the practical problems of contract formulation. Particularly interesting is the theoretical possibility of a strict logical foundation of the underinvestment problem. If so, is there a contract technology that can remove the problem? Can something be done through policy?

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

Labor market theorists traditionally approach their problems from the point of view of the employee, forgetting that the employee, if at work will be working for an employer concerned with extracting surplus value from his effort. Literature, hence, has exhibited treatises featuring the firm and the labor market very much as a social insurance operation.[1] In this respect the notion of a firm emerging in modern labor market theory is completely different from the theory of the firm that can be derived from the "modern" theory of finance. The two notions of the firm expressed in these two fields of literature are theoretically and empirically incompatible (Eliasson 1992a). In the last few years labor market analysis has begun to incorporate the labor management problems of the firm (see eg. Milgrom-Roberts 1992, chapter 7). The beginning attempts addressed the upward sloping wage schedule, going beyond the human capital analysis and the training of employees whose compensation should then increase with seniority. Asymmetric information and the demand for insurance of labor characterize these approaches. The modern approaches emphasize the nature of the labor market contract, and the problem of controlling for moral hazard.

Becker (1964) and Mincer (1974) observed that the wage of the worker differs from his or her productivity. Rather than taking this as a refutation of the assumptions of human capital theory, Lazear (1981) wants to make this observation part of a rationally organized labor market. He argues that it is optimal for the worker to be underpaid in the beginning of his career and

[1] See for instance Solow (1990).

overpaid thereafter and that this pay arrangement is also optimal for the employer. This, however, requires that the worker has a reliable contract that guarantees the higher pay when his productivity is low (this is essentially the same as a pension contract with the employer). The firm has to be credible to the employer. Lazear here argues that firms which cheat on their employees will not be able to hire workers next time, and continues with the question: What does the employer demand of the employees, and what do the employees demand of the employer? The employer wants a constant, reliable work input, and no shirking. The *employee* is risk averse and wants a stable, predictable income. Hence, the prerequisites for an *internal firm insurance market* have been demonstrated to exist. This proposition of Lazear corresponds to an extension of the life time consumption hypothesis, adding in an insurance for labor market risks, and pension saving to the portfolio of tasks of the firm. The insurance premium is the internal market price. The more efficient the labor insurance work contract in minimizing shirking, the cheaper the insurance for the employer (see Eliasson 1992a, p 110).

The critical question, not addressed by Lazear, is the exact conditions that establish an internal insurance market, rather than making it more efficient for the employer to outcontract that particular task to a specialist insurer in the market. One would expect the external insurer to be more cost efficient and able to offer specialized insurance service. Hence, the only rational conditions that favor an internal solution would be the existence of synergy effects merging insurance and other productivity activities internally. Lazear addresses one particular such synergy, namely a trade - off between less shirking and a guarantee of stable income in return for more effort. But this is only one of many possible forms of synergies. At the same time reality exhibits legally imposed insurance commitments where the positive efficiency effects (less shirking) have been effectively undone by the contract design.

In Lazear's (1981) model management offers a lifetime ("two-period") contract of job or income security in return for a higher work effort, or rather less shirking. His ambition is to explain the typical upward sloping compensation

schedule with underpaid young employees and overpaid senior employees. Lazear's article illustrates two sides of the employment contract problem; the risk averse employee looking for job security, his theme, and the incentives to train employees, which is not his theme or argument.

Harris-Holmström (1982) study a similar problem in a search or matching theoretic approach. Risk neutral firms are imperfectly informed about the productivity potential of risk averse labor. With downward rigid wages the employer wants a guarantee for the lack of flexibility and the risk of getting stuck with highly paid low-productivity labor, so he pays less, and upgrades the wage (reduces the "insurance premium") as he learns. Because of the external market, and the time it takes to learn, they 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 institution

There are, however, theoretical problems. Suppose labor quality is what matters for compensation and that quality depends on-the-job training. The upward sloping compensation schedule may then be the result of internal training, an implication that Lazear (1981) rejects, but Waldman (1984, p. 261) supports, as did Becker (1964), Mincer (1974) and Carmichael (1983). Both Hutchens (1987) and Björklund-Åkerman (1989) present empirical evidence in favor of the training hypothesis. (Note the conventional training argument a few pages below).

Insurance, lack of information and competence constitute the core of the labor contract that links the individual to macroeconomic growth. As I will argue, insurance and education are alien, but possibly profitable production tasks for the firm. But should the firm take on the insurance task? Shouldn't there be more efficient specialists on insurance in the market than in the firm? My argument will be that there may be more efficient solutions using the external

market more efficiently, rather than internalizing these activities and that empirical market forces are currently pushing firm organizations in that direction. This is a question about how to formulate the employer-employee contract when it comes to employee exposure to normal labor market risks.

3.5 The recruitment problem

In the experimentally organized economy, knowledge will be typically tacit (Murnane-Nelson 1984) and difficult or impossible to communicate. The employer, hence, when recruiting new talent normally risks capturing a lemon (Greenwald 1986, Jovanovich 1979), something he wants to avoid through *screening* his potential employees, and through properly formulated *incentive* contracts. The worker, using Hirschleifer's (1979) terminology becomes an "inspection good".

Holmström-Ricart i Costa (1986) look at a risk neutral firm (an owner) ready to hire a risk averse manager. The owner does not know the talent of the manager, but can learn through observing him at work. The formulation of the employment contract, hence, becomes an important part of the organizational technology of the firm. The employer/owner in the model of Holmström-Ricart i Costa (1986) has a schizophrenic interest in *learning* about the quality of his manager, but also of keeping this knowledge secret to the outside market, so that he can keep a good manager and get rid of a bad manager. Harris-Holmström (1982) demonstrated that the asymmetrically informed market normally will exhibit rigid (both upward and downward) compensation schemes. Wage increases occur when the external market understands that the value of the manager is higher than his current wage, thus forcing the employer to raise his salary, or lose him. Similarly, risk averse labor accepts a lower wage as an insurance premium for unexpected adverse changes, thus creating a downward rigidity in wages.

Ricart i Costa (1987, 1988) elaborates this case of asymmetric information further. The hired manager knows his talent (his productivity) better than the market and his employer. Ricart i Costa shows that the manager will be paid below his productivity and that he will produce less than what is socially optimal. An incentive contract that forces the manager to take on some of the employment risk himself and thereby be stimulated to exhibit his competence is more efficient for all parties. This contract analysis can of course be generalized to all kinds of employer-employee relationships, including the recruiting of workers in a factory.

3.6 Incentive contracts coping with asymmetric information

Let me assume (see Eliasson 1992) that the a) manager, b) the employer and c) the market are all differently informed about the capacity of the manager. Potential external employers in the market can possibly observe the results of the manager's 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 a bad manager would get, that is above the market wage. Very good managers will stay and be exploited, while bad managers that are lucky will leave. We have a case of "adverse selection". In Ricart i Costa's model firms that hire the lemons will go bankrupt.

The solution to this problem is a contract that makes it possible for the good manager to exploit the fact that he knows more about his own capacity than his employer or the market, i.e. through taking on some risk. There are many possible such contracts and Ricart i Costa's suggestion is dominated by a desire to obtain an analytical solution. The manager, in his solution, takes his contract and shows it "to the market" which will hire him on better terms, but with an incentive contract which will give him more if 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, Waldman concludes.

3.7 Over- or underinvestment in competence accumulation

The above analysis sheds some light on the classical *under*investment in on-the-job training argument, which runs as follows; Firms investing in the education of their labor will lose their trained workers. The reason is that the firm carries the cost, while an outsider firm, who does not, can hire the now upgraded worker, paying a higher wage. In the old human capital model this sounds reasonable. In the new IO setting this is an overly simplistic argument, and only a petty assumption distinguishes the two contrary arguments. The employer investing in his worker will always know much more about his/her competence then the external market, and hence be willing to pay more, provided the investment in education has been profitable, and the uneducated worker, as we shall see below, who cannot benefit from the investment in training, and be profitable, won't receive internal education. Hence, the presence of asymmetric competence to benefit from training strengthens the argument. Workers are differently endowed in that respect. The new conclusion is, however, much more devastating. Only the talented (with high receiver competence) workers will be profitable investment objects for the employer, who knows his employees better than does the market. They will receive the training, a conclusion that is supported by data on the distribution of resources for training within firms. This reinforces the "counter" on-the-job training issue and transforms it into a selection problem; only the best will receive investment in education at the expense of their employer, to become even better.

The *over*investment issue through duplication has been around in R&D literature for considerable time (Arrow 1962, Hirschleifer 1971). It is a classical result from the classical model and it builds on the waste of resources

that follows from competition through duplication. Nelson (1959) argues against it, saying that you need duplication. The underinvestment issue turns this argument upside down. Since there is knowledge (information) asymmetrically distributed, if it keeps being asymmetrically distributed maximum possible competence exploitation is not achieved. This is true if diffusion of knowledge (learning) is costless and/or if knowledge is homogeneous and substitutability is present in each application. Both propositions are false in the experimentally organized economy.

This whole literature on over- and underinvestment in this or that is based on the erroneous notion of almost homogenous capital. Once heterogeneity - or rather extreme heterogeneity - is introduced, which is the typical characteristics of human capital, the argument is turned over again. Redundancy is a desired property of human capital to achieve flexibility on-the-job (see further p. xxx).

3.8 Tradability in talent

The above arguments for and against the underinvestment hypothesis can be further complicated by considering also more or less *tradability in competence*. On-the-job training and education is 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 (reading, math, etc.) skills of their workers to make them more productive at increasingly sophisticated machines.

Skills and competences are more or less tradable in the market in the sense that the same competence capital can efficiently be applied at many job locations and that the market can fairly easily assess the talent-competence combination embodied in an employee. Hence, the traditional argument for underinvestment in work skills – that the worker will leave, with his skills – can be given a different meaning, also supported by evidence from firms. Why

should a firm invest in the creation of general worker skills, which is an alien production activity for a production organization, when the skills can fairly easily be hired in the market? Certain worker skills related to decentralized production processes (welders, etc.) are easily tradable in the market. If not available locally, or in a country, production will be relocated to where such skills are abundantly available. This appears to be one reason for the outsourcing of certain low skill content production of Swedish and US multinationals.

What does this mean for worker training. It means that if you are in a tradable skill profession the task of providing for training becomes a private task. If the individual is risk averse and won't take on the investment, underinvestment may occur.

Worker skills were originally developed (before they became easily tradable) close to growing production sites, were so called industry schools were established at the initiative of firms. This practice still continues in Germany and in Japan. In the US 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 socialized the production of worker training services during the post war period. Since the development of job skills had been subsidized by Government the compensation (or competence rent) should be correspondingly reduced. Two serious consequences followed from this reorganization of worker training. It (*first*) lost in efficiency from being alienated from production. The quality and experience of teachers were lowered. Furthermore (*second*) incentives to train were lowered. I will come back to this in the next chapter in discussing the relative efficiencies of the four models of worker training; the Swedish, the German, the Japanese and the US.

Tradability requires a fair amount of homogeneity in specification to reduce market information costs. Therefore literature has been very much 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 reveal their talents. This is also very much a concern of real managers. Again, however, heterogeneity is the critical problem.

There is a rather sophisticated theoretical literature arguing that the very fact that a worker receives a particular contract is a signal to the market that he is good.[2]

There is also the perhaps more relevant possibility to consider, that tradability or mobility in the labor market is part of the training and competence capital that accrues to the workers or managers, and that too much seniority on a job makes the worker obsolete. Such considerations, however, wash out in the two period models normally used in incentive contract analysis.

3.9 Receiver competence

Competence is the intangible asset that contributes to firm performance through conferring economies of scale to all other factor inputs. Competence resides in human beings, or in teams of human beings in the business organization, not in its machines. Competence is the result of intangible investments in education in the past. The conversion of investment money or time into productive competence capital, is, however, a production process in itself. Above all, it requires prior receiver competence to be productive.

Hence, the allocation of resources in the internal markets for competence development within a firm will be strongly dominated by the worker characteristics, notably their competence to receive education, a factor that

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[2] and vice versa, a stigma, a signal that he is bad, if the receives subsidized Government training. See below.

decides the firm's profitability and willingness to spend internal resources to train individuals.

Putting all the earlier arguments together we should expect the following to occur. Well educated workers are more capable of rapidly adding new knowledge to existing knowledge and, hence, will receive more education than those with little basic education. Training resources will be allocated only after a period of inspection.

Since the employer knows much more about the productivity of the employer than 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 1991d, 1992).

3.10 The strong leverage of basic education

The underinvestment issue turns up in a different form in this context, as a difference between private and social returns to educational investment. Should scarce competence in the economy be allocated towards solving the work place problems of the disadvantaged at the expense of economic growth, or should educational resources rather be allocated to maximize economic growth and then tilt the distribution of income generated in favor 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 (see next chapter). To sort out this question is the task of the next chapter. What we have learned in this chapter, however, is that incentives to engage in educational investments matter strongly for individuals, but differ a lot

between individuals. These incentives must therefore be incorporated in the school system for it to be efficient.

Hence a change in the incentive schemes of the economy will have consequences for the organization of school production. On this score there is something to say (in order of priority) on;

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

These three items are not unrelated but should be discussed one at a time.

a) The leverage of basic education - receiver competence

The time leverage problem is by far the most important and it sets in from the beginning. Attitudes are formed in the family, to a large extent before school begins. Important communicative skill begin to develop through primary school and the competence base for further education takes shape during a period when the individual is typically myopic and not very interested in the long term rewards from education. The leverage effect works through the cumulative development of the competence to receive more education profitably (receiver competence). Its relative importance depends on the relative importance of the educational investment hypothesis, but if the investment effect is strong, selection effects in the school career make the leverage even stronger. Hence strong social and allocational effects should be achievable if the leverage effect can be blunted. Public policy probably has a task here, provided public authorities are sufficiently competent, compared to the individuals, to take responsibility for the individual's long-term decisions.

Measures should, then, be directed towards

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

An important problem to be discussed in the next chapter is whether some *basic general competences* can be identified that the school should focus on. Another, more populist hypothesis is that creativity is what matters and that school should "teach creativity" (Reich 1992). This proposition does seem more political than meaningful. A more relevant concern is how to organize school, and work such that creativity of the individual is not destroyed. To this we will return in the next chapter.

b) Labor market reorganization in support of educational policy

The competence endowment of an individual won't be known to the employer for considerable time. Evaluations are made at hiring and throughout the career. It is to the disadvantage of all individuals, if this evaluation cannot proceed smoothly through easy job change and through careers within the organization. The basic assumption of the policy hypothesis of this book is that the individual will rarely find the best employer match early. Bad labor market performance in his respect means that most individuals will find themselves in less than satisfactory job positions for most of, or all their working life. The labor markets of Europe in particular are cluttered with restrictions on such mobility and discriminatory treatment of newcomers to work places. Much of this is the work of unions and employers. Government has an important responsibility for removing such market imperfections.

c) The rewards for competence

Quality evaluation in markets is fraught with the lemons problem, and conflicts directly with ambitions to equalize income, irrespective of contributions to production. This affects incentives for individuals to invest in their own education. There are two sides to this problem. (1) Talented students that would otherwise have become very productive workers decide on a low profile career, involving less effort, and more private leisure value. For instance, they pursue careers in medieval history rather than becoming production managers in a manufacturing plant. (2) Untalented students find it meaningless to put in an effort to learn, because it is difficult and frustrating and they nevertheless won´t earn much more. In the long run, however, the consequence will be that they earn much less, and that the income redistribution problem becomes even more severe. In a dynamic life income cycle perspective, hence, 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 and a consequent lower quality of workers.

It is important to observe that this conclusion is strengthened the more relevant the educational investment hypothesis, and the mechanisms filtering the students onto different educational paths.

d) The content of education - the basic competences

Apparently educational content matters in a growth perspective, and even though we know very little, something can be said on the required content of the school agenda.

Certain difficult subjects related to the accumulation of communicative skills may matter more for productivity than other skills. The school agenda is cluttered with items that have little to do with work performance. It does not emphasize building skills that appear to matter and (in many countries) it lacks items that would contribute to communicative skills.

Obviously school production could be reoriented and incentives tailored to achieve a reorganization of the content of educational output and effort.

There is, however, little research evidence to tell how to best change the school agenda, but a few suggestions can be derived from firm evidence, namely

a) that *communicative skills* that should have been provided at school are lacking, to the disadvantage of employees
b) that *work discipline* that should have been developed prior to entering the labor market, is lacking
c) that the ability to organize one's own work, and to work hard would be a benefit on the job, even though not likely to be discovered on hiring

3.11 The problem of heterogeneity

Jovanovich-Rob (1989) present a knowledge dependent growth model that operates on differences in the capacity of people to understand new things. Heterogeneity of such knowledge creates problems for the efficiency and existence of equilibrium because of adverse selection phenomena, which are most severe when the growth of knowledge is dominated by imitation rather than by invention. Equilibrium involves underinvestment in knowledge, because of externalities at the diffusion stage, because imitators capture the rent from innovation (the standard argument). When no such externalities occur, equilibrium coincides with the maximum of discounted output net of matching costs. This means that there must be a tradeoff between imitation and invention that maximizes output.

The important problem of heterogeneity, however, relates to the difficulties of organizing perfect markets. If heterogeneity arises as a result of on-the-job

learning, each particular competence package being optimal for a particular task. With sufficient levels of such heterogeneity (or diversity) the condition for an experimentally organized economy (see chapter I) will be established, and perfect, full information equilibrium and markets infeasible. The lemons problem will be a characteristic feature of the labor market. For our purposes it is sufficient to observe that a simple on-the-job learning model, or experience accumulation in general are sufficient to create such market properties. The career is an interesting illustration of this situation.

3.12 The career

The career is a particular form of combined labor quality selection and on-the-job training. While the training for tradable labor skills can be separated from the job (even though up-to-date job experience and a real job environment should be present at school) higher management competence accumulation has to be integrated with the job, and the more so the more unique the competence capital of the business organization. The final qualities needed to run a firm are typically tacit and cannot be taught at school, even though some business schools pretend to have the competence to teach business leadership. The qualities needed of top managers are general and, non-specialist. Their acquisition requires intense and risky work effort. The contract has to be designed accordingly to support the tacit organizational competence vested in the top competent team (Eliasson 1990b). The typical situation is that as long as the tacit competence specification of the team passed on through organizational learning is competitive and captures a rent in the market it should be accumulated synergistically with work. Such competence is capable of some innovative behavior. It is, however, not likely to kick the organization onto a completely different competence path. If the competitive situation changes radically the competent team may suddenly find itself incapable of dealing with the situation. The situation of the team is then similar to that of a worker who has acquired his skills through rote learning. The team does not possess the explicit intellectual capacity of an educated

individual to retool itself. As a rule then a fast and brutal injection of external knowhow is needed to get the firm back in business, or save it. This requires that lower level resistance to change be brutally crushed through removal of people. This is the immediate situation of IBM right now, changing its mainframe mind.

But for all practical purposes a firm - large or small - cannot be constantly organized for doing something else, if needed. Hence, the focus of internal competence accumulation has to be on mainline business; technology, markets etc.[3]

3.13 Organizational learning and organizational structure

The firm incorporates organizational learning as a natural production and investment activity. Organizational learning (Eliasson 1990c) is something much more than the training of people. It includes building the tacit competence capital of the firm that is embodied in its organization. This organizational mode is a technology in itself and it significally affects the life and experience capital of its employees.

In the last few years organizational learning has been intensively discussed in literature and the problem has been to give this typically tacit knowledge visible analytical forms. Aokis (1986) model is particularly useful for our attempts to link education and internal training, via firm organization to the performance characteristics of the firm. Aoki distinguishes between the American A-type organization, achieving efficiency through internal

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[3] Possibly add brief section on the firm as a competent team, based on human capital selection. Discuss:

- Rosen, Superstars
- Tournaments
- Learning and accumulating heterogeneity
  Jovanovic-Rob 1979.

specialization and the Japanese J-type organization, that builds on the ability of workers to relate to the whole organization, 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.

The A-type organization requires specialists in coordination (managers) and large administrative costs for monitoring and control. Specialization furthermore means a standardization of tasks, and that markets for standardized, specialist tasks develop. This may increase labor mobility between firms, but means that the integration of specialties in production becomes another, higher level specialty, and so on.

The J-type organization, on the other hand makes coordination an organic part of the whole, requiring fewer specialist coordinators (managers), since each worker has acquired a capacity and a motivation to relate himself to the whole. This mutual understanding of the members of the firm, a culture, becomes the result of the systematic training of individuals. It takes a long time to develop and therefore requires life time employment contracts.

Aoki (1986) especially emphasizes the capacity of the J-type organization to efficiently communicate internally, which means that it doesn´t need the elaborate A-type organization with well defined responsibility and decision hierarchies and a preoccupation with shirking problems. The J-form is self monitoring and difficult to represent in organizational charts. It is not exactly known centrally how decisions are taken and executed and responsibility exercised.

While the J-type organization takes well care of its workers, being in the interest of the firm, and gives them useful training and a firm related work experience, they become hostages of the firm being equipped with a difficult to trade knowledge capital.

An interesting question is which firm organization that is most innovative. About this we can only speculate, but logics provides a strong argument.

The A-type organization is capable of forcing change top down on the firm when the situation demands it, forcing a new combination of specialists on the organization, by "specialist" top management.

The J-type organization does not possess this top level reorganization specialist group. The organization has been trained to selforganize, which requires that changes be small to avoid destructing the self organizing capacity of its experimentally developed internal signalling system (See Eliasson 1976, 1990c). Hence there will be nothing ready to put in its place if the old system fails. Hence, the J-type organization will be conservative and difficult to innovate radically.

As the A-type organization is further specialized and refined it leads to production automation, and efficient production, provided the organizational structure achieved stays optimal.

3.14 The self employment contract

The more of the initiative and risk the contract places on the employee the closer to "self employment" status the employer. The new contract oriented literature demonstrates that inefficiencies associated with the classical employer, employee wage contract increase the more employee quality matters for job performance. The employer cannot assess quality until after a long inspection period in use, hence, lowering the incentives among myopic and risk averse individuals to invest in personal quality upgrading. Very competent labor - that knows about its competence - will always be grossly underpaid if on a wage contract. The employer cannot understand the full scope of a superior competence. Furthermore, he does not have to pay up because the outside external market knows even less. Thirdly, there are limits

to the extent of internal wage differentiation on a work place according to competence. Hence, if a competent worker wants to get fairly paid he has to work under a different contract; selfemployment or close to. Internalizing the quality upgrading within firms, under a regular wage contract will increase the classical shirking problem. If a well designed insurance contract cannot be designed that makes labor overcome its propensity to avoid risks, the labor market will be characterized by underinvestment in quality, but for different reasons than argued elsewhere. The logic, however, points in one direction; efficiency will increase the more of initiatives and labor market risks that can be moved from the employer to the individual, provided the resultant decrease in the propensity to invest in own quality upgrading can be countered. The reason is that more effort on the part of the employer is created and that the competence of the employer is more efficiently exploited.

If this proposition is correct one would expect to find a higher propensity among high quality individuals (whether because of talent or education) to operate on contracts that are closer to self employment than wage employment. This is to some extent supported by facts. It has even been shown that the self-employed enjoy superior pleasure form their job, compared to those employed (see Blanchflower-Oswald 1993). During the last couple of decades the 100 year downward trend in self employment as a proportion of total employment has turned around in the US, apparently permanently, and the self employed tend to belong to the most highly qualified labor market groups (Blau 1987). As discussed already in chapter I one reason for this change appears to be the change in industrial structure, making small scale, competence intensive production increasingly profitable. Consultants for instance, appear to be the most highly educated professional group both in the US and in Sweden, and typically work alone or in small competent teams (=firms).

It is interesting to speculate about whether similar factors explain the strong increase during the last one or two decades in the employment of highly educated labor in the US, at strongly increasing relative wages for educated

labor. Is this a prediction of even more self employment as highly educated labor finds that it can only capture a fair share of their competence rents through being selfemployed?

Why does US industry employ more highly educated labor than industry in other advanced industrial nations?

3.15 Main conclusions

One main conclusion for the preceding presentations is that there is no solid information about the best educational practice and that the educational process stretches far into working life. The organization of school and of the labor market are part of the same problem. The identification of talent and competence furthermore, due to extreme heterogeneity is a problem that stretches over considerable time for the individual. For this experimental search process to be efficient employer - employee contracts have to be designed such that decisions are automatically taken down to levels where competence evaluation is most efficiently done. The way this contract and market technology is organized is also a significant part of the knowledge base of the economy.

CHAPTER 4

THE PRODUCTION OF EDUCATIONAL SERVICES

Once the product has been defined, one can proceed to organize production efficiently. The problem with educational output is that it is badly defined. This makes the problem of assessing educational production efficiency particularly difficult.

In order to proceed quantitatively we have to narrow down the purpose of education somewhat. Among the three traditional tasks of education, to

1) support *individual fulfillment*
2) build *economic competence*
3) create *socially responsible citizens*

we focus on (2), economic competence. We know, however, from earlier studies (see p. XXX) that the perhaps most important aspects of social responsibility also enter as critical factors behind economic competence at work places, where teams constitute the production units. Workers being unable to cooperate with colleagues rank lower on most work places, and fostering that ability is occasionally part of the school agenda. It is also obvious that economic competence is a major element in the ability of the individual to achieve the other individual objectives.

Even with restriction on the scope of analysis several problems that have been very scantily researched have to be addressed. *First* of all we have the relative importance of the investment and the signalling (filter) effects of education. There are several theoretical versions of this controversy ranging from one extreme to the other. And each story carries a different policy advice. Since learning and selection are simultaneously active, the lack of empirical insight is embarrassing for educators. What should the purpose of schooling be?

Second, and related we have the problem of separating individual performance (talent, efforts) from school performance, and *third,* the contribution to scholastic achievement of home and parental quality inputs, the so called *social capital. Fourth,* the entire incentive problem of the earlier chapter pops up again in the form of student motivation and scholastic interest.

4.1 Does general education matter?

The analysis of the incentive problem in chapter 2 suggests that the educational process can be roughly broken down into four stages that serve different purposes.

(I) Basic ("High school")
(II) Higher Education (University)
(III) Vocational (in specialized training centers or on-the-job).
(IV) Updating (recurrent education).

All these types of education are carried out in a *classroom context* in educational institutions separated from the job, or on-the-job, or in different mixes.

Basic education is general in orientation and serves the purpose of building the necessary competence *(receiver competence)* for further education under (II) and (III). We are talking of communicative ("academic") skills like language, mathematics, presentational techniques (writing, oral presentation, etc). Basic education also includes the development and training of other, non academic qualities like discipline, certain moral principles, etc. to the extent, they were not developed at home. In that respect basic education is important in shaping socially responsible citizens.

Higher education is 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 probably so, that higher education more than other forms of educations allows the individual to achieve personal goals not necessarily related to his or her economic job performance.

Vocational education has more professional focus; the acquisition of skills, useful specialist knowledge, or *professional* experience. The main orientation of this education is to be useful on the job. 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. In more advanced circumstances an academic degree often precedes a varied job career. Again, formal class room education may be important, but only as a stepping stone towards what matters. (One extreme case is the research career, that despite its location, is vocational).

As we have observed in a number of studies on the nature of jobs in advanced industry (see, e.g., Eliasson 1980, 1986, 1987b) work tasks are becoming more and more abstract and removed for the actual physical process, that is increasingly operated without manual involvement (also cf. Reich's 1992 notion of the "symbolic analyst"). Such vocational skills increasingly demand prior advanced academic education.

Updating or recurrent education or adult education are again different. It adds something to an existing store of knowledge, that may be lacking or may have become obsolete. It involves taking the student out of the job context and/or into a new job context.

Different countries have different sequences and locations of these educational processes. The early view was to forget about the critical importance of on the job learning and about the importance of the filter or the selection (allocation) mechanisms. Thus basic education was provided in elementary and high schools, and vocational education (training) was provided through the earlier apprentice system, considered to be obsolete in the post war

period, to be replaced by government run vocational schools, separated from the job.

Again, recurrent education increasingly became a matter of public concern in the post war period to be run and subsidized by the public sector. Sweden went rather far in that policy (see below).

The high and increasing public share of all these educational production activities is partly explained by the "fairness" motive embedded in the "compensating education "doctrine of the early post war period. Since this doctrine no longer appears viable, it becomes appropriate to discuss a wider range of non-public schooling forms. Failure of early idealistic school reforms may explain why the "nationalization" of educational production is now giving way to various forms of privatization. The *conventional view* of the educational performance of various countries appears to be:

	Basic	Higher	Vocational	Recurrent
USA	Bad	Excellent	Bad	Bad
Germany	Good	Bad	Excellent	?
Japan	Good	Bad	Excellent	?
Sweden	so and so	so and so	so and so	Good?

What do we mean by bad or good and why is school performance better in some countries than in other countries?

In the absence of a well defined school product the efficiency of schooling requires that we address three problems:

(1) the selection problem
(2) the definition of performance of the school organization and
(3) how to motivate the student and his parents.

Increasingly larger public resources are being spent on primary and secondary education, and also on higher education. The motive has been to increase the

welfare of individuals and (recently increasingly) to stimulate international competitiveness of production, and economic growth. An educational system, mostly publicly financed, that uses up as much resources as almost half of the value added of manufacturing industry in advanced industrial nations certainly requires attention from an efficiency point of view. If we add in all resources spent on vocational, labor market and on-the-job training this interest becomes even more reasonable. Depending on which effects dominate – the educational investment or the filtering – the efficient organization of schooling also differs radically, and a wrongly conceived competence creation process would, indeed, be very costly. It is typical of most educational production studies to *assume* one variant of the two (one partial theory), most often the educational investment hypothesis, and forgetting about the other, thus running a not insignificant risk of coming out with entirely erroneous policy conclusions. It is obvious that the selection issue is closely related to the incentive organization and allocation issues of the previous chapter.

4.2 The selection issue – talent versus education

Bishop's studies (notably 1988a, 1992) indicate that math is a good predictor of performance on practically all jobs; crafts, technical, clerical and other. The important question is to what extent math adds to ability or rather serves as a proxy for general talent characteristics like:

- problem solving ability
- a well organized mind or
- conceptualizing capacity

The question then is whether such abilities can be enhanced through math education or whether good grades in math simply pass on a signal of original cognitive capacity. Most probably both the investment and the signaling effects are at work. Hence, understanding of their relative influence (not only by

assumption) is needed to formulate policy. If the *filter dominates* the rational policy would be to

- encourage those with talent to take math,
- discourage others.

If the *investment effect dominates* they should all be encouraged. Perhaps the less talented should take more math.

The *verbal* characteristics figure differently in performance (Bishop 1992). In crafts verbal capacity has a negative effect. In technical and clerical it is pronounced and positive. The interesting observation is that crafts rely on rote training, while technical and clerical very much involve abstract tasks and much communication within teams and between teams. The second observation is that these types of jobs are becoming increasingly dominant in the advanced industries.

We have so far looked at the individual in the labor market from the point of view of his or her usefulness in production in contributing to the objectives of the firm. I will now look at education from the point of view of the individual. I will, however, not do it as has become typical of labor market research, and look only at individuals who have problems. In concordance with the ultimate purpose of this study to identify educational policy parameters that help supporting economic growth through the medium of human competence enhancement I will restrict my attention (here) to these individuals that have acquired the right competence and have succeeded in landing good, well paying jobs. To do this we have to deal with the selection and the educational investment problems simultaneously. We also have to look at the pricing of educational services and the entire incentive structure relating individual educational decisions to the final productivity contributions at the work place, or in short, to the entire problem outline at the beginning of this book. Typically this means that we will have to take 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–Nelson 1984).

4.3 The school and the job – general discussion

John Bishop at Cornell appears to be the only person who has seriously taken on the huge empirical task to identify and to quantify the effects of basic competences acquired at school and job performance. The *first* difficult problem has been to model *the transition from school to work,* a typical selection problem that involves a series of choices. For the talented individuals basic training (through high school) practically always is a step towards higher education. The incentive to go on (future salaries, work environment, freedom, power etc.) is a powerful filter in high school that induces talented young people to shun manual work, even involving professional skills. (I will return later to the problem what this may mean for industries like manufacturing that rely on skilled workers that enter the labor market from high school).

Second, it has been found useful by many to adopt Beckers (1964) distinction between different educational content:

- general
- specific.

Sometimes this distinction becomes the same as that between *education* and *training*. Becker (1962, 1964) argues that general education is best provided separately from the job context by specialist educational institutions (schools, universities), while specific training with a profound job orientation is less portable and perhaps has to be provided on the job. This distinction was analytically convenient since you could then assume that employers would concentrate on organizing specific training. In retrospect this appears to be one of the many simplifications that induces economists to make very strong policy statements based on assumptions rather than on empirical evidence.

The distinction between general and specific training cannot simply be made empirically. I am doubtful about its theoretical relevance. I will come back to that.

One *third,* related, forgotten fact is the costs and prior talent and knowledge (receiver competence) it takes to acquire additional knowledge or competence, a type of competence school is supposed to have provided initially (communicative or academic skills), a competence that has to be maintained and updated constantly (Eliasson 1990b, c). This is a general competence characteristic that can be defined for individuals, firms as well as entire economies. So there is a time leverage and an aggregation (scale) aspect to such knowledge accumulation.

In addressing these problems empirically (fourth) we should also (as Bishop 1992 notes) take care to distinguish between:

(a) educational attainment
(b) occupational category
(c) performance category.

Our problem is to study 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 further chapter 7). And only under perfect labor market conditions (which never exist, when human capital matters, see chapter 3) will income earned be an acceptable proxy for job performance. Few researchers (except John Bishop) have put in the effort needed to link school directly to job performance.

Sorting out the filter

The classical distinction, however, concerns the functional characteristics of education. Is it:

- a filter for talent, or
- an investment.

The investment or human capital approach is rooted in neoclassical production theory. Through investment in education your personal production or (rather) earnings function can be shifted. Since perfect labor market conditions are traditionally assumed the last step assumed links marginal productivity and wage one-to-one. The *filter* theory was partly formulated by Arrow (1973b), Spence (1973) and Stiglitz (1972, 1975b) in the early 70s and probably conceived in the form of a critique of the simplistic use of human capital theory. Filter theory has later become part of modern signalling and information theory. The filter theory of education in its extreme form makes educational production a labelling machine, that puts quality labels on workers. There is a huge literature on the signalling value of school grades. A particular variation that also concerns us is the bad signal, or stigma that is associated with low quality workers in an imperfect market, where true quality is very difficult to evaluate.

The problem is that only the extreme versions of the two contrary theories can be easily modeled. Hence, theoretical as well as empirical research has tended to focus on models embodying only one of the extremes, achieving analytical clarity at the expense of erroneous specification. This is no innocent matter, as we shall see, since the educational policy of nations is often built on such erroneous specifications.

The academic literature that attempts to bridge the two "sets of assumptions" is very scant, and rather flavored by controversy. The assumptions you make critically determine the analytical outcome. Both Albrecht (1981) and Lazear (1977) emphasize the near impossibility of separating the two hypotheses empirically, while Griliches (1988) strongly leans on the human capital theory

(more to come). From this we understand that neoclassical theory has difficulties with the filter problem. Clearly each hypothesis tells part of a relevant story. However, by shrewd choice of assumptions you can cook up any educational policy story you may wish.

The argument I present, part of which will be my proposed research program (see chapter 7) is that you have to specify your model at such a level of disaggregation that both selection and investment decisions can be represented. This requires specification down to decision makers (individuals, firms). This specification should be particularly clear for the school in its capacity of being a selective transition filter (a path) into the labor market (Lynch 1992b). But it would also be desirable to capture the family (Stafford 1987b) as part of the total sorting process that moves children through school into the job market.

4.4. Productivity and income effects of schooling

To capture the effects of schooling on individual job and income performance, analysis has to be broken down into three steps; (1) the effects of school organization on scholastic achievement, (2) the effects of grades (educational achievement) on income, (3) the effects of grades and choice of courses on job productivity, and (4) the relation between education and the capacity to learn on the job.

Step I; effects of school organization on *scholastic achievement.*

The Coleman report (1966) could explain very little of the variation in scholastic achievement with variations in resource inputs in schools. This was a shock for a welfare minded world preparing itself to solve the social problems of the industrial world with more investments in, and resources allocated to school. The Coleman report emphasized correctly that educational production like all other production required organizational competence

on the part of school authorities. Solving the educational problem was not only a matter of more resources. Also, the competence to organize and run schools efficiently was needed. Even though the report was later criticized (Hanushek 1986, Murnane 1989 and others), the particular emphasis on the need for organizational competence to run schools is even more obvious today with the enormous resource investment in education. Perhaps an enormous educational leap forward can be occasioned with the same resource input but with a different way of doing things? Since the first step is the main theme of this chapter I will refer to it below under the heading of "educational production functions"

One critical problem is to determine final school output properly.

Step II; How does income depend on scholastic achievement?

A large human competence based literature exists in which education (usually only the length of formal schooling) is related to wages. Part of this literature rather carelessly makes the standard human capital assumptions in the beginning, and then translates the results on income into productivity effects at the end. Normally positive effects of schooling on income are reported. Such studies have been criticized as being naive, since they exclude selection effects by assumption. Hence, the positive effects of education on income might rather be the effects of prior talent, since the generally talented tend to go to school. Griliches objected to such criticism already in 1977 (also see Griliches–Mason 1976) arguing that education is in fact endogenous and the outcome of conscious and rational economic decisions involving future expected income. Using a model making this decision explicit Griliches (1977) concludes that the educational effect (coefficient) on income is rather underestimated. This study was, however, carried out before modern information and signalling theory had been developed, in which you don´t only look at an individual's educational decision, but also on the employer's ability to spot talent.

With very imperfect markets for human qualities accepted as a fact the decision situation begins to look very different. Furthermore, the educational decision is sequential, being at each step very boundedly rational and uniformed. If job choice is first determined by preferences for type of job and then possibly being influenced by income maximizing behavior it is very difficult to keep selection and investment effects separate (Orazem-Mattila, 1991). In fact, as Bishop has repeatedly emphasized education is itself part of the selection process, eventually becoming more and more informed as to final job-income potential. But this final choice - as I have emphasized earlier - is restricted by earlier choices, and the long term leverage of education appears to be very large.

To understand the selection mechanisms and the leverage effects we have (1) to distinguish between high school and higher education (college and up) and (2) between students that plan to go on studying and those that plan to enter the job market after high school.

Bishop (1987a, 1988a, 1991b) has studied these choice processes empirically. He finds that high school students that plan to go on studying behave very differently from those who don´t. Those who plan to go on have to take certain mandatory and difficult courses in natural sciences and courses developing communicative skills (notably languages and math) to become eligible for higher education, that in addition require good grades.

For the others, who plan to enter the job market directly Bishop concludes:

Conclusion I

Young American males do not capture high initial wages from taking high school courses in;

(a) natural science
(b) language or

(c) mathematics.

On the other hand, it pays directly to take courses in:

(1) simple computational skills and in
(2) technical subjects

The latter are skills that can be directly converted into productivity effects on the job.

Young women, however, capture an initial wage advantage from courses in

(a) natural sciences.
(b) languages or
(c) technical subjects.

A very important question is to what extent these results reflect basic imperfections in an american type labor market, or only short term effects, i.e basic skills will pay off later, when upgraded into better job performance.

What do we know about the productivity effects on the work place for various combinations of high school training.

Step III; <u>What are the relationships between education and productivity?</u>

Here comes the next surprise:

<u>Conclusion II;</u>

High school courses in

(a) natural sciences

(b) language

(c) advanced mathematics

significantly contribute to work place productivity and worker quality even though the workers have only acquired a high school diploma.[1] Similarly technical competence acquired in high school is positively correlated with job performance[2] of

- skilled workers
- technical staff.

These results build on studies of tests by the US defense department, in which a large number of job categories have been identified, that have rather exact counterparts in the civilian labor market. Similar results have been reported by Boissiere–Knight–Sabot (1985) for Tanzania and Kenya. A particularly interesting observation (Rumberger 1987b) in this context is that excess or redundant education, or "underutilized education" for the job does not result in a higher wage. This appears to be a general conclusion at all job levels. On the other hand, it should be remarked, redundant education or experience should be a valuable "quality" of the individual, making him more flexible in the job market, and "insured" for labor market risks.

Kang-Bishop (1989) observe that academic courses in high school (in math, languages and natural sciences) give stronger effects on work place productivities than on wages, at least in the short term. A balance between academic and vocational skills is, however, important to maximize the immediate wage effect. Over the entire high school career of 12 years, they

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[1] It is interesting to learn from *Business Week* (August 17, 1992 p. 37) about the Saturn division of GM. "Saturn 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 communications skills".

[2] In a later study Bishop (1992) reports that *verbal education* has a negative impact on craft performance, but positive on technical and strongly positive on clerical. Apparently, the more you have to communicate on the job, the more important verbal capacity is.

conclude, 4 years of vocational training and 8 years of academic courses pay off significally better than only practically oriented, vocational high school courses. It did not pay off at all to take more than 4 years of vocational courses. This suggests that the average employer is demanding more and more in the form of general, communicative skills that increase the capacity of the individual to learn new things (receiver competence), to work in teams, and to adapt to new work conditions, including as a rule, new people (*flexibility*)[3] These results come from the US, but there is no reason to expect that the results would differ in any advanced industrial nation. One would rather expect (my comment) that the more advanced the work environment, the more important these observations.

The results reported all concern the immediate wage and productivity effects on-the-job. On the long term effects for which panel data are needed there is very little to read. What is very important is to know how the on-the-job learning capacity of individuals is influenced by prior qualities and early scholastic achievement. Bishop (1991c) concludes that for non-college high school graduates competence in science, language and mathematical reasoning, indeed, increases productivity on the job in the long term, also the blue collar jobs. During the first 8 years, after leaving school, these students (young men), however, receive no rewards from the labor market for developing these competencies. It is, hence, very rational for them to stay away from such tough courses, unless they go on to college, where such courses are both mandatory and later rewarded in the labor market.

Step IV; <u>How do the relationships between formal education, and the capacity to develop new competences (to learn) look?</u>

Here the results are as expected; the higher the academic level of high school courses (especially in communicative skills like math and in languages) the more efficient the downstream learning of vocational skills. More simple

[3] Compare earlier footnote on Saturn project.

"computational skills" do not have the same effect on the capacity to learn (Bishop 1991b, p. 7). Even though this "academic" competence acquired at high school doesn´t confer immediate effects on the wage level, and the effects seem to remain the same for considerable time (Bishop 1991c), an increasing number of jobs require those competences that have positive productivity effects on the job, especially in complex tasks related to the maintenance of advanced machinery ("technical literacy" and mathematical capacity are related).

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 apart, something that is needed to design educational policy.

Research offers little help. Jones-Jackson (1990) observed that it is difficult, perhaps impossible to test the one theory against the other and point out that while Wise's (1975) study of college graduates in large firms suggests a human capital interpretation, Lazear's (1977) criticism of Wise (1975) suggests that a filter is at work. Lazear´s argument is that selective biases at different stages in the data base make the explicit representation of each hypothesis in one, empirically testable model impossible. Jones–Jackson (1990, p. 264), recognizing this difficulty rather attempts a softer inference, identifying particular inferences of the two hypotheses, to see which are empirically supported. Again the method is either or. They find that internal educational investments in firms do not increase with the grades of the employee, a circumstance that in their interpretation rejects the filter hypothesis. Higher grades, furthermore implies a higher income irrespective of size of internal educational investment. Contrary to Wise (1975) Jones and Jackson find a positive relationship between college grade and initial salary. Their inference is that they have found no support for the filter, and no strong reasons to reject the investment hypothesis (op.cit p 254).

Albrecht (1981) attempts to parameterize both hypotheses with the same model, with no significant results for either of the two. Lang-Kropp (1986) find support for sorting, when studying differences in school time between students with different talent, using the fact that sometimes school time is mandatory, sometimes not. Bishop (1989d) builds his analysis on a selection model and finds - not unexpectedly - clear support for sorting. Kostink–Follmann´s (1989) study of recruitment practices of the US marine corps nicely illustrates the mechanisms of the sorting hypothesis.

These results raise a major problem related to the nature of the enormous stock of knowledge and experience of advanced industrial nations as compared to less developed economies. Psacharopoulos (1985) observed from data on more or less developed countries that returns to education were at their highest for elementary education and decreased with the level of education. Are these results relevant for advanced industrial economies like the US, Japan, Germany and Sweden? Recent research in the US, for instance (see p. xxx), reports a general increase in the returns to higher education, and a general increase in the capacity of manufacturing industry to hire highly educated people.

We know that primary education carries rather low costs for a wealthy economy, not so for a poor economy. The higher and the longer educational spells the higher alternative costs in the form of lost productivity contributions on the job, and lost income for the individual. Together this constitutes the enormous stock of economically useful knowledge that resides in an advanced industrial economy.

Considering this, does Psacharopoulos' conclusion that it would be profitable for the economy to redirect funds from higher education to lower education hold for the advanced industrial nation? The answer is that the question is probably put the wrong way. The ability to hold even a simple manufacturing job in an advanced industrial society requires a high minimum "technical literacy" and "verbal capacity" that is not very resource demanding to develop

at school at an early age but very costly to develop later on. Without these intellectual capacities the worker is not useful in the production system. To place him or her there may even carry negative productivity effects. When seen like that, the provision of basic communicative skills in the rich countries becomes a matter of necessity that has to be taken care of in order to have the individual employed at all, and hence a matter of efficient organization of early education such that all individuals achieve a minimum basic competence *before leaving school.* Has the efficiency of basic education, as it is frequently reported slipped in countries like the US and Sweden? Is the pool of unemployable workers increasing. If the answer is yes, is the decreased efficiency a matter of increasing numbers of students dropping out of the educational process, or are we concerned with a more evenly spread average decline in student capacity? The first interpretation (selection) could be "solved" by simply accepting that a larger and larger segment of the population remains poor and outside the welfare benefits of a wealthy community. The latter interpretation would suggest a general decline in the wealth of knowledge of the nation. I make this distinction because it has also been argued that the increasing educational standard demanded in advanced industrial economies, means a demand on prior student intellectual capacity, that cuts higher and higher in the talent distribution of the student population. If this is a fact of life it would include educational efficiency and the later job allocation process if individuals could be presorted according to talent.

4.5 Can people be presorted by competence characteristics?

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

Are tests used for sorting?

Firms in Sweden and in the US rarely use tests when hiring people. The personal director may not believe in tests, the costs of using tests compared to their accuracy may be considered high compared to hiring people, and fire them if not up to standards, or tests may carry legal risks. If formal criteria are used, school grades are the most common. But here criteria rather appear to be prior checks on whether the applicant has, or has not taken certain courses. A particular observation for Sweden is that an academic exam today appears to be a minimum entrance ticket for a higher level career in a large firm.

It has, however, been argued by educators that productivity improvements corresponding to as much as 40 percent of the wage are achievable if more resources were devoted to "ability tests" at the hiring decision. Other studies show that both scholastic performance and results from ability tests, independently influence the wage.

Considering all this information Mueser–Maloney (1991) ask, how come (American) employers are so irrational? Their answer is that American employers do not dare. Minority legislation makes it legally difficult for them to select through tests. In addition, however, ability tests may not be as good predictors as psychologists and educators believe, and this the personnel people of the firms have learned from experience. It even appears to be the case (Gottfredson 1985) that the employer, in so far as he uses a test, rather looks at the high school diploma. Hence, the preferred allocation mechanism appears to be to use the market. Employ on rather loose criteria, inspect the employee on the job and promote or fire as you learn.

Suppose ability tests would be generally used, and assume that they improve the allocation of people with qualities on jobs, and assume that this screening is less costly than using the market. What would the firm and the macroeconomic consequences be?

Hunter-Schmidt (1982) have designed an assignment model in which people are allocated according to earlier performance at school or on the job. They conclude that even crude such sorting should improve the allocation of scarce competence in the economy. Hunter-Hunter (1984) even compute that "if the Pennsylvania 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" (op.cit. p. 72).

Hunter-Hunter (1984) determine the correlation between ability according to cognitive and psychomotor tests and workplace productivity at around 0.5. At the same time they observe a correlation between educational achievement and productivity of no more than O.1. However, Mueser-Maloney (1991) argue these results depend critically on choice of estimation method and imposed limitations on estimation range (I don´t know why?). This limitation technically means an underestimation. If you remove it the correlation can increase to 0.7. Then high school grades can predict job productivity as well as ability test.

Brenner (1988) finds that teachers' ratings of student skills and work habits are better predictors of student performance on the job (according to supervisors) than aptitude tests. Absenteeism and discipline on the job can be well predicted by absenteeism at school and teachers' ratings.

Whatever you believe in tests Bishop (1988b, 1989d) argues, the labor market is a very imperfect (and slow) incentive system when it comes to rewarding students (through high pay) to take those difficult courses that give high job performance. If the use of ability tests would stimulate the students to take the right courses they would both increase the educational standard of students and perhaps also improve the allocation of the so acquired competence on the jobs.

<u>How are private and public gains affected by presorting?</u>

Tests of ability to produce are examples of sorting à la 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 these tests will (on the average) employ higher quality people, than firms which do not, and sorting pays off partly because competing employers do not understand how to use the tests. Thus smarter employers using tests do not have to pay a higher wage, reflecting the higher productivity, but only the lower wage uninformed employers would be willing to pay. We have a typical case of "adverse selection" and those employers that do not use tests, which 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. The use of tests, however, is no evidence in this latter respect.

Next, Mueser-Maloney (1991) ask whether there is a *public* gain from using tests, say a positive GNP effect. They find that if left to choose freely firms may "do more testing than is socially optimal". There are two steps in arriving at this conclusion. *First,* using an argument by Rothschild (1979)[4] 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, while productivity on the job is worked up slowly, a biased selection of employees will be the result, such that - even if tests carry information - the wrong people may be promoted in firms. Hence, there will be no positive macroeconomic allocation effect of testing, or there may be a worse allocation than if the market had sorted the people, but there will be transaction costs associated with the use of tests, and hence a negative social macro effect.

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[4] In an unpublished paper that I have not had access to.

Another welfare argument would be, that if the above two negative circumstances are not at work and tests in fact do improve, or speed up the sorting process, that would otherwise take place less efficiently and more slowly through the market, then distributional consequences would be the result. Then a limited use of tests by a few competent employers would result in an income distribution effect in favor of them (as already concluded above), while a more common use of tests would force individual productivity and wages closer, i.e., result in a more uneven income distribution, compared to the more even income distribution obtained in the imperfect labor market.

Again this argument is identical to the perfect market argument in the static general equilibrium model, and may therefore in turn be completely wrong in its implications. It disregards dynamics, which is not captured by the tests, and it disregards the possibility that incentives may not only promote the exploitation of tests (as in the pure filter setting) but also increase investment in education on the part of the individual. Hence, we are back where we started. Let us try something else.

Concluding words on selection

Research apparently provides very little of clear insight into the basic important selection phenomenon. Can school nevertheless be reorganized to cope with this problem? Will the distributional problems be politically accepted when it has been recognized that equality cannot be achieved, or will political restrictions be imposed on the educational system that also make educational production less efficient for the students who are capable of coping with an increasingly deficient school?

Answers to these questions are needed to formulate effective educational policies, and unfortunately the talent (filter) versus investment controversy still remains unsettled. Summarizing, however, Behrman-Taubman (1989) conclude that it is difficult to refute the proposition that original, genetic conditions

explain most of the variation in educational achievement. Other factual circumstances like family affluence, parent educational levels etc. explain some, but not much. The earlier ideological policy of a "compensatory schooling" system (see e.g. Okun 1975) can no longer be supported by empirical evidence, when models that are not a priori kind to the compensatory principle are being tested. (See also Coleman 1988 and below).

Unfortunately, Behrman-Taubman (1989) continue, school ambitions to compensate for prior genetic disadvantages will only create inefficiencies rather than a more even competence distribution in society. Hanson-Sewell's (1986) earlier study is in agreement with this conclusion even though they emphasized "family background".

So what should we do with school?

I will return to this question when I have gone through some more basic research material on the importance of social capital.

4.6 Social capital and high school performance

Coleman (1988) introduces what he calls *social capital* as an infrastructure with positive externalities on those "involved". He observes that family social background has three dimensions: (1) financial capital, (2) human capital and (3) social capital and studies the effects of social capital on the drop-out rates among high school students.

The main reasons for bad school performance

Bishop (1993b) goes through the four reasons for the bad performance of American high school students, in order of importance

(1) low effort
(2) parental disinterest
(3) bad public support
(4) voter apathy.

All of them are non-economic, the most important ones relating to family background.

The by far most important negative influence on student performance appears to be low effort on the part of students, measured by a) *time* spent on tasks, b) the extent of *homework*, c) *competing uses of time*, d) *avoidance of demanding courses* and of the passivity of students. On all counts American students compare unfavorably with students in other (studied) countries. For one thing learning (i.e. student performance) is strongly positively related to time spent on task. There is a similar positive relationship with homework. Japanese secondary students spend almost twice as much time in school as do American students, and much more time on homework.

The total time devoted to study, instruction and practice in the US is 18-20 hours per week, compared with the typical high school senior spending nearly 10 hours per week on a part-time-job and almost 20 hours (!) watching television. Television time is negatively correlated with student performance in school.

Avoidance of demanding courses is a particularly tricky problem, since most students do not take rigorous college preparatory courses in science and math. Increasing the number of math and science courses required for graduation - as tried in many states - does not help since this is usually accompanied by a lowering of standards. Most students in fact avoid rigorous math and science courses since they increase their work load and lower their gradepoint average (Bishop 1993b, p. 7).

The passitivity of students, that must be based on attitudes developed at home, reinforces this problem and places a heavy burden on teachers that have to rely on "their own personalities (op cit p. 7) to motivate students". "All to 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" concludes Bishop (1993b, p. 8).

Parental apathy

The second reason for the low performance of American high school students is parental apathy (Bishop 1993b). Goodland (1983) also ranks "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 math or science courses. And American (but not Taiwanese and Japanese) parents report satisfaction with both school and student performance (Stevenson, Lee and Stigler 1986).

If American parents were dissatisfied with local school performance, which they should be (Bishop 1993b) they would send their kids to extra tutoring after school as in Japan, or to private schools. Private school students do not learn faster than public school students (Cain–Goldberger 1983). They are attracted by better discipline and absence of disruptive students.

Family environment

Björklund (1992) studies the importance of family background on school choice (length of school). He distinguishes between a *financing* hypothesis, affecting children from poor backgrounds negatively, and a *comparative advantage* hypothesis assuming that children from rich families get more, (that is higher returns) out of school. He finds no evidence for the financing

hypothesis, but concludes that this may depend on too little variation in financing data. Financing costs (marginal costs) in Sweden do not depend on family background.

There is weak evidence to report on the comparative advantage hypothesis, suggesting - under Björklunds priors - that individuals from rich families may choose more years of school because returns to school are high. The strong explanatory factor is, however, the education of the father. Leaving Björklunds interpretative framework the explanation might, however, as well be *tradition*; if you come from an educated family, you go on studying a lot, of *family support*; with a highly educated father you may have direct support, getting more out of school (Björklund acknowledges that possibility). But there may also be a deeper common talent factor, that is not part of Björklunds hypothesis.

Coleman (1988) finds that *parent attention* and parent (notably mother's) expectations of college significantly lowers the drop-out rate. The more siblings the higher the drop-out rate, especially among the younger kids. The bad results are reinforced when combined.

The number of siblings, vary across families of different kinds. Björklund reports a negative effect on length of school choice with number of siblings (On this also see Stafford 1991 and Lazear 1980).

Ethnic environment

Contrary to the standard view, even third and fourth generations of immigrants to the United States refuse to blend into a standard form. The U.S. remains a multicultural and pluralistic society, which also means that different ethnic groups are clearly distinguished by different income levels. Borjas (1992) finds that the skills of the next 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. Ethic capital is represented by several ethnic variables put together as an ethnic dummy. Average skills are measured by mean educational achievement of the ethnic group.

The father's educational attainment appears to significantly affect the educational attainment of the next generation. However, holding the father's education constant ethnic capital significantly and positively affects educational attainment. A one year increase in the average schooling level of one ethnic group increases the average level of the next generation by 0.2 years. The coefficients of ethnic capital and parental education variables are of similar magnitudes, only that parental educational levels vary more, suggesting not only that ethnic capital is a significant determinant of educational attainment in the next generation but also that it significantly contributes to preserving ethnic differences in educational attainment.

The sample Borjas uses indicates substantial improvements in educational achievement across generations, but not in occupational prestige. A huge dispersion in educational achievement across ethnic groups is evident from the data.

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

One of the problems of educational production function analysis (to be discussed in Section 3.8) is that strong biases result from even small selection effects such that a school that happens to attract above average students scores higher on scholastic achievement and is classified as an above average productive school. The attempted solution is to correct your input variables for prior home or parental inputs, to obtain a correct value added effect of schooling.

It was clear already from the Coleman report, using the educational production function approach, that pre-school, family and non-school environmental variables explained much more of the variation in scholastic achievement than school variables. Bosworth (1992) emphasizes the importance for school performance of student attitudes 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 the modification of attitudes and behavior of young people. He finds that absenteeism from school significantly lowers student performance. Absenteeism, however, in turn, depends significantly on family background. High parental income is good for school performance. It is bad to live in subsidized housing, low income, high unemployment areas *and* away from home.

Okamoto (1992) tells an interesting story about Japanese Schooling. The prior – and empirically unfounded – attitude of Japanese society towards the young students is that they are intellectually equally equipped. Hence, bad school performance can depend only on bad teachers or lazy students. If teachers can not be proved guilty of bad performance, which is difficult to show in a society that respects its teachers highly, there is only one reason left. Hence students are forced to work very hard at school, and the less talented, the harder they have to work, enforcing also strong work discipline. As a consequence the standard of the class does not fall as much as would happen if the bad students, in addition to being bad did not work. It is interesting to speculate what this may mean for welfare. Such an attitude of society to its youth is of course hard on the less talented students, but so is worklife on less able workers. We have also concluded earlier, that if you do not put in significant effort during the first years of schooling the leverage works against you (see chapter 2, p. xx). The less talented you are the more hard work at school matters. Hence, the less talented in Japan suffer more when young, while the less talented in sloppy Swedish or US high schools suffer with a cumulated effect when entering the labor 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 (1993) discussion of the intangible social or infrastructure capital.

The family plays a not unimportant role in the literature, as a prep-school for the formal education process. The family to some extent internalizes several functions normally provided in the market by Government, for instance insurance, retirement and education, including the management and financing of education, areas where altruistic behavior among family members may occur. Becker–Tomes (1976) have formulated a provoking such internal family allocation model where the parents attempts to do to the family members, what egalitarian welfare Government attempts to do (through taxes) to all inhabitants, namely to allocate family resources on family members education such that family wealth is maximized, and then attempt to redistribute income ex post. This means allocating resources on those most fitted to acquire income generating knowledge. The final distribution is then corrected through gifts and heritage. The critical theoretical problem is how to control the ex post redistribution. This can only be done in a family with considerable financial wealth to transfer, or for that reason human capital. The final equitable distribution, however, requires certain assumptions to overcome the strategic avoidance measures that the more talented typically take in welfare economies attempting to do the same thing as the Becker–Tome family, but on a grander scale. To some extent the final distribution may depend on the talented children being willing to part with some of their income, as desired by the parents. That egocentric, talented children really will do that (Becker 1974) is an assumption Nerlove-Razin-Sadka (1984) do not accept. If they are right, the analytical results change. There is also an additional complication, not discussed in literature. Suppose successful educational outcomes depend on childrens' efforts that in turn depend on compensation. If such efforts depend on the degree of enforcement of the final egalitarian distribution, then of course the whole analysis collapses.

4.7 Motivation and willingness to pay for education

The more motivated the student, the more efficient education. If education is organized as a contest and/or if the 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

To begin with it is important to recognize that the effects of own financing ought to differ significantly at different levels of education. It is also important to remember that the equity financing input can be anything from a little to all. It might occasionally be privately very efficient to keep the number of educated low to limit competition for the educational rent by having a 100 percent equity financing. Furthermore, at higher levels of education (college and up) students always put in a significant own financing by abstaining from an alternative income during education. The problems I address here are the motivation and efficiency effects at a relatively low level of own financing of educational costs. I will report on the research results generally and add a few comments of my own.

A general view after Manski-Wise (1983) has been that the propensity to go on to college (in the US) is negatively correlated with costs and positively with the degree of student aid. Choice of college is also affected by relative educational costs. Hanson (1983), however, countered that this analysis had to recognize the environment (more or less affluent) from which the student came. He also observed that the increased access to student aid of below-medium-income students had not increased the supply of educational services for these "groups".

McPherson-Shapiro (1991) have recently surveyed this research area and added their own research. They confirm the original view that costs reduce the propensity of students from low income families to go on to college. They, however, question the early view on student aid and argue that federal student or financial aid have not affected the same propensity, even though, they add, clear answers to all these questions really require panel data which are not easily available.

Equity financing is usually associated with higher education, for which a significant own financing is reasonable. Psacharopoulus (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-Glewwe (1990) in fact observe – supporting this view – that the willingness to pay one's way through secondary education exists with families in Peru, even though it increases with family income. The quality of the school (notably teacher density) furthermore strongly affects this willingness to pay. It is also important to recognize that these empirical results have been reached on data from developing countries, where the returns from primary and secondary education should be high.

Risks and limited financing

"A striking feature of US public education" begins Fernandez-Rogerson (1993) is "the large disparity that exists across communities in spending per student". They conclude that this to a large extent depends on the fact that financing of US public education is based on local taxes, the large differences in average income across communities and the endogenous adjustments of the populations with different incomes over communities to avoid paying for other peoples public costs.[5] Bishop (1993b) goes on observing that the US by all

[5] Go through their simulation model here, or elsewhere.

measures spends less on education, compared to its level 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 part of total secondary school costs in the US is devoted to other tasks than to academic instruction, a ratio that (Anderson-Shugart-Tollison 1991) contributes negatively to student performance.

A particularly negative factor, observes Bishop (1993b, p. 11) is the low teacher's compensation. It is low in international comparison even in absolute terms, compared to countries with a lower per capita standard of living. If the comparison is made with reference to compensation in other occupations teachers income is very low in the US and very low in an international comparison.

Lazear (1980) asks whether variations in levels of attained schooling across groups can be explained by a model that assumes perfect capital markets and that individuals maximize wealth. Do financing cost differences explain variations in education and income, and that poverty is perpetuated through poor families, as argued by Bowles (1972) and Jencks et.al (1972). Implications from policy varies significantly whether financing cost differences or differentiated returns to schooling, e.g through labor market discrimination or other imperfections is the reason. In the first case subsidized financing would be the recommended policy. In the second case policy designed to reduce labor market imperfections would be recommended.

Lazear (1980) finds evidence for very small difference in financing costs. The very small differences are significant, but the differences are 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 labor market discrimination.

Whether empirical research will provide more reliable insights 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 be productive. This (Ljungqvist 1991) makes it necessary to explain the even larger (than in the West) income differences observed in developing countries, in terms of different access to the financing of education and/or to the assumed fact that risk averse individuals, to educate themselves, demand a very high 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, comes up with an entirely different explanation in terms of limited or asymmetric information that creates equilibrium wage distributions that are more diverse the less developed markets (i.e., the search processes) are. Incentives to search matter, and the policy implications are contrary to the human capital explanation.

The human capital theory short circuits the labor 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 large, requiring a very high return to investment in education as an incentive. The risk premium is high, because failure means a large decrease in life income (Ljungquist 1992). The question then is; suppose the assumptions are correct, then Government can step in, not to subsidize education directly, but rather by taking on the risk, by supplying a loan guarantee to make it possible for students to borrow in the market at reasonable rates. This has, in fact, been standard policy in some industrial countries, increasing the supply of students and leading to a lowered relative income for some academics.

Who knows best; the individual or Government? Different theories make different assumptions and suggest different policies.

However, before any such policy conclusion can be reached the underlying prior assumptions have to be sorted out. And the search or sorting (filtering) of people would rather (than educational failure or credit market imperfections) emphasize imperfections with individuals (bounded rationality) in choosing the right educational paths, or failing to find the right job, or being misunderstood by the employer, who cannot evaluate the competence of the individual. The latter explanation has often been proposed by Bishop (e.g. in 1989d).

Human capital based research often suggests that more tasks should be given to Government, while search or filter research places emphasis on the capacity of the individual to take care of himself or herself. These biases in policy advice are embodied in those theories by prior assumption. An additional complication arises if welfare policies are carried on by parents within the family (Becker-Tomes 1976). Since the family is a much more informed and controllable economy than a nation, effects from internal family policy might be much more important to consider than Government policy. Becker–Tomes observe that if publicly financed education to compensate children from disadvantaged home environments make parents reorient their allocation of internal family resources, the intended policy effect may be entirely eliminated.[6]

It is still interesting to discuss whether the returns to basic education are lower or higher in the advanced industrialized economies considering the fact that the higher level abilities acquired at higher educational institutions or on the job, that we think create our industrial wealth, cannot and/or will not be acquired without the appropriate receiver competence acquired in high school. Whatever, the educational result is not only a matter of student talent or educational costs and financing. The prospective returns and attitudes to education also matter.

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[6] This conclusion of the failure of compensatory education does not require (as with Jensen 1969), that children that receive compensatory education are less talented than other children.

4.8 Educational production functions

The Coleman et al. (1966) report shocked the educational world in two ways. It (first) introduced a host of new empirical methods, that more or less initiated[7] the study of "educational production functions". Second, it observed that variation in school resource inputs explained close to nothing of the variations in school performance. This was clearly disappointing for a school world (just then) ready to solve the social problems of the industrial world through increased spending on education (see e.g. Okun 1975). Coleman et al. (1966) observed that educational productivity like all other production suffered from efficiency and organizational problems. Compensatory education programs were not simply a matter of increased public spending. Competence was required to organize and operate educational facilities. Even though the details of these rather straight forward results were later criticized (see Hanushek 1986, Murnane 1984) in modified versions they have been more or less accepted.

Educational production functions allow generalization of results. The results are, however, limited to available data and what econometric techniques can handle. Such methods can never replace the use of case studies and in dept inquiries allowing for non-quantifiable dimensions of human capital.

It is important to note, for instance, that most (in 1986, when Hanushek's survey article was published, practically all) studies of school or student performance measure performance with *student achievement*. The interesting performance variable would of course be either long-run labor market performance or some broader *utility* measure. Recent years have witnessed a merge of educational economic and human capital theory, in which student post school performance in terms of earnings is related to various aspects of school experience. I will go through that literature in some detail below.

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[7] See Hanushek (1979).

However, very little (also see below) has been done when it comes to measuring the effects of schooling on productivity performance. John Bishop appears to be one of the few that has been willing to put in the effort needed to do genuine empirical research in this area.

The new multiple input, multiple output methods, allowing producers to operate under their production frontiers, not even aiming for cost minimization, some prices and services not being measurable, and some prices not being exogenous, due to monopoly or monopsony power, originally rest on the *indirect production function* method of Shepard (1974), using *distance functions* (Shepard 1953, 1970) defined such that a dual method can be used. The Shepard distance functions are closely related to the family of efficiency measures originally proposed by Debreu (1951) and Farrell (1957). Färe-Grosskopf-Lovell (1988) explain, and apply this method to compare the production of school performance in reading, mathematics and economics in the state of Missouri. They also point out that *data envelopment analysis* (DEA, see Charnes-Cooper-Rhodes (1978), Bessent-Bessent (1980) etc.), rapidly becoming popular with educational economists, is related, but a bit extreme in ignoring all prices, and all behavioral motivation, and evaluating performance solely on the basis of the efficiency of the physical transformation process.

As pointed out by Grosskopf-Hayes-Taylor-Weber (1992a) econometric research studying school productivity has taken one of two paths. For many years research was confined to (1) estimating single output average production functions. Recent studies have attempted to (2) estimate multiple output production functions allowing for scale effects and technical and allocative efficiency. Such studies on school districts in Texas (Bessent-Bessent 1990, Bessent et al. 1982, 1983, 1984, Grosskopf-Hayes-Taylor-Weber 1991, 1992a), in Missouri (Färe-Grosskopf-Weber 1989) and in Connecticut (Callan-Santerre 1990) find significant evidence that schools are not allocatively efficient, notably using capital excessively. Similar results were obtained for England by Barrow (1991).

These studies use cost functions in their analysis, which makes it possible to employ a dual technique in specifying (school) production technology. One reason is that public enterprises in general, including also schools, probably are not cost minimizers and furthermore are not free, because of regulations to choose the most efficient educational methods (Grosskopf-Hayes-Taylor-Weber 1992a)[8]. Hence, schools operate underneath, but at different distances from their production functions, maybe some operating on their production frontiers. The technique is to estimate the best practice frontier assumed to be observable for the best schools, using a stochastic linear programming technique.

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.

While quality and volume of teacher input per student appears to matter significantly the results, of course, depend on where on the "production function" one operates and the type of student material that is subjected to education. At the very low end scale effects appear to play a role.

Jimenez (1986) has found scale economies in Paraguay and Bolivia primary and secondary schools, suggesting that larger schools are cheaper to operate. Butler-Monk (1985) address the question of optimal school district size, using data from New York state. Rather than finding all schools of all sizes operating on the same production function they find two distinct parameter settings one for small and one for large schools. The small schools enjoy economies of scale while the large schools exhibit constant returns to scale. This could be taken to indicate that different organizations of production are associated with large and small scale. Butler-Monk (1985) suggest that the

[8] Which is certainly also the case for private firms.

small schools would realize scale economies by marginal increases in size, which is not possible for those already large.

In a recent paper Grosskopf-Hayes-Taylor-Weber (1992b) simulate deregulation of schools using their (1992a) model. They first correct the school output measure (test scores) for (1) home produced inputs and (2) previous student attainment (What exactly? I cannot find it.) to obtain a better measure of value added created by the school. They then look at the contributions to value added of four variable inputs (1) administrators, (2) teachers, (3) support staff and (4) teaching aids. They also look explicitly at one "fixed input" namely "operations and maintenance" and a measure of other fixed inputs. Their relative contributions to educational output were: ???? (I cannot find the answer!).

They also find that education by school districts is subjected to *diminishing returns,* suggesting - if returns are not monotonously decreasing - that there is a school district size that should not be exceeded. If schools are free to reallocate and combine inputs efficiently a potential gain between 4 and 10 percent in student performance can be achieved.

The size of the school or school district is only one measure of school organization. To capture the influence on quality of school output and efficiency of educational production of school organization far more sophisticated modeling is needed.

Organization and productivity

The importance of school organization for student achievement has recently been studied by Anderson-Shugart-Tollison (1991). They find that the higher the share of resources invested in teachers and physical school facilities (mostly classrooms) in percent of the total school budget, the better student achievement and the lower the drop out propensity. This means that the

higher share of school bureaucracy (other costs than for teachers and physical facilities like advisors etc., administration etc.), the worse student performance.

Card-Krueger (1990) also show that the number of teachers per pupil increases student performance, this time measured by returns to education (= the wage). In general, however, size of classes does not appear to matter very much for student performance.

Callan-Santerre (1990) study multi input educational production functions in Connecticut. They find significant substitutability between instruction, administration and support staff service 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 economies of scale, i.e., in the sharing of complementary resources.

Walberg-Fowler (1987) study the productivity of school districts "in the sense of increasing the learning of their students beyond what would be expected from their family socio-economic origins". They find, studying average scores on state developed and nationally standardized tests of third-, sixth- and ninth graders in New Jersey districts (1) that test scores are significantly and positively related to socio-economic status of the district, (2) insignificantly and inconsistently associated with education expenditures per student and (3) 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[9] the phenomenal public school performance in New York City slum schools left alone and undisturbed by the "systems goals" of the 6 000 head public school bureaucracy of New York City,

[9] *The Economist*, June 13th, 1992, p. 50 f.

to solve their problems, individually and innovatively, including the hiring and firing of teachers.

Hanushek-Taylor (1990) try to measure state variations in school performance, or the effects of different state wide school policies, using a method to estimate 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 percent of the variation in school quality falls between states.

While many studies find, or argue (see, e.g., Chubb-Moe 1990) that students in public schooling fail because monopolistic school bureaucracies' stifle innovative local initiatives and impose regulations that decrease efficiency, other students (like Reich 1988) argue that more public investment is needed to attract good teachers and to finance education. Both points of view can be true, if investments in education have been small compared to the productivity or profitability of educational capital. Perhaps then this productivity could be increased even further if schools were privately organized to a larger extent and if students financed a larger part of their own education, thereby increasing their effort. Very little has been done in the form of research on this topic, probably because it has been almost a political doctrine among the western industrial nations, that primary and secondary schooling is a public task. There are, however, a few studies from the developing countries and on US higher education that is both private and public.

Since individuals are typically risk averse, they will abstain from acquiring education if they have to pay their way themselves, even though efficiency of schooling may increase very much when financing is private. Is there a role for innovative financing arrangements that make individuals overcome their risk averse behavior that also captures the efficiency effects of the private school,

without exhibiting the adverse selection effects of a 100 percent private schooling system?[10]

4.9 On-the-job competence development

There is a related problem that has perhaps been more thoroughly investigated because of the more acute concerns for concrete results, namely the problem of creating the right internal firm culture to motivate people in the organization to learn the job and to perform better. This on-the-job competence accumulation process is an integrated part of the formation of efficient teams.

On-the-job training (OJT) is the typical method of developing work related, specific and tacit competences, that cannot be efficiently taught in a classroom. The discussion has still not resulted in any conclusive results as to whether industrial or vocational skills can be efficiently developed in a classroom context or in schools with all the necessary equipment, but not integrated with production, such that experienced people from production can 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 - have sometimes been quoted as explanations for the difficulties of university graduates - compared to engineering graduates with similar education - of landing good jobs in business firms. I will leave the individual skill development on-the-job or at school for the next section.

Here I will focus on the fact that also an organization can learn, not only through developing its individuals but through developing competent teams of individuals.

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[10] Perhaps more on selective schools, competition and performance.

Sociological literature often emphasizes the capacity of the organization to mobilize desired personal capacities among its members, like work motivation, that cannot be as efficiently motivated through pecuniary incentive schemes. Schou (1991) and others have shown that such motivation is important, in this particular case among engineers. The way work is organized, however, is decisive for the system´s motivation effects achieved, especially for newly employed engineers during their first decade of work. Thereafter motivation declined, if they stayed with the same task, and the older the employee the less work environment mattered. This in itself suggests an organizational benefit from rotating people in the organization.

Visible work appreciation mattered a lot, notably through closeness to final market users, and top down from managers, superiors. Distinctly spelled out compensation rules made employees less satisfied. My explanation to that would be that low performance would then be revealed to the individuals themselves and to others as low performers, while high performers would always find themselves underpaid. Employers in research departments, however, often tended to be satisfied with relatively less pay, because of the more open work environment, allowing for more freedom of choice of work tasks.

Motivation, not pedagogic methods or support material is also decisive for the efficiency of workplace learning (Holmqvist-Jarrå 1991). These results correlate well with the few results on school production available. Motivation is higher when "the students" understand the importance of knowing something.

The same problem pops up in Aoki (1986) in the different learning characteristics in the US A-type organization and the Japanese, J-type organization. Far - reaching work specialization - as in the A-type organization - is not as motivating for skill development, as is the organic J-type organization when each person understands his or her importance for the whole.

4.10 Higher education

Secondary education is either a pathway to vocational training and the labor market, or, if excellently done, an entrance ticket to higher education. Strong educational criteria select and guide the students onto either of the two careers.

Is more higher education good for the economy?

Apparently, the students going on into higher education and research careers are the more talented, more motivated, and more willing to put in an effort. Do these students then go on into useful occupations contributing to economic growth? If they don´t, higher education may have a detrimental effect on economic growth. In the past the academically more talented often wound up in the clergy or in the military and in more recent times in some countries, in large numbers in the bureaucracy. Since much of output from institutions of higher education enters research, the question of efficient research appropriability also has to be addressed. Can it be so that a very efficient research establishment in the US has not been matched by a corresponding competence to transfer R&D output into competitive industrial production, thereby rather benefiting other countries with more capacities in that respect, like Japan and Sweden (Eliasson 1991e)?

The assumed outcome in most economic literature, however, is that more higher education is good for the country and for economic growth, by adding positively to the qualities of the labor force. Computations carried out by Denison (1967, 1979), Jorgenson-Griliches 1967, Jorgenson-Fraumeni 1989, 1990 etc. exhibit these results, thereby strengthening the argument for more resources to higher education, even though both Psacharopoulos (1985), and more recently Jorgenson (1993) argue that it may be even more beneficial to

the economy to reallocate money from higher education to primary and secondary schooling.

The computational methods used are, however, self-fulfilling in the sense that they could not possibly, given the facts, produce other results. They normally disregard the problem of efficiency of school production, a circumstance that may change the policy conclusion *from* more resources *to* reorganization of higher education.

Recent concerns about declining competitiveness of national industries and a deteriorating technological base have activated the discussion of the economics of higher education.

Pencavel (1990) has surveyed the literature on the productivity effects of higher education. He finds it difficult to quantify but concludes on a positive note. However, Pencavel concludes, not until research has been moved down to the micro level, can this positive relationship be understood. This is a conclusion we have already drawn, but it also means that we have to deal with the difficulties of selection effects.

There may be very strong positive results at the micro level when the allocation has been successful. But suppose the allocation machinery moves talented people through school to the wrong place, when they would otherwise have stayed in more productive skilled worker positions.

Returns to higher education are increasing

While Pencavel´s (1990) partly intuitive interpretations may nevertheless be correct, it is surprising that he has not quoted those who really have attempted to understand what goes on at the micro level, namely Bishop and Osterman and associates. Pencavel 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 have responded rapidly (see section 7.8 in Eliasson 1992a) to the significant increase in returns to higher education during the 80's and increased their educational investments, and warns for political ambitions to squeeze salary differentials and thereby reduce these strong supply effects, such that the market is unable to deliver scarce resources to those areas of the economy where they are most valued (op. cit. p.4). Highly educated labor appears to be better paid in industries showing rapid technological change (Bartel-Lichtenberg, 1988; Dickens-Katz 1987 and Davis-Haltiwanger 1991). This could be interpreted to mean that competence and skills developed in school and in higher education is most profitably put to use in those industries (under standard human capital assumptions). Adams (1990) approaches the same problem from another direction and emphasizes the economic importance of academic production per se; education and research. "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 about 20 years are needed to convert research results into academic knowledge. It should again (see p. xxx) be emphasized 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 1991d).

CHAPTER 5

ON-THE-JOB TRAINING, SELECTION AND THE LABOR MARKET

Education and retraining is a life-long affair. It is largely guided through choices of path through school and through the labor market. Selection effects, hence, dominate in the distribution of human competences at each point in time, and their allocation over time. Supply of, and demand for competence are accordingly affected. The organization of these choice processes at school and in the labor market, and the supporting 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?

The question whether talented individuals are filtered out of the manufacturing sector eventually leaving it staffed with low quality people may not only be an academic one, considering the development of industrial technology and the shifting of competence and educational rents.

Demand patterns in wealthy nations with a large population of highly educated individuals are rapidly shifting towards the output of the service sector, notably its high quality, low scale end. Technology is simultaneously, as we have demonstrated (see xxx) doing the same thing to manufacturing hardware production, pushing up rents in its high quality, low scale end. This typically means that the high quality end of the talent distribution must be gradually shifting in the same direction; something that is suggested by a

comparison of the distribution of jobs in the US and the Swedish economies (see Table 5.1).

The first industries to suffer are the manufacturing sectors that are based on skilled workers, the skilled workers investing in higher education and hence moving up into higher quality production, leaving manufacturing with low quality workers. It may be the case that this is exactly what US manufacturing industry has been suffering from during the 80s. A similar effect may occur in the high level engineering end, talented engineers moving "up" from processing into R&D, and probably into more academically rewarding industries like defence and space and out of mature hardware industries. There is some evidence both from the US, Sweden and Japan that this may in fact be happening (ref. Bata). It is also important to remember that this is no problem under the assumptions of pure human capital theory and that it doesn´t matter that simple manufacturing firms are killed and if large differences in income distribution are accepted. Neither is the drain of talent of any important consequence if the talent is gainfully employed in prosperous service industries.

5.2 Vocational training and labor market retraining

School is partly a form of knowledge-creation, partly a selection mechanism, and partly a pathway onto vocational training and the labor market. The three functions overlap. None can, however, be studied in isolation from the other. Labor market training and retraining, to be efficient, are in a large measure a labor market search process. It has long been understood (see e.g. Lundquist 1942) that if retraining is removed from the job context, retraining programs do not work well. Thus, incentives to be trained should be worked into the employment contract.

Labor market training and retraining is a normal element in advanced production. All modern industrial firms carry on informal on-the-job training

programs to stay competitive through an updated labor force. On the average, at least 3 percent 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 have no tradition to keep all internal educational charges explicit in their accounts (see Eliasson 1990a). Internal education is, furthermore, heavily biased in favor of those already well educated and trained. These are the labor categories that are profitable investment objects.

The nature of these internal training programs still remains more or less obscure. If you except partial studies of learning curves, etc research is lacking. Studies on labor market training have a strong bias towards people with problems in the labor market and heavily subsidized labor market retraining programs, often separated from the job-context. The results on retraining are flavored by these biases in the selection of research topics.

There are three principally different reasons for labor retraining.

a) In an active, expanding growth environment, new technology makes constant competence upgrading necessary.

b) In a depressed economic environment subject to restructuring (steel, simple manufacturing) obsolete labor skills have to be replaced and people moved to new jobs (steel workers updated to electronics engineers).

c) Production establishments (often very low-tech) are closed down in regionally distressed areas where no new industries will locate. Laid-off labor both has to retrain and to move.

The organization of training programs differ significantly in the three circumstances. The first category is by far the most important for economic growth. It should require no public subsidies. If it does not work on its own, within industries, industry has a problem.

The two other retraining situations represent two different stages of a social problem, partly due to risk aversion among labor, partly because there is no private pay-off to commercially based retraining due to low receiver competence or to high age. We then perhaps have a case for Government subsidies. In a way the stylized notions of the organization of labor market training in various countries reflect the national attitudes to the private and the social sides of such retraining.

Four different labor training models

Four different labor organizations and labor training models are usually recognized in the academic discussion:[11]

1. *The German Apprentice system* in which youth pay for their education and experience through a low pay. The content, the balance between specific and general training is subjected to negotiations and there is certification at the end.

2. *The Japanese model* is not an apprentice system. It is not occupation, but firm oriented, which means steady job rotation and a broad-based experience. The presumed risk for employers is that educated workers jump job, but since labor has had a low pay during learning years they have, in fact, paid for their own education. The risk of job jumping is, furthermore, low because of the high social transaction costs associated with job jumping.

3. *The Swedish model* essentially means more Government involvement to overcome presumed market failure. Vocational training as an industry was gradually nationalized during the post war period.

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[11] Presented by Lisa Lynch at a seminar on *Human Capital Creation in an Economic Perspective*, Helsinki, May 14-15, 1992.
– Perhaps the *Dutch* system should be added? - and the French (see Bishop 1993c)?

4. *The US model* means mostly private training, different approaches depending on firm, no apprenticeships and pronounced specialization.

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 organization of work. The latter is partly a matter of technology, but it is very important to realize (Eliasson 1990b, 1992c) that work or firm organization in itself is the perhaps most important industrial technology (see above). Hence – as I argued in the first chapter – the development of technology and firm organization very much determines both industrial performance and the efficient organization of team training of employees. If - as many believe - the work organization, which is closest to the individuals is the slowest to change, established, now obsolete, labor organization forms (contracts), including arrangements for training may be the real impediments to change and progress.

Aoki´s (1986 and later; see also Eliasson 1992a, p. 119 ff.) comparison of the Japanese J-organization with the American A-firm organization is therefore very illustrative in this context. The interesting question is which solution is the most appropriate for the organization of work in the industry of the future.

As we have discussed earlier (see p. xxx) in some detail, while the US organizational form is analytically transparent and populated by specialists, the Japanese J-organization constitutes an integrated whole that requires generalists at all levels. The American A-firm, hence, requires coordination specialists, managers, while the Japanese J-firm has an innate ability to self-organize and - to some extent - self-reorganize. Since all workers position themselves in relation to the whole, they understand the problems that always pop up better and can take independent action to fix them. This requires the kind of training typically associated with the Japanese vocational training model, while the US system doesn´t to the same extent. This synergistic property, however, does come with a change in the form investment - notably

time and effort - in establishing and maintaining the employment relationships that makes the firm machine run efficiently (Hashimoto 1991). It is important to know that one cannot simply say that the one labor relations model is generally better than the other. Each has different characteristics which are both good and bad depending upon how we view the development of organizational technology in future industry. Will it require more frequent drastic work reorganization, in which case the A-firm may be better or can change be accommodated gradually, in which case the J-firm may be better?

The Swedish labor organization system - the old Swedish policy model - is entirely different. In one sense, it goes beyond the firm, and recognizes that firms have to change radically now and then, including complete failure and exit. In that sense it had a dominant, explicit insurance element that was solved partly through subsidized mobility. The other part of insurance was re-education, and here the Swedish solution, contrary to the Japanese and the German solution, was based on the assumption that retraining - like insurance - could be organized separately from work and run by government. Hence, workers´ retraining was gradually changed over the postwar period, away from a German type apprentice and industrial school system towards an organization of separate schools operated by the public sector.

The entire, old Swedish labor relations model had been gradually developed through experimentation over the postwar period, and formally documented in a number of joint publications of the Federation of Employers and the Central Labor Union Organization (see Eliasson-Ysander 1983). One clear principle was guiding, namely that business decisions should be taken where the appropriate competence resided. The old Swedish policy model can be summarized (Eliasson 1986b) as in Table 3.2.

This policy model functioned as a very relevant guiding principle as long as heavy hardware technology and large scale factory organization made up manufacturing frontier technology, and as long as manufacturing was the dominant value added creator in the competitive sectors of the economy, and

as long as (!) redistributional ambitions were kept at bay. One could even say that the model created enormous synergies between management and unions, that were very productive during the 50s, 60s and part of the 70s. Industrial change, rising redistributional ambitions and a growing aversion to geographical mobility after the green revolution of the 60s and the 70s, however, gradually removed the rational foundation of the old Swedish policy model. More specifically, it did not work with a large part of "production" being organized under the "protected" conditions of a huge and growing public sector, that appropriated a growing part of value added created in the economy. Since the early 70s the old Swedish model has been replaced by something very different, and not really worth a separate story. Increasing international economic integration, increasing mobility of capital and competent labor have made these types of government run systems, forcing massive redistribution of resources through the public sector unmanageable and detrimental to macroeconomic performance.

The four labor organization and training systems above reflect four different solutions of the normal retraining needs of a viable growth industry. The German and the Japanese systems both recognize that labor is risk averse but willing to pay for its retraining. The social side is internalized as an insurance and differences in talent or receiver competence are handled through pay differences.

The Swedish model treats labor insurance and labor training in general as a market failure. The Swedish solution, however, has not been to try to overcome this presumed market failure through stimulating the market, but rather by taking over the production of educational services, and removing this activity from the work context into a separated classroom situation.

The typical U.S. model reflects the exact opposite, and little public recognition of the social problem. The presentation of the four schools is of course too simplified, but in these stylized presentations very different efficiency characteristics can be identified, depending upon how we interpret the labor

market training problem. Let us review available empirical evidence before we discuss this.

Firm insurance and internal education

To begin with we define the nature of education and competence demanded of individuals exposed to the labor market risks of the experimentally organized economy. We find that education, labor market insurance and job choice are joint decisions on the part of the employee. With labor assumed to be risk averse it follows that labor should demand insurance for labor 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 labor market risks is to acquire the appropriate combination of talent, education and experience.

Hence, risk neutral employers may find it profitable to extend both education and insurance services to its employees, provided that internal insurance and education business do not exert negative (external) effects on their main business. As far as we can see (see chapter 2) it does where synergies are not present i.e. when on-the-job training is not necessary to build unique firm competence. This means that firms prefer not to organize training in tradable worker skills, but find it necessary (if well organized) to organize efficient careers.

Insurance has many dimensions. Two are important in this context. First, there is a standard coverage for normal labor market risks; loss of job, job accidents etc. Second, internally provided education increases workers' ability, and lowers his or her labor market risks, notably the risk of losing a job and/or of not getting a new job. Hence, the provision of labor market insurance and internal education appears as joint production.

There is a fairly large socially oriented labor literature that deals with labor risks, union organization and internal labor markets. The interesting literature emerging within the IO field on the other hand does not deal with labor strife and conflicts but with the more fundamental questions of the possible *existence of a rational foundation for making insurance for labor market risks and internal education part of the internal firm business portfolio*. If this rational foundation can be demonstrated to exist, there is a case for sustainable, mutually beneficial contract relations between employers and employees to form spontaneously in the market, a possibility that might earlier have been concealed by the moralist literature in the field and prevented by regulations. As it appears, the insurance problem has to be studied simultaneously with the internal training and production control problems.

The first set of studies was oriented towards explaining the upward sloping (with seniority) wage schedules observed. There were two (in the literature mutually exclusive) explanations; internal education (Mincer 1962, 1991 etc.) or an internal implicit contract, providing job protection, and a stable lifetime income (Lazear 1981). It is interesting to observe how each author advocates one side of the insurance or education contract, playing down the other, while obviously both – I argue here – are in play simultaneously.

Consequences of internal competence development

The conventional idea (since Becker 1975) has been that firms do not provide general education in portable skills to workers, since the workers would then leave for other employers that pay more, since they don't have to carry educational costs. We have already observed (p. xxx) that this proposition is too simple to hold water.

Besides that, in its simplistic Becker form, the jump job hypothesis is rejected by facts: Feuer-Glick-Desai (1987) report that:

(1) workers whose firms pay for most of their post graduate course work do not necessarily earn less than workers who pay their own way,

(2) when firms pay for this education, separation rates are lower.

Apparently there is a mutual benefit that makes firms pay and employees stay. Feuer-Glick-Desai (1991) propose an insurance explanation. They find, first that employees, who receive firm financed internal education tend to stay long. Furthermore their separation rates are lower. There is so to speak a lower incidence of lay offs. Hence, firms offer trained workers the expectation of long-term employment, which workers buy at the price of a lower pay, even though they have received a general, firm financed training that has increased their tradability in the market. F-G-D (1991) explain that in terms of a lowered bargaining position in an internal labor market, which is a way of restating the proposition on internal retraining that Lazear (1981) rejected. For me the same results would emerge from the assumption that the employee is more risk averse than the employer and/or that a lemons market prevail such that outside employers do not understand the competence of the generally trained individual, and, hence, offer less in wages than the current employer is happy to pay (see my argument in section xxx). This is what F-G-D (1991) call the insurance hypothesis.

Human capital theory and imperfect labor markets

The labor training issue has a relatively long, *incentive to learn* oriented tradition in human capital literature. Becker's (1975) argument was that general training is a public good that would not be provided by firms, if 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 logics of this argument has, however, been theoretically rejected in cases where general and specific training are provided jointly (Glick-Feuer 1984), where firm provided

education is a form of insurance (check Feuer-Glick-Desai 1991) and when the quality part of the labor market has lemons characteristics (Eliasson 1992, pp. 110 ff). The latter appears to be a case general enough to render the original Becker proposition invalid.

Mincer (1991) is, however, satisfied with keeping the human capital assumption, and concludes that more than 10 percent of the U.S. wage bill is made up of On-the-Job Training (OJT) and that OJT accounts for most of the observed increases in individuals' earnings over their working lives. Indirectly, his human capital conclusions (p. 16) can be 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 turnover and the lower the incidence of unemployment. This is a restatement of the Mincer-Jovanovic (1981) "duality hypothesis".

Mincer (1991) also concludes – and this is important (cf Eliasson 1992, pp. 86 ff) – that (1) the more prior schooling, the more OJT and (2) the faster technological progress, the more training is provided by the firm.

The more training, the longer tenure results were also reported by Stafford - Stobernack (1989) for high tech industries. They concluded that sophisticated firms need trained and experienced workers, not fresh college graduates. But without good school grades (Eliasson 1992, pp. 86 ff), the workers won't receive training, or rather won't be capable of being profitably invested in.

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

While the by far most expansive public labor retraining efforts have been enacted in Sweden, Björklund (1989a,b; 1991a) observes, resource use on the

average reaching some 3 percent of GNP, and in recessions far more, little effort has been spent on evaluating the effects of these programs. The situation is exactly the opposite in the U.S.; very small public resources being spent on labor market training, while relatively much more than in Sweden has been spent on evaluating the little that has been done.

In retrospect it appears that the U.S. approach may have been wise. You have to know what you are doing when you enact very ambitious policy programs. And the knowledge that exists on a usable format comes from the US. Let us see what US research has to tell.

U.S. experience of education and labor market training

Blau-Robins (1987) observe that there are normally no positive (wage) effects of publicly financed labor market education. They argue, however, that these negative results may depend on the fact that practically all empirical studies are public. If you use a general equilibrium model and also recognize the scale of retraining programs, the results may be altogether turned around. They find strong positive effects of public high school vocational training programs on the marginal return to training, but they also observe a negative relation between the income effects and the scale of the program.

Kang-Bishop (1989) observe that prior high school education matters importantly for the wage of a worker. Educational specialization exhibits decreasing returns. Vocational training, education in basic academic or communicative skills have to be mixed appropriately. A student without plans to go on to college ought to take vocational courses - however, not only vocational courses.

Lynch (1990) finds that OJT figures importantly for 70 percent of all new workers in the U.S. without a college exam. She continues to note that a new employee (without a college exam) who wishes to receive wage increasing

internal education, first has to finish high school with a degree and second should have some form of post high school education. This is particularly important to get an opportunity to participate in firm sponsored external education programs with no specific job orientation, a form of education that appears to be on the increase (Lynch 1990, 1991) and also increases the worker's possibilities to make a career towards better pay within other firms.[12]

Lynch (1992) summarizes the properties of different training programs. On-the-job training appears to be highly firm specific in the U.S., and not portable. It hence raises wages on the current job, but has no effect on wages in subsequent employments. Off-the-job training, being less specific, on the other hand, has little effect on wages on the current job, but raises the expected wage in subsequent employment.

Experience from Swedish labor market policy

The enormous size of the Swedish labor market policy budget – 3 percent of GNP on average – makes one inclined to think that perhaps something could be learned if more research was devoted to evaluating the effects of the Swedish programs. An important question relates to the negative macroeconomic side effects that may follow from such large infusions of resources in the economy if not done with the right touch of insight, (see Eliasson–Taymaz 1992). The little that has been done in Sweden, makes it necessary to complement with U.S. research results to understand what is happening in Sweden. There is no reason to believe that human behavior is principally different in the U.S., only conditioned by different environmental circumstances. Furthermore, and very important, U.S. research has been rapidly

[12] This should be distinguished for the complementary general education that a few firms offer workers that have dropped out of high school. It appears to be a handicap to be a woman or non-white if one desires to be offered such compensatory education opportunities.

adopting the modern IO methods, while Swedish research is still heavily into socially oriented unemployment research, strongly influenced by human capital assumptions. Such assumptions furthermore mean a positive bias in favor of traditional Swedish labor market policy that emerges, possibly unintentionally as empirical results. Hence, a reinterpretation in terms of the U.S. methodology is clearly warranted. When done, the U.S. results reappear in a stronger form for Sweden, because the Swedish labor market programs have been so much more ambitious. It has, in fact, now and then been softly asked, whether or not Swedish labor market policy has reached such dimensions that the social and economic consequences on the margin are negative. Since the results of labor market training, or retraining, appear to be strongly conditioned by labor market search, labor market pricing and closeness to job context, let us go through both the mobility and training issues in turn.

Mobility in Sweden

First, Holmlund (1984) and Björklund–Holmlund (1989) observe that labor market mobility has a high private pay-off, especially if initiated by the individual early in the job career. But also employer initiated pay-offs which force the individual to move appear to have non-negative wage effects, as long as the employees move and make sure they find a permanent job.

In an earlier study on data for 1971 and 1975 Dahlberg (1978a,b) compares workers who have enacted (subsidized) moves with those who stayed on their jobs in northern Sweden. It pays to move as long as you do not return to your old job. To stay on in local employment programs definitely does not pay in terms of wages. Another study from middle Sweden (see Björklund 1989a,b, 1991a) demonstrates that intensified efforts on the part of the local labor market agency significantly shortened unemployment spells and increased the probability to find a permanent and better paid job. In a similar econometric study on data for northern Sweden Ohlsson (1988), however, finds no significant improvements beyond those achieved through the regular labor

market service (op.cit, p. 168). A third study of unemployed youth in four cities 1984 showed that temporary public jobs or subsidized private jobs increased the probability to find a permanent job, which was not the case for relief works, labor market training or any other educational activity.

Apparently intensive and taylor made search and better information improved prospects for the unemployed. This search and matching process becomes more efficient, the better informed potential employers are about potential employees. Such improved market information reduces labor market imperfections. There are of course potential selection effects to consider. Most important, however, in this context is that this improved information concerns a quality developed through education and training, making *labor market search and labor market training a joint activity.*

Labor market training in Sweden

While the results on labor market agencies are inconclusive, the results on labor market training are even negative (Björklund 1989a, Björklund–Moffit 1983, Axelsson 1989, p. 340). To be unemployed, on the other hand, also had significant negative effects on the probability of landing a future job.

Axelsson (1989) reports on positive wage effects which, however, appear to be biased by selection effects (Björklund 1991a) due to specification problems in his econometric model. In general these models are based on simple human capital assumptions, which make the results suspect, in particular when wage effects are reinterpreted as productivity effects.

Axelsson (1989) observes that, however he measured, the effects of labor market training programs were negative. 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 labor market training but imposed human capital

assumptions to use income as a proxy, hence also obtaining 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 programs.

Axelsson is aware of the risk for selection effects. Those who enter Government sponsored labor market training have a lower than average general education. As we have observed elsewhere this should mean a lower receiver competence for labor market training than average, and hence small positive effects. If general receiver competence acquired earlier at school is in turn very much a matter of prior talent, the question arises to what extent it is worthwhile to complement labor market training with general education. If in turn publicly financed training carries a stigma, it is possible to build a strong case for a negative overall effect of publicly financed labor market training, if a negative selection dominates the participants in such programs. We don't know, but the magnitude of resources allocated in Sweden on moving troubled people through such programs suggests that this possibility is carefully and rapidly checked out. In a recent study Axelsson and Löfgren (1992) have tried to do a bit of that. They try to control for the negative selection effects characterizing the participants in labor market training compared to the population of normal searchers in the labor market. They restrict their attention to effects on yearly income, a measure that reflects both changes in employment (hours worked) and income, effects that cannot be separated. There is no real change in the earlier (1989) results. No significant relation is found between yearly income development and completed educational spells of different duration and skill orientation.

The negative conclusions on the effects of labor market training as currently provided apparently dominate literature. In an early and by modern econometric standards perhaps somewhat primitive study Dahlberg (1972) observes positive income effects of labor market training with older (above 25) people, who get a job in their field of training, compared with individuals with the same training that had to take a job in a different field (op.cit., pp.

87ff). Dahlberg also observes that those persons that have had the opportunity to use what they have learned, also have gained a reduced exposure to the risk of lay-offs (op.cit., p.168).

Small scale preferable

Edin (1989) and Ackum (1989) find no positive effects of labor market training. An internal study by *Trygghetsrådet*[13] finds that internal education to be viable and to open up jobs has to be tailormade for the individual, but not at all necessarily long. The main thing is that education is coordinated as a package and is concluded by an exam (a form of certification) and preferably a job.

Two conclusions can be made here. These negative results have been obtained from econometric studies on data from labor market programs run *as currently organized*. There is a strong a priori case for expecting labor market intermediation and training to provide positive allocation, productivity and welfare effects. Hence, there is a strong case for expecting other organizational forms of this activity to be better than the currently prevailing ones. Second, and reinforcing the above conclusions labor market search (intermediation), labor market training and labor market insurance are joint production activities, best organized on a *small scale,* that allows all the individual adaptations that correspond to the heterogeneity of the labor force.

5.3 The problem of the disadvantaged

In general, labor market studies show a strong bias towards investigating people with labor market problems. The reason probably is that public

[13] The SAF–PTK *Employment Security Council* is an organization for placing laid-off white collar workers, jointly sponsored by the Swedish Employers' Confederation and the Union of Salaried Industrial Workers.

financing of such research also has the same bias. This may, however, mean a negative efficiency of labor market research as well, since research results drawn from data on people with problems cannot possibly include the information needed to understand the problems normal people have, which is necessary to understand how low quality people can be upgraded to a normal work situation. Information on successful, retraining programs of normal people is required for a full understanding of the competence needed on jobs.

The disadvantaged need help very early

The most common way of solving the problem of the disadvantaged in the labor market, in fact is not to begin until the problem is acute and the person unemployed, Bishop (1989a) observes. His survey of public retraining and labor market programs in the U.S. clearly identifies one problem. Those who receive public labor market service also get a label (a stigma) that warns the potential employer about problems if he hires the person. If somebody has got into a publicly financed labor market program, the probability is high that he is not a productive worker, something that employers soon learned. And the general attitude of employers became to avoid such people, and in doing so they use very simple filters, that are likely to reject even high quality people that have happened, by bad luck, to be stigmatized in a labor market retraining program. This filter mechanism, hence, works even though retraining has made the worker more productive. In fact, Bishop reports on positive productivity effects from public retraining programs.

In order to soften the stigma effects, a common attempt, pursued most systematically in Sweden, has been to make Government labor market services and retraining include all, by taking over and monopolizing these institutions. The consequences, in Sweden at least, have been to increase the number of people employers are reluctant to hire and to lower the quality of the training etc. services. This approach is contradictory in itself. The experience reported

is that a large number of people do not need any service at all but may be lured, by generous benefits, into programs that they should stay out of. On the other hand effective labor market service for the really disadvantaged requires intense, tailor-made and very costly efforts by the agency, of a kind that cannot possibly be expended on but a small number of people and in small scale, professional operations.[14]

Another important observation is that the really disadvantaged in the labor market carry their disadvantage with them from early school age and the family. The time leverage is enormous and almost impossible to correct later in life. (See XXX) Remedies should therefore be prevented and begin, at the latest, in secondary school.

Lynch (1990) observes that U.S. firms sometimes (8 percent of 645 observed firms) offer general internal education to "high school drop outs". She finds this low figure expected, since general internal education increases the probability that young workers take better paid jobs elsewhere. This, however, is not the case for job specific internal education. The job change effect is particularly strong when the worker has been offered (by the firm) the possibility of commercially based general education outside the firm. Lynch (1990) interprets this as evidence that this type of education reinforces the signal that he or she is a good worker and improves his or her probability of getting a better paying job.

While Ritzens (1991) argued that "the market fails to provide the socially efficient amounts of general training" may be correct as stated, this does not exclude that we perhaps have to deal with the far more serious non-market failure in Government training program suggested by this overview and reinforced by Hansen's (1991) survey. If both types of failure exists there would still be a case for Government policy, provided Government knows

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[14] See Eliasson (1992a). Also see the suggested method to minimize the stigmatization problem using economic incentives for the retraining institution in Eliasson (1992e) and in *Ett Hav av Möjligheter*, SOU 1992:123.

what it is doing, a conclusion that can not be drawn, on the basis of the advice it can get from the research community. The over all conclusion I may allow myself at this stage is that Government should cooperate with the market, rather than try to beat it and organize everything on its own.

Selection effects – and the two markets for labor training

It is important to keep two dimensions of competence development and retraining apart;

(a) industrial growth and individual labor market success require human competence. Hence, significant competence and retraining activity should be a viable commercial activity.

(b) Human beings differ a lot in their ability to upgrade their competence, to the extent that not all individuals are profitable educational investment objects, neither for employers nor for themselves. This is not a case of market failure, it is a social problem, and the decision to correct it with subsidies is a policy problem, that should be covered on a separate account.

Quality differentiation in the labor market is a serious problem that will increase if

a) competence demand in the job market keeps increasing

b) the ability to receive education profitably (receiver competence) differs significantly among individuals.

c) this receiver competence is talent based rather than education based.

If a) and b) but not c), better education is the solution. If c) as well, the problem is *more* fundamental.

In addition, to the extent

d) *receiver competence* can be developed, it takes a very long time and has typical leverage characteristics.

The leverage characteristics are such that certain basic communicative capacities are decisive for the later efficient acquisition of particular skills. This makes competence development sequential and places *school* in focus as the early primary policy institution. *How should school be organized to prepare for later efficient learning on the job?*

Since early entrance into the labor market constitutes a learning experience in itself school has to compete with work as a different, but still viable competence development institution. A bad school may therefore be worse, especially for the disadvantaged than no, or only little, elementary education, because it keeps the young person away from a better training experience on the job. Modern youth spend their most receptive (learning) years in an artificial classroom environment, subjected to little of the pressure they will encounter in the job market. If the school is bad, for twelve years they may learn little, but acquire bad discipline and work habits, making them less attractive for employers. This is a particular worklife hazard for the disadvantaged student, who will be restricted to employers that ask for hard manual work and discipline. The talented students that continue through higher education are in an entirely different situation.

Evidence on the effects of various forms of education or variously endowed individuals is inconclusive in this respect. The research program of the last chapter, however, aims at shedding light on the contributions of different types of education to economic growth. The important lesson to learn here, however, is that education cannot do it alone. It has to be supported by well organized labor market and social insurance policies. Some research, reported in earlier chapters indicate the possibility of serious misallocation of educational resources in the sense that more resources to primary and

secondary education, and less to higher education, might improve macroeconomic performance. The exact nature of that possible misallocation remains to be investigated in the proposed research agenda. Suffice it to note, here, that for every dollar spent on a student in secondary education among advanced industrial countries, almost twice as much is spent on each student in higher education.

The question has also been raised that not only the less educated, but also the disadvantaged should be subjected to more schooling to compensate for their disadvantages. Such practices occur in some labor market training programs, and in the old days it was common-place to force students that performed badly to repeat one grade (year). There are two sides to this issue.

(1) Is it economically rational (profitable) in terms of relative growth contributions to shift more resources to the less educated or disadvantaged.

(2) Should this be considered socially desirable by some other criteria. If so, exactly which.

In any case, evidence from the job market does not suggest more school years but a different and more demanding school, or earlier entrance into the job market where learning also takes place, although the consequence will be a permanently lower quality work experience. For such students (drop outs) the signalling effects in the job market (stigmas) are particularly devastating (see for instance Lynch 1992b).

It thus ought to be recognized that even though I have emphasized the importance of channeling the young generation through an efficient and demanding schooling system from the very beginning, the problem of the disadvantaged so far remains unsolved. However, whichever education and training they receive, *the clear conclusion that can be drawn is that a bad early school experience (sloppy students or bad school) will hit the disadvantaged harder than the talented individual.* Therefore, whether you have a positive or

a skeptical view on the capacity of schools to solve the human quality problem, a more demanding, and efficient basic and secondary *schooling is still relatively better for the disadvantaged.* Hence, if the current discussion of a deteriorating basic schooling system corresponds to a reality it forebodes bad times for the disadvantaged in society.

5.4 Summing up on labor market policy

Let us assume that positive productivity and income effects are the objectives of education and labor market training, not to provide an artificial source of income for the unemployed or to reduce the official number of unemployed. Research results then tell that education cannot do it alone. It has to be supported by adequate labor market organization and an efficient social insurance system that stimulate labor market mobility. Intensified and tailor made job search programs and training programs should furthermore be merged and restricted to a small number of people with problems, and be coupled with tougher demands on effort, motivation and initiatives on the part of participants.

Above all, labor market search, intermediation and education are not provided efficiently in large scale organizations. Volume production of labor market services (training, intermediation) appears to be a particularly inefficient form for the disadvantaged.

We also know from many studies that work itself is the most efficient form of education. The Swedish organization *Trygghetsrådet*, that offers tailor made programs to get unemployed salaried workers back to a job or to start their own business, therefore appears to be an efficient form of getting people re-employed. It should be observed in passing that the Swedish system with a Government monopoly in labor market services is an inefficient form of labor market service, notably for the disadvantaged, not only because of its large scale volume production, but because its protective (from competition) status,

which makes it unable to develop through experimentation the varied supply of individually tailored services that are demanded.

If, in addition, stigma effects are associated with participation in such Government subsidized training and job search programs, participation will be a negative signal in the market, even though it contributes to job productivity, and increasingly so the more such programs become populated with disadvantaged people, because normal employees stay away, to avoid stigma labels.

The conclusion therefore is that large scale, government sponsored monopoly programs to solve the problems of the disadvantaged may have a problem with their organization, and may do more bad than good on the margin.

The recent Swedish committee on labor market training, charged with the task of giving the program organization a corporate status and to prepare for its later privatization has learned these lessons (Eliasson 1992e, and *Ett hav av möjligheter*, SOU 1992:123). It is observed that social insurance related to unemployment, retraining, education and retirement in a large measure is a form of reshuffling of income over the individuals' life cycles, but that the reshuffling – as it is now organized – takes place over a large number of public tax and subsidy accounts. The committee concludes that to stimulate the individual effort and motivation needed for successful training, these accounts to a large extent should be managed and controlled by the individual, not in the least to prevent him from becoming unemployed before becoming eligible for financing of retraining from the labor market bureaucracy. The proposal is that the individual on his own initiative can freely use the accumulated savings in such an insurance-retirement account for education and training under certain conditions. The individual pays part of the costs himself through drawing on his or her retirement wealth. He can decide himself when and where to receive training. The Government is prepared to part finance this program, varying the subsidy according to the situation. The idea is to increase motivation and support more informed decisions by making

the individual more responsible for himself. If the individual chooses the appropriate training, he should later earn more to be able to recoup the investment for his individual account. His higher competence should make him more productive. Hence, there should be neither private nor social costs associated with the program (Eliasson 1992e). The committee argues that the problems of the disadvantaged and of stigma effects can be solved in a more efficient and reasonable way within its proposal, than in the current system.

While researchers have had difficulties finding direct positive effects from the labor market programs, Björklund-Holmlund (1991) diplomatically conclude that the enormous Swedish labor market programs at least have kept open unemployment low, as we measure it.

This raises the interesting problem of whether a very low open unemployment of the Swedish type is something positive in itself, and whether it is very important to keep people formally on the job, whether they produce something or not, rather than separating them from the workplace, when there are no profitable tasks for them at the wage they demand.

For *one* thing we have to ask whether an extremely low unemployment rate is good for the macro economy in the long run (Eliasson-Taymaz 1992). *Secondly*, while it is recognized that work is the best post school educational experience, this means productive work, not only presence at the workplace. Being in the way for others that work, or simply idling at the workplace, may be as bad an experience for the unemployed as it is for his or her colleagues and the employer. In such a situation, being compelled by circumstances to look for a job, to market oneself and to learn may be both the best long-term solution for the individual and the best work experience he can obtain. At least, it should not be excluded from the experimental labor market policy program that the current situation warrants.

In fact, while Björklund (1989b, 1991a) observes that more research is needed for labor market authorities to know what they are doing, it may nevertheless

be impossible to learn what is needed if direct experiments - as in the US - are not allowed.

I want to emphasize that this point of view on research methodology is identical in principle to suggesting a market solution to labor market policy, to overcome the deficient innovative capacity of a standardized central management under monopoly market conditions. To try different labor market experiments for systematic scientific evaluation is not principally different from allowing and providing incentives for a number of private institutions to compete for labor market insurance money through *innovative* product development. The scientific experiments are more conservative focusing on systematic evaluation while the market solution is more innovative, but lets the clients of the system determine what is good or bad. The clients are the participants in the labor market programs. Hence, an efficient market solution makes it necessary to allow them to choose, not, as is still the case in Sweden, run those decisions through a monopoly Labor Market Board.

For Sweden the efficient solution that maximizes the welfare for the participants in the program would then be to break up the centralized labor market policy apparatus into a number of independent, competing producers of labor market services, including labor market insurance, that can initiate, develop and try new different solutions to labor market intermediation, education etc. in competition with one another. A market solution like that is probably the only way for government to learn to organize the institutions of the labor market such that the enormous resources currently provided even under normal circumstances, are efficiently used.

Table 5.1 **Distribution of labor according to quality in the US and Sweden.** Percent.

	USA 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, laborers	34	38
Total	100	100

Source: Eliasson 1990a, p. 76 and 77.

Table 5.2 **The old Swedish policy model**

1. No central policy involved in production and investment decisions
2. Open economy, subject to competition (free trade, free introduction of new technology in firms, free entry).
3. Active labor market policy, including solidarity wage policy. Move people to the jobs.
4. Fair distribution, 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?

The economies of the industrial world are currently facing a dramatic transformation of their production systems. The base of their welfare, an almost 150 year old industrial technology is rapidly being learned by the non-industrial world and the recently liberated Eastern European economies, forcing obsolescence on large cadres of workers and management.

At the same time new industries, with some exceptions have been slow in coming, exposing the Western world to large scale employment of long duration, and worries about job-less growth.

Lack of competence at all levels, by definition is the origin of this transformation crisis. If not solved through appropriate competence development and structural adjustment it will be automatically corrected through inflation and downward real wage adjustments, creating new social problems in addition to unemployment.

Competence development, hence, has become the buzz word among politicians. It is probably also the appropriate political signal. Competence is the origin of the problems of the economy as well as of the individual. On this we can believe the theoretical chapter I. As the previous presentation shows, it is, however, by no means clear what kind of competence is lacking and what politicians can do, and should do to improve the situation. Above all, education cannot be viewed independently of the allocation of competence, which occurs in the labor market. And the efficiency of the labor market depends on the willingness of the individual to participate in that allocation

process, which in a large measure is a question of adequate social insurance provisions to reduce the exposure of the individual to the local hazards of market life. A good education and a varied job experience, furthermore, is the best such insurance. With education, labor market efficiency and social insurance being the triad of interdependent policy measures, we can procede to identify what exactly this means for policy.

Policy making directed towards altering the competence characteristics of the working population of a country *first* of all requires competence on the part of politicians and their advisors of a kind that nobody thought of demanding in the old days; a knowledge about how individuals function in more or less demanding work environments, knowledge of how a dynamic economy operates and knowledge about which educational and other policy levers to pull to achieve desirable results on growth. This information does not exist today. Neither is there experience to use it for policy making, were it to exist. Education, *second,* already draws very large resources in the economy. It is not obvious that the solution to a deficient educational system should be more public resources, but rather a differently organized schooling system. This, differently organized schooling system, *third,* cannot be implemented in isolation. It has to be simultaneously supported by a reorganized labor market and an appropriately remodeled social insurance system. This reform (*fourth*) has to be based on the incentives of the individual to become effective. This (*fifth*), policy takes us into the tangled web of institutions and interest groups currently representing the individual on too many tasks, and being significantly in control of the distribution of income in most economies, the most powerful incentive instrument. The key task is to *charge* the *institutions* of the market that *enable* and *stimulate* individuals in their search for interesting and rewarding work experiences. Current research gives no role for earlier, mechanistic parameter adjustment target policies.

6.1 The economic welfare of a nation – a question of labor market ability and insurance

Economic welfare has something to do with the total production value of an economy. GNP is often viewed as a cake available for consumption. But individual welfare also depends on its distribution, i.e., on who contributes to what, and who gets what of the total cake. In order to carry on economic policy beyond the ambition to promote the interests of particular groups at the expense of others, some generalized welfare measure is needed that captures the costs and benefits of political action. GNP, despite its deficiencies, still carries some information on national welfare, if reinterpreted.

First of all, GNP per capita can be interpreted as a productivity measure, i.e. of how much output a population is capable of producing on average and a measure of *resources available* on average to each citizen (Eliasson 1991 pp. 29ff). Thus GNP per capita measures the resources or opportunities an economy offers its inhabitants. Individual welfare then depends on the individual and political competences to exploit these resources. The ability to capture economic welfare in an economy thus depends on the

(1) competence of the individual to exploit opportunities, which both increases growth in GNP, and increases with growth in GNP.

(2) competence of the individual to cope with unexpected change associated with growth in GNP.

Typically associated with economic growth furthermore (*second*) is a steady, and largely unpredictable change in the composition of GNP, creating social hardship for some in its path. Unpredictability here means not being able 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. As with accident and illness a considerable element of (random) luck is associated with economic success. But random failure is part and parcel of the same process. The faster economic growth the larger the change enforced through the labor market. Returning stagnant mature

economies to growth will make the hardship of adjustment come before the benefits and the opportunities, Myopic, risk averse individuals, especially of middle age and up won't accept this politically.

Hence, economic welfare is very much a question of a properly organized *insurance* system (Eliasson 1992a). Unemployment insurance is its perhaps most important part. This means that the basic welfare policy task of Government has to be oriented both towards supporting (1) *competence development,* and (2) *insurance* for the negative consequences of a successful growth development. The first task is difficult and the subject of this study. The second, being a natural task for Government, has a long tradition in European welfare economies. It is easier for Government to find a well defined policy role in social insurance than in education. Since the two tasks are not independent, I will return to the social insurance theme at the end.

Educational and insurance institutions operate as *infrastructure capital* in an economy. They add capacity to perform to the individual as well as to all other individuals. Together they use up a significant part of the resources of an economy. Once the nature of the competence capital that contributes to economic growth has been identified it becomes important to identify the *incentives* that make individuals and firms invest in their own competence development and the *insurance arrangements,* that facilitate for the individual to take long-term investment positions in his or her own future, and to investigate the efficiency characteristics of such infrastructure provisions. We have found that this very much is a matter of how the production of these services is organized, notably the relative engagement of the public sector in their provisions. Here the policy problem enters very directly.

The previous analysis does not suggest that educational policy should allocate more resources to education, but rather change the ways educational production is organized, notably the division of work between individuals, firms and public authorities.

By this account the provision of education for competence enhancement and the provision of social insurance arrangements seemingly become a joint political task. This is so in particular since a good education is the best social insurance for the individual in a demanding labor market.

In order not to complicate the presentation, however, I will focus this policy section on the provision of educational services to enhance individual competence for economic growth. Certain clusters of policy attention can then be identified. They all refer to the institutions of the economy, notably those institutions that regulate the trade-off between today and the future. They relate to the *specification* of the educational product, to the *incentives* to learn and to the *efficiency* of the production of educational services. Since the final rewards for competence depends on the individual's possibilities to find the right job in the labor market, an important part of policy is to allow for the institutions that *enable* him or her to do so, and to *remove those institutions* in the labor market that prevent him or her from finding the best match with an employer. The more efficient this labor market search process the larger the total economic value created in the production system.

6.2 The nature of human capital - a matter of tradability

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 recognize two dimensions;

(1) *Dynamics.* Educational output is always an input in some further development of competence.

(2) *Redundancy;* more than any other type of capital, human capital is characterized by being extremely redundant in any application.

Contrary to machines, only a minor fraction of human competence is being used in each job application. Human beings are therefore, to use the proper expression, always overeducated and overcompetent. This defines the comparative advantage of human beings and explains their flexibility in a job context. Such overcompetence should be an objective of the educational process, since it creates flexibility and ability to respond intellectually in a broad range of job contexts. The extreme complexity and redundancy of human capital makes it impossible to assess it properly. Much of it is tacit, because of its complexity and most of it has never been exhibited in application.

This observation allows a few strong conclusions.

First, the labor market is a market in human competences, a market that will always be very imperfect and incomplete, due 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 labor market search process, hence should never end.

Third, we know that the returns to competence earned (the salary) are earned solely from the competences 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 competence development, 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 suggests a long term danger of specialization. You may earn an extra rent by placing all your competence development into a narrowly specialized range, at strongly diminishing returns,

but that will diminish the redundancy of your intellectual capacity that makes you flexible and more able to learn more.

As pointed out by Ysander already in 1978 the heterogeneity of human capital has made it intractable for traditional economic analysis. Hence, to get around the problem homogeneity is traditionally assumed, an assumption that removes all important features of human capital and reduces the educational policy problem to choosing the *volume* of resources to invest. This misunderstanding, conveyed by the economists to the educators explains the gigantic policy failure of school politicy in the 60s and the 70s. The current economic situation is too severe to allow such a policy failure to be repeated.

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

6.3 Educational product specification

The first policy question is: do we know the specification of educational output demanded in the labor market? The answer is: not well.

The standard package student

Heterogeneity of output and lack of understanding of what is learnt at school is put to use in the labor market and has forced educators to specify the educational product through specifying the teaching agenda, relying on regulation and tests to achive quality, and subsidies to make enrolment attractive. This approach very much resembles the quality control apparatus of just-in-time production, with the significant difference that the raw material

of the educational process (students) is extremely heterogeneous and should be extremely heterogeneous, while components for just-in-time production have to be exactly defined and identical. The school agenda view promotes standardization in production (teaching). When applied to a heterogeneous student material, the consequences, will probably be a lowering of the average level of quality. It will furthermore mean that diversity of the educational process is reduced. Hence the schools will have little to learn from one another. Privately organized education and training close to jobs, on the other hand is typically characterized by uncertainty about the final product specification desired. Firms engage in extensive experimentation to achieve the right competence improvements, and make participation in company provided education part of the possibility to go on in a career. A business firm achieving success in its internal training program will immediately be studied and imitated by other firms concerned about their competitivness.

The previous empirical survey suggests that educational choices should be individually made in order to efficiently incorporate the particular characteristics of the individual. If an equal output specification (equal standard competence) is desired the educational input has to be tailor made. Our first conclusion is that this is *not* a desired result.

Individual risk aversion causes educational myopia

Even though most studies show that education is profitable in comparison with other investments, and that primary and secondary education is both socially and privately very profitable, especially in backward economies, the willingness of risk averse individuals to privately take on the risk of such investments is considered low. Hence, countries and notably wealthy countries spend very much on subsidizing schooling and/or on operating different institutions of education and learning. A large part of these public engagements have been motivated by the ambition to provide education for the disadvantaged, that is those individuals that would not take on the risks associated with investments

in education, expecting private returns to be very low. In order not to stigmatize the disadvantaged it has been typical not to organize their education in separate schools. But to run primary and secondary schools with a very heterogeneous student material, all costs being subsidized by Government, and incentives of students to perform, hence, low, is not an efficient organization of school production. As public education programs are becoming increasingly costly and inefficient, and at the same time increasingly important for the efficiency of other production, serious concerns are being voiced and political pressure stepped up to do something. Studies have furthermore been conducted that show that even poor people would be 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 softened, the discussion has focused on the possibilities of mobilizing individual talent and incentives in the educational process to increase the supplies of economically useful competences. The previous survey of research confirms that policy has to recognize that if incentives to choose the right education and to mobilize enthusiasm and effort at school are not strong and properly directed, the quality of education will be low. The policy technique will have to be to increase private financing of schooling *without* creating underinvestment in education.

Is there a political role in supporting long-term decisions?

The above analysis gives Government a role in supporting long-term decisions on the part of individuals. Practice has, however, been restricted to financial support without ties. Such subsidies reduce incentives to mobilize individual efforts to learn, that may sometimes even create a negative educational output compared to a system where all educational financing is private. This problem has been studied extensively in other policy areas, for instance investment subsidies. The results on informed policy making are not altogether encouraging. In education we also have the social problem to consider. Summing up, however, the under-investment hypothesis boils down to the question whether

risk averse and myopic firms and individuals spend too little on educational investment account, and how a Government policy support can be organized without decreasing decreasing effort, such that increased total investment does not result in a lowering of school output.

Social capital

The family and school are important institutions that carry the wealth of social capital infrastructure of a country from generation to generation. If people of today are worried about the development of a myopic society, they should also be concerned about which social codes of behavior are being passed on to children *within families* and *through school*. Educational policy cannot be formulated independently of policies affecting family formation and disruptions. The best educational policy may be nullified by an adverse development in the family sector.

The willingness of the individual to take a long term perspective is a critical success factor 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.

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 are removed from bad family environments. Since Western codes of behavior do not allow significant authoritarian intrusions into family life there are few policy remedies for children in families with a low endowment of social capital. This gives school an important role in correcting for unequally distributed family background. Again the empirical evidence suggests that this is much less a matter of promoting good academic learning, than it is for enforcing good behavior of

bad and disorderly students from the very beginning of, and through primary and secondary school.

School Agenda and human capital content - are there basic competences that everybody should have?

Some subjects have always been considered more important than others. This is partly a result of viewing school as a producer of final knowledge capital. Thus, school theoreticians, educational policy makers and school administrators have all asked the same question; What are the *basic competences* needed from school to go on successfully in life?

Evidence from research is not clear, even though indications are that certain parts of the school agenda are more important for work than others. There are three problems reported in the previous chapters.

- *Selection* makes it difficult to tell whether difficult math courses upgrade skills, or select talent.

- Particularly designed studies to identify such basic competences have not been carried out, only tests of existing hypotheses about what was thought on a priori, traditional grounds to matter.

- Some evidence is not supporting the general view that difficult math, and science courses, and teaching of communicative skills enhance performance in the labor market.

It is surprising to note that explorative steps towards such identification have not been taken. Examples would be systematic interviews of different employers about what competence criteria they use for screening applicants for various job tasks, and case studies on the job of what qualities matter for performance. I am not talking of the large number of aptitude tests on which

an enormous literature exists. They are often conceived as general intelligence tests that may or may not have predictive power for the job. I am talking of exploratory interviews at work locations with workers, their foremen and personnel people and careful case studies aimed at formulating hypothesis, not to test hypotheses drawn from theoretical literature.

Some of this has been done in conjunction with this and other ongoing IUI studies. Preliminary interviews, do not suggest the commonly held view that *advanced* intellectual capacity in math, science and communicative abilities - typical products of School - matter critically for job performance. It is rather abilities to work in teams and hard discipline etc that are demanded. But this preliminary result may depend on the selection of work places we have made. More research is needed here (see next chapter).

In business firms competition will improve product quality - why not in school?

Competition in industrial markets is through innovative product quality upgrading, and rarely - in the sophisticated parts of manufacturing - through price competition only. This product quality orientation is even more pronounced in private services, however not in services, private or public, that operate under protected monopoly conditions. This is typically the case of educational production.

The conclusion of the earlier chapter is that innovative educational service production will not be achieved under the standardized regulatory regimes that characterize Western primary, secondary and (in most countries also) higher education. The rationale for such regulation is no longer empirically valid, as the quality of educational services are becoming increasingly important for the economy and for the individual, and very costly to produce. There is only one policy way; namely to deregulate the schooling system and

allow experimentation and competition for customers (students). This argument has been elaborated at length in chapter 3.

6.4 Incentives

While product innovation and educational production efficiency play a decisive role for competition, incentives play the critical role in making it happen. The inclination of the young people to take a long-term perspective on their future is part of the incentive complex that determines educational effort. Social indoctrination from home and at school is important. But pure pecuniary incentives also are at work throughout school and the working life of individuals. Many of these incentive structures can be controlled through political action. The most important such policy parameters refer to the provisions of finance and of insurance.

The standard story is that incentives are such that individuals and firms underinvest in their education. But one can also turn this story around and ask the question: Is the existing competence capital of the country efficiently used?

Underinvestment in education is a matter of educational output

A standard story of education is that without Government subsidies *underinvestment* in education will occur. The conclusions emerging from research are that this may or may not be the case depending on what assumptions are being made in the analysis. There is even a story of *over*investment. There may be "underinvestment" in some individuals that is, however, too costly for society to correct, since a different allocation of resources for education to the disadvantaged would create less output.

The problem of underinvestment is complicated by the prescence of individual risk aversion, assymetric information, lacking receiver competence and low private incentives. There is a host of market imperfections that contribute to the underinvestment problem. Jacked up youth wages, for instance, which is typical for the Swedish labor market make it unprofitable for both individuals and firms to invest in education at the work place. 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.* There is in fact no good case for more public inputs in 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 organization of educational production may produce more competence

A principal problem is, who should be made responsible for the competence development of individuals; the individual, the employer or Government. The answer is, that without strong individual incentives and significant private financing underinvestment in one sense may occur; not because too small resources are invested (by the employer or Government) but because individual incentives to supply effort and keen interest make learning inefficient. The output of educational resources invested will be too small, because of an inefficient organization of educational production.

Since Governments in wealthy western countries already spend very large resources on education, one cannot simply conclude that more resources are needed. Perhaps the appropriate conclusion is to spend less and instead re-organize the production of educational services and its incentive structure to promote more effort on the part of students? One way to do that is to focus on the tilting of the *compensation schedule in favor of competence* and to look

at private financing arrangements with public guarantees (insurance) to overcome financing constraints and risk aversion.

Wage setting and the rents from educational investments

Many market imperfections prevent the appropriate educational supplies from being established. The most important market imperfection, however, refers to the correct pricing of competence. The educational rent to be captured in the market is the most potent incentive to move the young people to engage in long term educational investments. As Chapter 2 cleary demonstrated, the incentives to become more competent, with the exception of going on to higher education, are not very strong. Above all, to capture educational rents you have to wait for considerable time, much longer than people in their late teens are willing to do. Before anything else is done, the most important incentive for educational investments, is to give compensation schedules a very strong tilt in favour of competence. It may even be so that other educational policies will not work, if private educational rents are too small. Again, however, policy options are limited. The tilt we are talking of is primarily determined by demand in the market. And the competences valued in the market are not grades from school, but productivity on the job. Excepting modifications of the tax system, that reduce progressiveness there are few traditional policy instruments. The large policy potential lies in *changing the institutions in the labor market*, notably removing price discrimination and other imperfections, changes that will directly affect the very foundation of union activities.

6.5 Educational production efficiency

We have placed priority emphasis on the product specification and incentive problems of education. This emphasis comes out very clearly in literature even though literature gives little advice as to how to change the educational

process. Even though we do not have a clear idea about what output to strive for, and on how to increase incentives to achieve the same end we also have to look at educational production efficiency. We will then find that incentives play a critical role behind efficiency. Since a large part of schooling is provided by Government the efficiency problem becomes an important part of Government responsibility.

Apparently the potential for Government policy is to be found in the organization of education. Many of the deficiencies of the educational system, however, may be traced back to Goverment policy, notably its heavy regulatory involvement in the educational process. This, however, also means that there should be plenty of potential to improve the educational process, through allowing for different organizations, especially when it comes to the division of responsibilities between (1) the public sector and the market and (2) Goverment and the individual.

Since the preceding survey of research gives few guidelines on how to go about in this reorganization the efficient way is a gradual deregulation of the schooling systems, opening it up for experimentation and competition at all levels. This means *instituting competition as an instrument to enhance innovation and production efficiency in the educational system*. To be workable this means stimulating private competition by allowing it and removing public financing that discriminates against private initiatives. Research evidence very strongly supports that such institutional change be politically enacted.

Above all, however, the organization of educational production such that it supports the transition of students from school to gainful work is the first efficiency concern.

<u>How to improve school as a path to the labor market?</u>

Individual success begins with individual talent that is improved upon and affects future upgrading as the individual is filtered through the family, different stages of school and through the labor market. It is obvious from research literature I have gone through that the organization of education and of the labor market very much influences this filtering process. This organization is in turn dependent on a number of institutional factors that have been placed there by political design. A policy analysis of the production of educational services has to look carefully at these institutional characteristics. Before that has been done, furthermore, very little can be said empirically on the educational investment hypothesis. So much can, however, be said; if the filter matters, the organization of the transition from school to work should be studied carefully and research proposed to that end follows in the next chapter.

The efficient mix of public and private education

Part of the institutional design of educational organization and of the labor market is embodied in the differential mix of public and private solutions to the production of educational services.

The family is private. Most of primary and secondary education is in public domain, being regulated by school authorities, and run and financed publicly.

After high school the institutional setting among industrial countries begins to differ. We first have the split between students leaving for the labor market and students going on to higher education. On-the-job training is largely private and experimental. Higher education, with a few exceptions, is public.

Both categories meet very differently organized environments among the different industrialized countries. And the differences are very much dominated by the policy hand of Government. Hence, the filter characteristics of school and the labor market are strongly influenced by Government

regulation. But differences between countries are large enough to make country comparisons of educational and labor market organization interesting.

Paying for school?

Government is involved in education in three principally different ways; it *pays for* education, it *regulates* the educational process, and/or it *operates* schools.

Paying for school can be partial or cover all direct costs. Paying for school can be in the form of *subsidized schools, vouchers* or stipends to students or through *low cost financing*.

The reason for paying for schooling is clear; to overcome risk aversion among students, or bad home enviroments, or simply to promote more education. There is no prior reason for Government, however, to pay for all education, even though tradition has become to pay for at least all primary and secondary education and regulate the rest. For higher education practices vary. Research results suggest that there is a social value in subsidizing education, especially primary and secondary eduction, but there is also a private and social value in both stimulating more individual effort and enforcing more discipline at the same levels. Result reported in previous chapters indicate that a high subsidy level coupled with heavy regulation is removing both incentives and possibilities for individuals to do anything about their private competence, as long as they are in school, causing apathy on the part of both students and parents. There are thus strong efficiency reasons for establishing stronger private connections between who pays and who receives educational services in order to make each individual (and/or his parents) more responsible for his own education. Rather than paying taxes into an anonymous account perhaps a specially designed tax should go into a school account from which ones children can draw money, and also decide which school to attend. There could be a subsidy element in the early years, which would gradually be decreased, and be replaced by guaranteed loan arrangements as

the student enters higher levels of education (see Eliasson 1992d). Such arrangements of privatizing schooling can be tailored to achieve a good combination of incentives and equity and also overcome the constraints associated with risk aversion and myopia. Such a proposal of the Swedish committee for labor market training is in fact currently in the political process.

Financing school

Paying for the schooling of individuals blunts incentives. Financing part or all of schooling, through *guaranteed loans*, to overcome financing contraints, however, will retain some of the incentives of private financing without keeping students from engaging in educational activities. Again, a family financing arrangement through a family tax deferral account might do some of this, even though differences in family income might make it necessary to arrange for some direct subsidies. Alternatively, each student reaching school age could be given an account from which he can draw resources up to a limit for various educational activities (Eliasson 1992d, Fölster et al. 1993).

Running school

Why should Government operate schools? What particular competence resides in a publicly controlled educational system? There is no convincing argument if the financing system is appropriately organized, and there is definetely no good argument for removing competition among schools and making school a monopoly institution. The question is, however, rarely raised. Literature normally takes for granted that a public authority is operationally responsible for the educational institutions. Private schools and universities are looked at as exceptions, or with suspicion.

With education becoming increasingly important for the performance of the economy and for the well being of people, and with the performance of the

public schooling system becoming increasingly questioned, the dominance of public education will also be questioned.

There is one argument in favor of publicly run schooling, but of doubtful relevance. If students can freely choose and schools compete freely there will be long run selection effects such that good teachers and good students tend to cluster. In a privately organized market, however, the bad firms and the bad schools will eventually go out of business. Factories and shops will do that on the basis of consumer preferences being expressed in markets. Why not schools? The standard answer to this question is that regular people are not sufficiently competent to be entrusted with such demanding decisions as to choose school. The problem of quality selection, however, also occurs in Government run schools, though by other criteria than direct private choices, and through selective choices of housing (see Fernandez-Rogerson 1993). The fact that this occurs should be seen as evidence that some parents are taking the eduction of their children seriously, ambitions that should be respected and not blunted by regulation.

Regulating school

Whether paying for, financing or leaving school entirely private, Goverment has always had a heavy hand in the schooling business through regulation. Many reasons have been expressed for such regulations; to provide for equal opportunities, to standardize quality, to "make sure" that tax money is not wasted etc. The perhaps most far reaching regulation, compulsory schooling, refers to the individual, but requires the existence of schools to be enforcable. Since schools did not spring up everywhere spontaneously, Government stepped in and required of local communities to open up schools. The difficult thing is that such regulation was later modified to make it difficult or impossible for private schools to operate. Compulsory primary and secondary schooling is the perhaps most important reason for more than a century of school regulation and public schooling. Schools have to be in place everywhere

for universal education to be possible. Most evidence that I have presented suggest an open, and rather experimentally organized educational system at all levels, to efficiently exploit individual incentives and talent. The existence of a mandatory primary and secondary school system will unavoidably make a Government regulatory prescence necessary, not in the least to operate schools where private incentives and the market fail.

How to make schools innovative?

The problem with regulation is that it requires standards, and that standards reduce the allowed variation in solutions, and hence kill innovative initiatives. The problem comes back at you. If you want control by administrative devices you need well understood and stable quality references, meaning no experimentation. The only way out of this dilemma is to allow the customers (students and parents) to decide what is good quality to them. This will allow both innovation, competition, variation and efficiency *by customer standards.*

Much educational administrators are hesitant to hand over such responsibilities to the "customers" of schools. As noted above, however, there is no rational argument that supports the view that school experts and administrators are more competent in choosing schools than the customers themselves, since there is no generally accepted and precise definition of what good education means for the student. On the contrary, the customers trying to sell their (at school) acquired competence in the market should know best and be most concerned. Under a free experimental regime the good, innovating school will be providing a wealth of positive welfare effects for other schools to learn. The bad schools will eventually go out of business. But the customers will be the quality judges.

Rational economic argument and empirical studies are clearly in favour of much less regulation to achieve a better school.

6.6 Distributional considerations

The reason for Governments to regulate both educational production and the labor market has also been to achieve certain redistributional objectives. Furthermore, most problems of education we have discussed are there because of distributional policy objectives. The observation here is that such policy conclusions rest on a misunderstanding of the role of education in the production process. Empirical evidence rejects simple human capital analysis, that generate such policy conclusions.

Economic growth being the only objective, a strong tilting of compensation schedules and an educational resource allocation heavily in favor of competence accumulation would optimally support the growth objectives. We are of course reluctant to advocate such extreme policies, because standard economic analysis would predict a skewed income distribution. One result of the earlier analysis, on the other hand, is that this will not necessarily be the ultimate outcome of a free market based organization of education if some dynamic considerations are allowed to influence the analysis. The outcome then depends on the particular design of the models which are often very sensitive to minor variations in their assumptions (see xxx). Such models should not be used for the design of policy. One thing is, however, certain. If individual economic incentives and the individual capacity to retool intellectually are allowed into the analysis the theoretical conclusions on educational policy making change radically in favor of placing heavy emphasis on the early years of schooling - and family social capital - on "teaching" good work habits, and on making sure that certain basic intellectual competences are learned. The latter is becoming increasingly important as the economic environment of once rich industrial nations is shifting rapidly in a direction where individual capacities to retool intellectually are becoming critically important for individual, firm and national economic success.

We have learned form surveying literature that the efficiency of school, and success in the labor market, depend both on how the school and the labor

market are organized. The existing school and labor market organizations are, however, very much the results of Government regulation. Since we are currently worrying about competence provisions in the labor market one clear conclusion is that Government should not continue to do more of the same thing, but prepare the way for significant change in organizing both educational production and the labor market. The previous survey of evidence on the educational process suggests that given its current degree of regulatory involvement in different industrial countries, *less* regulation, and more reliance on local experimentation and market incentives both in the education and the labor market process will positively contribute to economic growth and most likely also to a more equitable distribution of life time income. This, however, requires that the labor market insurance problem be adequately solved.

6.7 The organization of the labor market and the social insurance system

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

Educational output is largely directed toward, composed for and enhanced in the labor market. Most human capital used and valued (compensated) in the labor market, has also been developed and finally shaped on-the-job.

If the labor market is badly organized for the further development and allocation of human knowledge and talent, the economic returns to education will be accordingly reduced.

The overwhelming evidence is that the highly regulated and price rigged labor markets among the industrialized countries are badly organized for these purposes, and that deregulating the labor markets would provide a major boost in educational achievement. This is an unavoidable extension of the

allocation argument, since the original questions asked was about educational solutions to the problem of job-less growth.

There is no such educational solution without strongly supporting labor market politicies aimed at changing the institutions of the labor market.

A labor market organized to support easy mobility between jobs will support individual competence development and a growth promoting allocation of labor. However, mobility requires that the inherent aversion to risk of human beings be overcome. This is were the social insurance system comes in. A social insurance system that contains labor mobility also reduces competence development in society. Most social insurance systems have significant elements of such mobility constraints on incentives in the sense that benefits are lost when you change occupation, and that benefits that have been paid into public accounts are not available according to well defined rules, but after intimate evaluation of needs. All these inefficiencies of the social insurance system depend on the fact that it is financed by the employers and/or through taxes and the public sector. First of all employer based social insurance will always be biased in terms of employers' needs. And publicly based insurance systems will be heavily weighted down by regulation, among other things to prevent parasiting (moral hazard). There is only one way of dealing with this unnecessary dilemma, i.e. empowering individuals (the customers) to make their own insurance decisions, to finance a significant part of their insurance themselves and to link benefits to incentive schemes that prevent moral hazard. The most rational and efficient such incentive scheme is based on a life time consumption model, drawing a significant part of the benefits from the retirement capital of the individual. This is not the place to go deeper into this insurance question, except recalling that it figures importantly in two educational decisions: labor market retraining (see p. xxx) and that human capital is an efficient protection for labor market risks (see p. xxx). As with labor market organization, the social insurance problem figures importantly in overall educational policy.

The labor market problem of the OECD countries have an immediate and a long term dimension.

The long term problem, which occupies the bulk of this text concerns reforming the institutions of education, the labor market and the social insurance system in an integrated way. The immediate problem of adjusting the mature, semi obsolete industrial economies to new growth paths is heavily dominated by the social insurance problem. A massive transformation of labor across age groups from the public sectors and from obsolete industries to new growth areas is needed. This is impossible without continued high unemployment and significant downward adjustment in compensation for obsolete skills. The softening of this impact all depends on the capacity of markets and Government to provide efficient retraining and the capacity of the labor market to move people to the right opportunities. This is not going to be done well in a publicly run education, labor market and social insurance system, protected from competition.

Table 6.1 The educational policy map

Educational product specification - Competence to relearn - School as a quality filter - Social capital (infrastructure) - Short and long term trade-off
Incentives - The life time compensation schedule - Relative compensation - Who pays for education? Financing - Risk aversion and insurance provision - The allocation of competence within the firm, within the economy - (maximum use of existing competence) - Underinvestment? - Attitudes
Efficiency of educational production - Public or private - Leverage and the importance of early schooling - Infrastructure - School as a filter into the labor market

CHAPTER 7

WHAT MORE DO WE NEED TO KNOW?
– THE RESEARCH AGENDA

The theoretical and empirical survey of literature that you have just read indicates several important areas, where critical knowledge and, hence, research is missing to support the policy agenda of chapter 6. These areas are those which have been the most difficult to research. It is not meaningful to design a research agenda to fill in *all* the missing information. There are, however, gaps in knowledge and understanding that effectively prevent informed policy making in areas where it is economically and socially extremely important to do something. In this chapter we will identify those gaps in knowledge.

It is *socially* extremely important to prepare the individuals of advanced industrial nations for a much more demanding future work environment. It is *nationally* important for economic growth to build a viable competence base of the economy and to make sure it is efficiently allocated. It is also necessary to accept the fact that the current output of an industrial economy can be produced with much fewer people than today, using existing technology, if the organization of the production system is properly reorganized. Competition from the industrializing economies is increasing the pressure on the mature industrial economies to achieve this reorganiation fast. In this radical reorganization the less educated will not fare well.

To achieve a socially acceptable outcome it is vital that the entire educational process of the economy is capable of *innovative product* development. To achieve that radical decentralization and free experimentation in a competitive educational market environment is probably necessary. This *may* conflict with

the social ambition to provide a minimum basic competence endowment of the individual, the nature of which we do not know well. The resolution of that compromise or conflict is the main task of the research agenda. An additional task is to investigate whether policy can overcome the natural myopia of individuals and firms in providing the necessary long-term competence development. It needs no further explanation, that if such policy is carried out on the basis of unreliable and incomplete information the risks for policy mistakes are very large. And a large part of current public involvement in education, labor market organization and social insurance is fraught with major negative consequences, not only for individuals but for the entire economy of nations.

The gaps in knowledge unfortunately are to be found in places where it is most difficult to achieve *wholistic understanding* of the social and economic significance of education. Information is especially lacking on relationships that stretch over time, and where the origins of student or worker performance have to be looked for before school. Reliable evidence on the filter versus investment hypothesis and on economic systems effects are largely missing. This should, however, not prevent us from moving in where the complementary information is most needed. Significant enhancement of understanding can be achieved by combining facts with reasonable assumption. It is also the case that to understand fully, for instance the filter hypothesis, unconventional research methods, like *setting up experiments* have to be used. Such research projects, although very desirable, are, however, beyond the time horizon of this study.

In this final section I will indicate what *I see* as the complementary research needed to answer the questions raised within reasonable time. This research has to learn from the existing variation in the organization of education *between* various countries. Unfortunately, the *within* country variation in educational production is too small for anything significant to be learned. Hence, the way primary, secondly and often higher education is currently organized as public monopolies, innovative educational product development

can never be achieved without extensive learning from experience in other countries. This study tells the story of non-innovative national education systems, that have been regulated by Government to become non-innovative. The variation in approaches has been regulated away. Learning about better ways can only be achieved by opening up the educational system for free experimentation at the school and classroom levels, and to competition for students between schools *and* through studying how other countries have organized their educational service production.

Studying schooling systems in other countries is rather costly. Experience from the U.S., Japan, Germany and Sweden would, however, provide a sufficiently rich source of variation, that is at the same time relevant for advanced industrial economies. It is important, though, to observe that some, not yet industrialized nations have organized school systems that appear to perform very efficiently by our standards (see for instance Stevenson 1992). The above four countries, however, do not only exhibit important, distinguishing characteristics but also have data and research results easily available. The research agenda should furthermore be organized on the format of this book, emphasizing educational product specification, incentives and attitudes to, and in school and the organization of educational production. Since a guiding principle of educational policy among the wealthy industrial nations has been to curb market forces to achieve a more equitable distribution, country comparisons should be designed to investigate not only whether the use of less market incentives in the educational process has really produced a more even distribution of life time individual incomes, but also to what extent such regulation has lowered school quality.

7.1 Suggested research agenda – micro studies

The previous chapter concluded that policies should aim for improving the institutions that guided and controlled the individual's life-long educational experience, notably observing the creation of such *enabling* institutions that

efficiently exploited the individual's own incentives. This suggested policy reorientation, however, means a radical reorientation of existing educational policy practice. Above all it dramatically reduces not only the perceived possibilities, and hence the ambitions to control the ex post outcome of education. Many would expect the variation in outcomes to increase. The analysis of the book, however, suggests that this will not necessarily be the case, at least not in terms of academic achievement. On the other hand, the *variation in output qualitiy differences*, will increase. But a more differentiated educational product is desired. Hence, the research agenda should be designed for better ex post evaluation of new educational policies. The ideal then would of course be to set up controlled educational experiments. But to allow for reasonably free experimentation at the school and classroom levels would also provide a rich source of information for innovative educational learning.

It still remains, however, to clarify the minimum, *basic standard competences* that are needed for an individual to pursue a reasonably successful labor market career in an advanced economy, benefiting from the rich opportunities of continued education and competence upgrading offered. As important for the future, therefore, is to do what should have been done long ago, namely to carefully investigate the practical potential for more precise, but less ambitious policies of the old kind, i.e., to attempt to identify the minimum basic competences an individual should possess before being allowed to graduate with a certificate from the secondary school system. This proposition seemingly contradicts the earlier proposal for free experimentation. It does not. The improvement of educational output through different organization of schools and innovative product development, of course, requires good and competent students. The basic competences needed should be identified, if possible, to arrive at the optimal educational compromise between rigorous classroom teaching and innovative experimentation. It is distressing that the nature of this compromise has not been investigated already, considering the billions of dollars spent each year on education. This inquiry has to begin now.

Research evidence reported in the previous chapters, also strongly suggests that new research should focus on the *transition from school to the labor market.* The research agenda, hence, should include the following five elements:

- identifying the competence characteristics of individuals that are demanded at recruitment of youth,

- identifying the *competence platform* needed for the individual to participate gainfully in production and to successfully update his or her competence capital throughout worklife,

- identifying the role of primary and secondary school in providing these needed basic competences,

- assessing the expected needs of future production technology, compared to production technology of today,.

- identifying, through econometric method the relationships between educational achievement and job or firm productivity.

I see a project the analytical part of which is organized around the following tasks;

A. Educational product specification

Under this heading extensive interviews with employers should be carried out, not with the purpose of defining the educational product, but to capture the multitude of intellectual dimensions demanded at various work places. The questions are: what do we know about critical elements of competence demanded, and when should we leave the field 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 very vague ideas about what they want, should this be taken as an indication that more experimentation is needed?

It should also be recalled in this context that the *value of knowledge depends on the match between competence and job achieved. This makes* the transition from school to work and the efficiency of labor market allocation a critical support for education.

On this we can observe that primary and secondary education, typically publicly run, is the non-experimental part of schooling. Thereafter education diversifies into higher education and on-the-job training in the market. Primary and secondary education make up 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 needed for future competence development, acquired at primary and secondary school be carefully researched. Part of this wider competence specification includes investigating the *redundancy characteristics* of competence needed for work at different levels, even though not explicitly demanded in the particular job context. This makes the design of both interviews and econometric inquiries difficult. I have not found any attempts reported in literature to do exactly this. To go on much more careful investigations of the job characteristics than before probably have to be carried out, bunching together different jobs that can be served by similarly trained individuals. Preliminary attempts to get closer to this problem at the IUI suggest that the research task is feasible, if begun as an exploratory project.

For this specification of the basic educational product international experience should be carefully used to see to what extent particular variations in different countries in primary and secondary education provide competence characteristics that contribute in special ways to economic competence. Again,

to spot such characteristics the same researchers have to be involved in all country investigations.

The main purpose of this part, as emphasized, should be to identify to the extent possible the *basic knowledge, skill or competence base* that forms the initial platform for further competence upgrading through school and work.

B. Incentives

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. Until very recently neither academic research nor educational or labor market policy makers paid any attention to this important part of the individual's school and work life. The contract was taken for given at each point in time, and when changed, it was part of a central school or labor market reform based on political decision and on principles that did not recognize the efficiency implications of the contract. Special emphasis should be placed on the least understood side of the labor contract, the use of competence in firms and the possibilities of other contracts than employer/employee relationships.

Investigate:

B1 The importance of *social capital* background as initial conditions for choosing educational ambitions, pathway through school into the labor market and labor market success.

B.2 *Demand structure* in job market, *relative compensation schedules* and the private costs for education at the three levels (primary, secondary and higher) of education to see how educational investments relate to private benefits.

B.3 *Signaling*, and the nature of *labor market imperfections* that makes employers underpay talent and thus reduce the incentives to acquire competence among the young, new entrants into the labor market. Are there labor market (contract) reforms that would increase incentives of individuals to upgrade their economically useful competences?

B.4 The use of other contract forms than the employment contract of wage earners.

B.5 On-the-job training *incentives*.

One purpose should be to test the *underinvestment* hypothesis. If found valid, do restrictions on contract formulation create negative social and economic effects? Identify policy parameters. In this task one has to control for the possibility that *underinvestment is simply a result of rational economic choice* in the sense that firms do not invest in low quality labor with low expected returns to education, and that these individuals for the same reason do not find it economically rational to invest in their own education. We then have a *social* rather than an economic problem. A particularly difficult task is to assess the long-term vs. short-term implications of such choices. It may be so that both the individual and the employer impose a short-term view on their choices, discounting future benefits (profits and incomes) heavily. What would follow if Government wants to stimulate long-term positive effects through policies?

C. The organization and efficiency of educational production

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

Above all a study of the efficiency of educational production has to incorporate labor market performance as part of educational output. Since simple human capital assumptions are ruled out the entire incentive structure at school and in the labor market as of above 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

c1); the carrying out of traditional studies of partial problems, including educational production function analysis.

Here, a more detailed survey of earlier work should complement the analysis of the above chapters. Since the research proposed aims at supporting educational and economic policies, new research should be oriented accordingly, playing down the academic interest in method, and placing the decision problem in the foreground. Since empirical insight is particularly lacking on the difficult links between school and labor market performance, and the proper definition of educational output, this means a reorientation of research effort towards significally more data gathering and costly empirical efforts. The appendix gives more detail on what can be done here.

The more important *second* part of this inquiry, however, includes an attempt to link school, the labor market and the production process through.

c2); micro-macro analysis incorporating the dynamics of the entire selection and investment processes in school, in the labor market and on the job.

This requires the use of (micro-to-macro) dynamic simulation method, into which other, partial research results have been incorporated. Fortunately, such a simulation model of the Swedish economy, including the important characteristics of the labor market and the production process already exists. Appendix III gives more detail of this method. Above all, the research program has been reformulated in appendix III to show how it can also be

used as a preparatory study providing empirical inputs for the entire micro-to-macro modeling project, in particular its capacity to uncover the importance for economic growth of (a) incentives to upgrade individual and firm competence, and of (b) the allocation of competence through school and in the labor market. This analysis will explicitly and quantitatively link the magic ê competence rent of the introductory chapter to macroproductivity growth. It should be understood from the beginning that there is no other way to uncover the relative importance of the selection and the educational investment hypotheses, and that such understanding is necessary for the economic potential of the more precise educational policies to be explored in this chapter. It is, however, a bit ironic that this means carrying out an investigation of where in between a free experimental educational approach and the overly ambitious educational policy practice of the past decades the optimal compromise lies.

7.2 Particular observations

Let me go through some details of the research program outlined above to tie the program back to the structure of this book.

Defining the knowledge base of economic growth (chapter I):

Identifying the characteristics of the *knowledge base* of economic growth comes first. I have deliberately been rather extensive on this subject in chapter 2, elaborating on the necessity of taking analysis down to the micro level where education takes place. Competence development is the "antithesis" of equilibrium analysis. Competence development increases the diversity of the human knowledge base employed, increasing the number of possible organizations of production. Even if we should now and then use results from standard equilibrium theory, I find it important to prevent further work in this context from slipping too easily into the interpretative framework of

neoclassical macro analysis. The knowledge content we are interested in is something much broader than decomposing the shift factor of the macro production function, and this knowledge content has to be linked to the schooling process broadly defined, including the hiring process in the labor market. This analysis will involve the empirical study of rent ($\bar{\epsilon}$) creation in firms, technological competition and the link between those rents and the technical shiftfactor of the macro production function. Those links are mathematically demonstrated in the appendices I and II. The Swedish micro-macro model has been designed for such analyses. In fact, IUI has a separate project going, attempting part of this on parts of Swedish manufacturing industry. Next,

the filter vs. the investment hypothesis.

The *selection* issue has to be somehow settled. It has two dimensions; (1) the relative influence of original talent and education on human capital formation and, (2) the importance of educational selection, being part of the transition from school into the labor market. The first part is the traditional controversy and available evidence tells us no more than that both investment and selection matter. The second selection problem is, however, quantifiable, given what we have decided to believe in the first hypothesis. Education carries the student partly into the job market, but the institutions of the educational system and the labor market that influence this selection also exercise a profound influence on the overall allocation of competence in the economy.

Some data on the use of competence in firms exists. Simulation models that integrate these facts should therefore make it possible to get some quantitative grasp of the selection problem. This is what is proposed in the project above (section 7.1). Here we can rely on research already done, even though some complementary interview studies with employers would help identifying certain characteristics of the schooling process that they appreciate and that cannot be learned by econometric methods.

Indicator studies

Currently available databases offer few opportunities for nice econometrics. Therefore, part of the task has to be to design efficient future data collection programs. OECD´s latest indicator statistics on educational performance should be useful here. Considering the importance of the problem discussed in this text, and the large amount of resources spent on collecting data for less relevant inquiries, new forms of data collection should be emphasized.

The *second task* above is more straightforward if we restrict ourselves to the methods already used to study school production efficiency. There should be ways of improving on the output specifications of school by following students from different schools with different input characteristics into the job market. On the basis of such studies, perhaps a better school output measure can be designed.

7.3 Summarizing

The most important sub projects can now be listed. They are:

1. a large scale project attempting to tie the teaching agenda and experience accumulation to job performance. This is the by far largest part of my suggested project. It has four 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. Its scope depends on the data available.

c) ditto, on vocational training programs, on-the-job or in vocational schools.

d) ditto linking individual competence characteristics to firm performance.

e) *career analysis* relating school and other individual characteristics to job career (panel data needed).

2. Preparation for *micro-macro analysis* by introducing different competence and organizational learning characteristics in firm production function.

3. Model the *diffusion process* through family, school and through the labor market to a job in terms of (1) and integrate within micro-macro model.

4. *Identify policy parameters* that affect selection mechanisms in the diffusion process to study macro policy effects.

5. Carry out a particular inquiry into the nature of *imperfections in the labor market* in its capacity to identify, evaluate and properly reward human qualities, and to stimulate endogenous learning in the market. Assess to what extent restrictions in employer/employee contracting create inefficiencies in labor market performance.

6. Survey areas where the *market* is *failing* and where the provision of public educational services is superior to the market and vice versa, survey areas where public interference in educational production is already too large. This should begin in the markets for *vocational training.*

7. Compare higher education enrollment with industry structure and industry performance. Compare different countries.

This would make it possible to quantify roughly the school productivity link, including the labor market selection process through the school system (NB not the original filter controversy). IUI has already been engaged in this kind of productivity studies. In the first round, hence, Swedish case studies might be preferable. International comparisons of teaching agendas would come next, including also job and market organization. The four countries Japan, Germany, Sweden and the U.S. would again be ideal to compare. Appendix III presents a more concrete research project specification that can be completed within a two-year period, and efficiently take us a good way along the ambitions outlined in this chapter.

As I see it, this research agenda covers the white spots where complementary knowledge is missing. It is an outline of what should be done. Even though this project will only have time for some modest complementary research, it will be possible to design a quantitative method to merge the bits and pieces of fragmented information and informed assumption to get a better grasp of the *entire educational growth problem*. This approach furthermore, is in line with the broad definition of the "content" of knowledge and of education that began chapter I. It means that education, labor market efficiency (flexibility) and labor market insurance will be studied in one and the same context.

Appendix I

INFRASTRUCTURE KNOWLEDGE CAPITAL CONFERS ECONOMIES OF SCALE TO OTHER FACTORS OF PRODUCTION[1]

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

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

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.

I will now translate Romer's model for the general equilibrium setting of an entire economy to a *firm model.*

Let me assume that measured factor inputs are:
k_1 = Machinery and equipment capital,
k_2 = Product-oriented R&D capital,
k_3 = Marketing capital items,
x_i = Labor input, standard hours, allocated to the various capital items,
i = 1, 2, 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 general organizing knowledge needed to organize 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.[2] 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 1988a). In so far as 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. The latter is the magic epsilon variable that I referred to earlier.

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

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[1] This appendix is a modified version of the model in Eliasson (1989a).

[2] 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.

scarce resource whose production occurs at diminishing returns. The K factor input is assumed not to depreciate from use, as do other factor inputs.

It now only remains to show that K in fact has the "scale" or "leverage" properties we have postulated. To do that - following Romer (1986) - assume F() 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 $\phi > 1$.

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

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

The proof I have given has been in terms of the traditional, static production function. We can then use the term economies of scale, although economies of scope may be more appropriate. However, even this term is not the right one, since we are talking about an *organizational learning process* that creates tacit competence embodied in the organization and its people. Some of this knowhow 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 ORGANIZATIONAL COMPETENCE WITH TOTAL FACTOR PRODUCTIVITY GROWTH

Competence coordination 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 I link the "unmeasurable knowledge" or innovative competence function to firm objectives (profits) and the creation of economic value over and above the value of resources put in (total factor productivity growth = DTFP)[3]. I will do this 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 $(= \bar{\varepsilon})$, firm total productivity change (DTFP) and growth in output (DQ).

In doing so I cut right through the dynamics of competition discussed in the previous section. I exclude the endogenous growth drive of the macro economy by assuming perfect competition and making ex ante equal to ex post.

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[3] The mathematical derivation has been taken directly from Eliasson (1992c).

Let me assume for simplicity that the only measured inputs needed to produce output (Q) are labor (=L) and capital (=K). DX stands for the rate of change in X.

Define:

$$\varepsilon = PQ - TC \tag{2}$$

$$\bar{\varepsilon} = \varepsilon/K \tag{3}$$

$$TC = wL + (r + \rho - \frac{\Delta p^K}{p^K})K \tag{4}$$

$$R^{NE} = R^N + (R^N - r)\phi \tag{5}$$

$$R^N = M\alpha - \rho + \frac{\Delta p^K}{p^K} \tag{6}$$

$$M = 1 - \frac{w}{p}\frac{1}{\beta} \tag{7}$$

It follows immediately that:

$$\bar{\varepsilon} = R^N - r \tag{8}$$

$$pQ = TC + \bar{\varepsilon}K \tag{9}$$

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 labor input (=L)
r = interest rate
p^K = capital goods deflator
p = value added (=Q) deflator
Φ = D/E
α = pQ/K (capital productivity, uncorrected for relative (p,p^K) price change
β = Q/L (labor productivity)

$\bar{\varepsilon}$ is the difference between the rate of return on total assets (R^N) and the interest rate (r) paid by the firm. $\bar{\varepsilon}$ can be positive or negative. But a firm will not survive for ever with a negative $\bar{\varepsilon}$. Compare (2) and (7) and you will see that $(r+\bar{\varepsilon})$ is the equilibrium price for capital services that exhaust total value (=pQ) product when $R^N=r$ and $\bar{\varepsilon}=0$.

$\bar{\varepsilon}>0$ 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 $\bar{\varepsilon}$ is negative the corresponding asset, hence, might very 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).

To the extent $\bar{\varepsilon}$ measures value created by a not measured capital input it must have something to do with economic growth. I therefore prove (see below) the following relationship:

$$DQ = s_1DL + s_2D\bar{K} + \frac{\Delta\varepsilon}{pQ} \qquad (10)$$

s_1 and s_2 in (10) measures labor and capital income shares respectively. Apparently $\Delta\varepsilon=0$ when these shares exhaust total value added.

A whole lot 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.

After differentiation the entire class of functions:

$$Q = CL^{s1}K^{s2}T \qquad (11)$$

becomes (10), where T is a shift factor, usually assumed to represent exogenous disembodied technical change.

Apparently from (10) and (11) total factor productivity change becomes:

$$DTFP = DT = \Delta\varepsilon/pQ \qquad (12)$$

under the assumption of Cobb-Douglas technology. This is enough for my purpose. I have demonstrated - for one particular production technology - that the estimated (on specification (10)) 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 - that I have labeled $\bar{\varepsilon}$ - 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 $\bar{\varepsilon}$ in the modern theory of finance becomes part of this more general formulation.

Proof of (9)
From (1) and (2);

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

Take differences, assuming (p, w, r, p^K) fixed;

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

Thus,

$$\frac{\Delta Q}{Q} = DQ \equiv \frac{wL}{pQ}DL + \frac{[\ ]\,\Delta p^K \bar{K}}{pQ} \cdot D\bar{K} + \frac{\Delta\varepsilon}{pQ}$$

$$DQ = S_1 DL + S_2 D\bar{K} + \frac{\Delta\varepsilon}{pQ}$$

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

$$S_2 = \frac{[r + \rho - \frac{\Delta p^K}{pK}]p^K}{pQ}$$

$\frac{\Delta\varepsilon}{PQ}$ is, by definition DTFP. QED

Appendix III

RESEARCH PROGRAM IN DETAIL

This appendix details a first step in the research agenda of chapter 7 that is currently being started at the IUI.

The ambitions of this research agenda covering two years is:

(1) *exploratory* analysis to arrive at *preliminary* policy conclusions, and

(2) to prepare the way for the more rigorous specification and testing of policy hypotheses.

The policy objectives to be preliminarily evaluated are:

(a) the design of institutions of a decentralized educational and labor market system, in which considerably enlarged scope for local, innovative experiments is allowed, and

(b) the identification of basic economic competences, not to be compromised in primary and secondary schooling.

This seemingly schizophrenic research program aims for the possibility of pursuing more precise educational goals, thereby delimiting the possibilities of central regulatory intervention in the school agenda and setting the limits beyond which policies do more harm than good in the sense of undermining *innovative* product development in the educational system.

First, to achieve that the possibilities of identifying the basic (minimum) competence platform for the labor market needed at end of high school should be investigated.

Second, the origin of such competences should be clarified, and most importantly the ability of an innovative school to create them irrespective of social background.

Third, the role of the labor market (and the social insurance system) in facilitating for the individual to pursue his or her optimal education and work career should be studied. This includes the study of the incentive effects of alternative financing arrangements at school and during retraining and alternative contractual arrangements in the labor market. Part of the task should be to clarify to what extent imperfections in the labor market and lacking insurance facilities create myopia with individuals and underinvestment in education.

The reader may find a contradiction in this assertion. It is, however, superficial. The basic proposition is that the educational product specification can't be determined 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 labor market and in receiving opportunities for further upgrading. The evidence is that this universal, basic competence relates to the receiver competence of the individual or his capacity to engage in continued life-long learning. Research should be focused on investigating this possibility.

This is an extremely ambitious research agenda. It should be realized, however, that educational policies of the postwar period in most industrialized countries, departing from earlier traditions required answers to the above questions, in order not to do more harm than good. These policies were clearly pursued on assumptions rather than on knowledge.

The policy approach envisioned here, on the other hand, means moving incentives and initiatives back down to the individual and to establish, through serious empirical research where the limits to more precise and ambitious central policies are. Contrary to educational policies in the 50s and in the 60s, now in disrepute, this approach is, hence, very well founded empirically.

Thus, the following items will be addressed in the research project about to be started at IUI. Resources, however, only allow some of them to be concluded in the first phase.

Identify basic competences

1. Study relationships between labor quality characteristics (notably formal education) and individual and firm performance econometrically. Swedish and French data will be compared (Ballot–Taymaz).

2. Study criteria used when recruiting workers and assigning them to internal training programs (Kazamaki Ottersten).

3. Study competence requirements of most advanced ("future") production technology compared with average requirements. Be careful to include private service production in analysis.

Choice of educational path into the labor market (incentives)

4. Study family background and other social capital characteristics in determining choice of educational ambition, school performance and early choice of labor market career (Meyerson).

5 Study labor *market efficiency* in identifying and compensating individual competence, with special consideration of the long-term effects on individual incentives (Eliasson, Kazamaki Ottersten).

6. Investigate infrastructure effects on economy of structure and size of total knowledge capital in firms and elsewhere.

Educational production efficiency

7. Estimate educational production functions in which labor market achievements, rather than the scholastic achievement defines output. This may be possible using data from Swedish retraining programs (Mellander).

8. Conduct international comparison of school organization (Eliasson).

9. Make overall assessment of filter vs. investment hypothesis, using results from above empirical studies. Micro-macro analysis (Eliasson–Taymaz).

10. Conclude on question: 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?

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

The first project step, however, aims at uncovering the role of primary, secondary and higher education in the provision of useful competences for further competence upgrading on-the-job (the provision of *receiver competence* and the leverage effects)

It would also be interesting to test the following two hypotheses operationally at the macro level

(a) link agenda characteristics of national school systems to educational performance indicators and

(b) link educational performance indicators to economic performance of the country.

This is part of item 6 above. For this purpose data from the OECD indicator studies can be used. Part of this analysis may be integrated with the micro-macro modeling part (item 9) of the project.

Establish quantitative links between micro and macro

On the basis of data from the above research program the Swedish (IUI) micro based macro model can be reformulated to make possible a study of the macroeconomic consequences of different schooling regimes. The Swedish micro-to-macro model allows these modifications. This would be a small part of the project if the rest of the project has been carried out.

In doing this we would follow the organization of this survey: identify the knowledge that operates behind measured economic growth, evaluate incentives to accumulate this knowledge and study the corresponding educational production efficiency.

The micro-macro integration of research should begin with an ambition that is feasible and practicable today. The following proposal concerns a project that has already been started and that is well prepared.

Economic growth and the incentives and organization of educational production – a quantitative micro to macro research project – summing up on method

The complex fabric of educational production and the economic growth process prevents a definite answer to the policy question: How should the national educational system be organized to increase economic growth. What we know so far, however, suggests that a five step approach, involving a reasonable work effort would provide significant and fast results.

Econometric analysis

The *first* step involves establishing the relationships between *competence composition* of firm knowledge capital on the one hand, and the *performance characteristics* of the firm on the other. The purpose is to quantify the parameters of the Swedish micro-to-macro model.

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 modeling *the firm as a learning organization* and the career paths from school through the labor market. There is some theory to draw on but very little in the form of econometric results. The micro-macro model, however, allows important empirical structure to be entered as organizational and search characteristics minimizing the need for econometrically established parameter estimates.

Modeling the educational and labor market filters

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

Infrastructure – the educational system

The very fact that the labor market can offer quality labor represent an infrastructure or social capital that confers scale economies to the region or the national economy. The availability of such infrastructure capital is also an attractor of investment that is important for the economic development of the local region. Hence (the *fourth* step), the modeling approach should involve specifying certain characteristics of the educational system as infrastructure or social capital provider.

There should be some possibilities of modeling this econometrically. Above all, if project part 1 above indicates that human capital is important for firm performance, the availability of such human capital in an area would constitute such infrastructure capital.

An additional problem is equally significant. The survey of empirical research suggests very definitely that *even if* original talent (at birth) would be equal, preschool acquisition of prior educational receiver competence at home, matters enormously both for individual performance at school and for later labor market experience.

There should be possibilities of capturing some of this selection process by appropriate combinations of fragmented econometric results and assumptions such that the significant - as I expect - cumulative effects over time can be illustrated through simulations on the Swedish micro-to-macro model.

Policy simulation

The *fifth* step thus involves combining the results from the four earlier steps and setting up the micro-macro model for policy simulation. With the educational and labor market production and search (filter) model specified it will be possible to simulate the cumulative impact on economic growth of varying certain policy parameters, and particular parameters controlling the search or filtering process through school and the labor market. In doing this it will be possible(!) to relate simulation results to traditional macro production function analysis through the magic $\hat{e}$ variable. The $\hat{e}$ variable will figure as individual educational rents, as firm returns from competence capital, and at the aggregate level as the shift factor in macro production function analysis.

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