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THE ECONOMICS OF TECHNICAL CHANGE – The Macro Economic Consequences of Business Competence in an Experimentally Organized Economy

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THE ECONOMICS OF TECHNICAL CHANGE —
The Macroeconomic Consequences of Business Competence in an Experimentally Organized Economy

by Gunnar Eliasson[1]

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[1] This paper summarizes the results of a number of recent studies of mine, notably (Eliasson 1989, 1990a, b, c, d, 1991b, c).

1. The economic dimensions of technology – introduction and summary

Technology means knowledge about technical matters. Hence, technical change in mainstream economic thinking has come to be understood as improvements on the great production machine that drives the economy; the manufacturing sector. This analogy fitted neatly with equilibrium modelling as manifest in macro production function analysis. It has come, as well, to be associated with one branch of Schumpeterian economics, preoccupied with new technology as it arises out of R&D spending in, not so much firms as in sectors of the economy.

The notion of technical change, and the interpretation of technical change as it appears in macroeconomic growth can never be expanded beyond the intellectual construct, or theory within which data gathered have been defined and compressed. Hence, classical economic analysis as well as Schumpeterian analysis of technical change has missed, by pure intellectual confinement, the essence of technical change, or rather has misunderstood the origin of technical change.

There is no simple machine or macro production function explanation to total factor productivity change. At the level of a firm, a sector, an industry as well as the entire economy, everything technical first has to be allocated through hierarchies (or management systems of firms) and more or less perfect markets for factors of production. The dynamics of these allocations determines change in total factor productivity at the macro level, as measured. As I will show these economic allocation mechanisms dominate the macro productivity outcome. Hence, pure technical circumstances and improved technology operate as upper limits to the exploitation of a dominant and broader based knowledge than the engineering knowledge, implicit in most economic analyses of technical change.

The aim of this paper is to make the interaction of economics and technology clear through theory, empirical documentation and case descriptions.

The organization of the paper is as follows. *First* a few introductory words to set the stage for the role of dynamic markets in economic progress. *Second* I introduce the experimental nature of economic activity among the advanced industrial economies that makes up the environment of modern firms (Section 3). Technical change becomes synonymous with change in information technology, which is again synonymous with structural change in the organizational memory that controls all information processing activities of markets and hierarchies. We will find that the changing mix between markets and hierarchies, between large and small firms etc. are important determinants of technical change at the macro level. The logical foundations of this experimentally organized economy (EOE) are established in Section 4. Section 5 identifies *the nature of the firm* in the EOE. Section 6 makes the accumulation of firm-based knowledge (*organizational learning*) the source of business competence and the driving force behind macroeconomic growth (the aggregation problem). The nature and difficulties of learning among large firms in the EOE are presented empirically in Section 7 to demonstrate that large incumbent firms are not sufficient in an EOE to carry economic growth in the long run. Viable entry and effective exit are necessary. The policy implications of this conclusion are briefly discussed in Section 8.

2. The way dynamic market competition matters for economic growth

Adam Smith is the declared father of many novel ideas in economics. He is, however, not as well known for what he argued was most important of all for the wealth of nations, namely dynamic competition, notably dynamic competition maintained by free innovative entry, that checks the formation of monopolies which are detrimental to the creation of economic wealth. Such dynamic competition is made possible by a superior capacity of some firms to compete for customers and for resources. This competition is driven by the

rewards for the same superiority. This superior capacity in turn defines the organizational competence of the temporary monopoly that we call a firm. The rents from that competence, or rather the possibilities to capture the rents from using the competence determine the incentive system of the economy (Eliasson 1992b). Superior organizational competence in business is always temporary, since it is relative to the competence of all other firms, and firms are all the time generating new competence through organizational learning and innovation (Eliasson 1992a).

The raison d'être for the existence of a firm must be based on this *competence* to generate organizational synergies, needed to earn a rent above production and financing costs. To explain *how* the firm captures its rent both a theory of the firm and a theory of the institutions of the markets in which the firm is supposed to operate are required. Since the rents created both define the output qualities and the incentives to engage in entrepreneurial long-term activities, financial markets and their institutions dominate the growth process. The deep problem in economics is that the characteristics of the market needed to explain firm behavior is totally dependent on the dynamics of all business agents. Mainstream economic theory, thus, offers very little in the form of a useful theory of the market to explain the dynamics of firm behavior (Eliasson 1992c). Micro-macro theory is needed, embodying an explicit representation of competition as a dynamic process. This process does not necessarily converge to an equilibrium determined outside the economic system. Indeed, the dynamics I have in mind does not have the equilibrium properties of the classical model, even though my model is as selfregulating as a well functioning economic system should be. The equilibrium of my dynamical system is rather a balance between a number of mechanisms of the economic process that I will return to below. Hence, we do not discuss this economy in terms of equilibrium analysis. We rather redefine the notion of equilibrium in a way appropriate for dynamic analysis. The direction of change of the macro economy will be seen to depend on the micro structures along the way, and on how competing agents react to, and change them.

With dynamic agent behavior in core the creation and the death (entry and exit) of agents will have to be made explicit. The modeling of these selection mechanisms has always created difficulties for the formal faction of the profession, since its standard mathematical tools refuse to accommodate typical irregularities of economic selection processes. Once entry and exit are considered explicitly the entire intermediate life cycle of a firm will also have to be made explicit. The life cycle of an agent includes routine management of operations, including investment behavior and innovative, reorganizational behavior.

Thus, the dynamic economy I envision in this paper is governed by four categories of behavior of agents (firms), namely; (1) innovative *entry*, (2) *reorganization*, (3) *operations management* and (4) *exit*. With fairly unrestricted selection mechanisms guided by initial market conditions and competitive processes in markets any attempt to use the standard mathematical tool box of economics will fail or force specifications that remove the relevant features of the growth process. I will use, as a supporting intellectual tool the micro-macro simulation model of the Swedish economy that incorporates the above features.

Competition among agents in markets drives economic growth through innovative behavior and the selection process and coordinates the economy through multimarket price and quantity setting.

(Figure 1 in around here)

The *intensity of competition* depends on the spread in the capacities of business organizations to generate synergies, or scale economies, or rents, or productivity. A ranking of such capacities, sometimes called Salter (1960) curves (see Figure 1), is made up, not only of existing firms, but also of what every firm expects existing firms to be capable of doing, like the consequences for market competition of investment, of exit and of not yet existing firms, that may come into existence (entry).

This paper, hence, makes organizational competence part of (and indistinguishable from) technical change as it relates to the performance of the macro economy. This is not an analytical piece, but a story about ongoing self-coordinated economic activities, moved by live agents. My story will be about micro firm behavior, but with particular attention being paid to how firms stay in business in a competitive landscape that they themselves create and change. My notion (1987, 1990c, 1991c) of the *experimentally organized economy* (EOE) will be fundamental for my explanation of how firms create and maintain the competence they need to do that. It determines the nature of firm behavior as "experimental learning machines" that operate in the imperfect intersection of the product, labor and financial markets, making up a *path dependent* economic system. I need this "picture" of the dynamic market organization of an economy as an alternative to the classical economic model in order to address the problem of technology and firm-based economic competence in a macroeconomic perspective. The behavior of firms in dynamic markets is therefore central to my understanding of macro. The constant competitive struggle of agents to beat each other, induced by the incentives of the economic system and forced by competition moves the macro economy, very much as Adam Smith argued it would do. The "novelty" of this paper is that I can demonstrate through a numerically specified model – the Swedish micro-to-macro model – that these competitive growth mechanisms exist (Eliasson 1991a, c) and that they are kept in operation by the firms' need to stay competitive, and their means to do that, namely their efficiency in upgrading their competence through organizational learning (Eliasson 1990b, 1992a). The theory of the firm, to be relevant for this analysis, has to incorporate such organizational learning and the theory of the market economy has to explicitly model this competitive process and firm dynamics. This is a minimum theoretical requirement for the understanding of macroeconomic growth.

One result is that technological change, traditionally measured and interpreted as machine-based technological improvements in production function analysis,

mostly originates as organizational change between firms and establishments, and that the same picture emerges within the firm.

This means that hardware (machine) technology sets the upper limits of the capacity of the economy to grow, capacities that are moved outward through investments and innovations. But innovations are global phenomena, and the organization of the economy, and of its firms, represents a higher level organizational technology (that can also improve through organizational innovations) that limits the capacity of the firm, or the economy to exploit globally available new technology (the *business opportunity set*). Therefore some economies soar alone in excellence despite an obvious absence of new technology. Therefore some economies stagnate in the midst of soaring technological advance and/or global economic expansion.

Human competence dominates economic performance at all levels. Its hallmark is heterogeneity to the extent that – in each agent – certain dimensions of it are unique and not (directly) imitable or communicable. Each of us walks through life with strong opinions of what is the best, whether it be our views about how to run a firm, on which economic theory to use, or on how to organize family life.

We all need a theory to feel comfortable, and whether good or bad we have to believe in what we have chosen. We need a theory to restrict our vision to make it possible to organize the facts we think we know and our thoughts, to get a coherent picture of the whole, without getting lost in the complexities of our entire economic environment. Theory is just a more sophisticated name for the "bounded rationality" of Simon (1955) and others. There are many possible "theories" to guide firm behavior, which means that although some of them will be right, most of them will be more or less wrong. This is the essence of what I call the *experimentally organized economy* (Eliasson 1987, 1990b, 1991c).

Economic analysis, economic forecasting and economic policy making have a strong hardware tradition that has difficulties dealing with the *quality dimension* of economic activity, especially the importance of the human competence contribution to production. Without human competence in production the productivity of other factors of production dwindles. This paper takes a software look at hardware technology through the theory and reality of the firm. I will view the firm for what it has to be, namely "a competent team" (Eliasson 1990b).

3. The experimental nature of economic activity

Adam Smith (1776) laid down the principal design of a decentralized market economy in which division of labor made economies of scale "in the small" possible and the realization of large macro productivity effects feasible. This benefit, however, came at a significant cost, a fact that "modern" mathematical representations of the invisible hand have missed. The organization of the division of labor itself is an instance of innovative behavior. It evolved gradually in the market. Once realized, economic activity had to be *coordinated* physically (transports) and through communication.

Once an innovative design, whether being technical, organizational, or commercial has been accomplished, competitors will soon learn (imitate). If your organization is large enough you will want to diffuse the new knowledge throughout your organization. You may also want to sell your knowledge at a profit (licensing, "consulting", etc.). *Learning*, hence, becomes a general and resource-using economic activity.

Even very simple and tiny tasks (you soon learn) can normally be solved in a large number of ways. The higher up, the more complex the decision problem and the larger the number of possible solutions. Some of these solutions have to be better than other. The problem, however, is that *you will never know until you have tried them. This is the essence of the experimentally organized*

economy. The number of solutions delimits the large *business opportunity set* that faces each agent, who has to search his way into the opportunity set by trial and error, being directed by a limited vision ("theory") of all possibilities ("bounded rationality"). Since each agent has his or her particular vision as guidance, there will be strong limitations on communication because of limited and differently composed *receiver competence* (Eliasson 1990a p. 17, 1990b). The result will be, at each point in time, a heterogeneous structure of competence, defined by the organization of people in the economy.

Much of the knowledge put to use in a firm, especially high-level knowledge, vested in the top competent team of a firm is difficult, or impossible to communicate on coded form as information. It is *tacit*. Tacit knowledge is acquired through on-the-job learning and filters through the economy (selection); through the acquisition of the whole of, or parts of, firms in the M&A market or through the mobility of people or teams of people with competence in the labor market (Eliasson 1990d).

I have now introduced four general, knowledge-based information activities; *coordination, innovation, learning* and *selection* (see Table 1, and Eliasson 1987 p. 12). Together they can be defined to cover all activities in the economy.

(Table 1 in here)

The economic classification base, hence, should begin from the knowledge or information side, which dominates all other activities. If you want to capture the substitution of physical labor for automation technique, this is necessary, since this substitution means replacing one information system for another (Eliasson 1989, 1990, p. 57). For instance, any hardware factory process can be broken down into a sequence of coordination processes, being controlled by an information system. If you change the information system you change the productivity properties of the whole production sequence. *Automating a workshop* means substituting a decentralized production organization, built on the local competence of skilled workers for the centralized control of physical

flows of production. The problem is that it is almost impossible to construct statistical systems with enough fine detail for this kind of *complete information accounting*. You have done it, however, when you have a fully automated plant.

From a practical measurement point of view, at the level of the top competent team of a firm, however, this degree of detail in measurement becomes impractical (Eliasson 1976). It is, nevertheless, perfectly possible to quantify large parts of the input structure of the economic information activities, using readily available data in firms. Using these data we can then uncover the mechanisms by which the soft and the hard parts interact. We will also find that even with standard definitions of the content of production, information processing, broadly defined is a dominant resource-using economic activity. Hence, productivity advance as measured at the macroeconomic level, and usually identified with improved hardware performance, is significantly influenced by competence-induced technical change in economic information processing. Such technical change in economic information processing originates in the changing organization of institutions that controls the market processes of the economy.

A reasonable modification of the traditional economic measurement system is sufficient to demonstrate the economic importance of knowledge-based information activities. We can establish that most of what we call technical change, as observed through macro production function analysis, really is composed of changes in the technology of economic information processing, which in turn originates in *innovative organizational change*, including innovative change in the organization of learning to accumulate new competence. This observation demands a very broadly based definition of innovation. Innovation is something much more than hardware technical matters. Innovation also occurs at the level of the top competent team in the form of innovative, organizational change (Eliasson 1990b, c).

On this score we can learn *three* important things from research carried out by Bo Carlsson. *First*, in two early IUI studies (Carlsson et al. 1979, p. 34, Carlsson 1980) Carlsson demonstrated that when stripped down to the level of a division or an establishment more than 50 percent of total factor productivity change at the manufacturing industry level originated in structural adjustment between existing establishments as low-performing units upgraded to the best-performing units, most of the improvement, however, being due to the exit of low-performing units, and the transfer of resources to high-performing units. New investment in best-practice plant technology raises the upper limits of that transfer, but since the economy is all the time operating far below these upper limits significant macroeconomic effects of new investments in best-practice technology will take a long time to show. There is no direct drive behind new technology and macroeconomic growth. Economic allocation mechanisms that require time come in between. *Second*, Carlsson (1989) reports that technological change in manufacturing is generally making smaller scale production more economically viable than earlier, this being reflected in a general reduction in the average size of both plants and firms among the industrialized countries. This observation is strengthened by the relatively faster advance of private service production observed above. Carlsson notes that Sweden is the only important exception to this development. Smaller scale, service-oriented and competence-intensive production will increase the importance for macro performance of structural adjustment at the plant and establishment levels. It is also interesting, in this context, to recall Pratten's (1976) results from an analysis of comparable Swedish and U.K. manufacturing firms. While the U.K. firms were generally larger (by a financial definition) than their Swedish counterparts, the Swedish production plants were generally much larger and much more productive than the corresponding U.K. units. The predominant concern with process cost efficiency in Swedish firms was also obvious from a comparison between Swedish and U.S. budgeting practices in the early 70s (Eliasson 1976, p. 227). Apparently the Swedes have continued to enjoy increasing such economies of scale through the 80s, in contrast to a contrary development in the rest of the world. This time, however the base for such economies has been broadened

to include also financial (group) size, meaning that R&D in product development, production and global marketing has been integrated very productively to enhance competitive behavior of Swedish multinationals during the 80s (Eliasson 1985b).

Third, Carlsson (1991) observes that in a 20-year perspective total factor productivity growth is almost all a matter of reallocation of resources within existing plants. This tallies nicely with my own results on entry and exit (1991a). Beyond the 20-year horizon the introduction of new technology through entry and through new investment begins to exhibit sizable macroeconomic effects. I will return to this conclusion below.

These empirical observations make it clear that selection mechanisms play an important dynamic role in the growth process. Innovative entry immediately affects competition in markets and forces incumbents to raise performance (Eliasson 1991a), but exhibits direct productivity effects only in the very long run. Exit has an immediate impact on productivity and releases resources for other agents to grow on. All this can be illustrated in the Swedish micro-macro model.

The deviant and successful pattern of development among large Swedish firms during the 80s raises the interesting and worrying question what the probabilities for a repeat performance in the 90s are.

Swedish industry shifted its competitive base from generous raw material rents in the 50s to the high-level organizational knowledge and technical capacity of the large engineering firms of the 80s. This shift took place mainly through the faster growth of existing firms in the right markets and product technologies and the slower growth of firms in less viable basic industries. The Swedish economy currently very much bases its economic prosperity on such competence in a small number of giant international firms (see Table 2). The critical question for the future has a competence and a policy side. The competence question is to what extent countries like Sweden can continue to

base their economic wealth on the organizational capacity of such large firms to stay ahead technologically, as the rest of the advancing industrialized world learns to do the same thing. If not the competitive situation of the entire economy is very exposed. Another, equally pertinent question is whether a particular nation like Sweden will be able to enjoy the presence in Sweden, of these highly internationally mobile, value-creating businesses (the policy question).

(Table 2 in here)

Having come this far we can conclude that the engine of the macroeconomic growth machinery has to be looked for in the individual rent-seeking behavior of firms that are more or less competent in organizing themselves to exploit the vast number of commercial and technological opportunities that exist in the global business opportunity set. The question is how such dynamic competition occurs in the experimentally organized economy and to what extent particular industry structures mean better preparedness for the future than other.

4. The open economic system bounded by local competence

Karl Marx, observing the impressive economic performance of the industrial revolution, did what economists have always done; he extrapolated what he saw, and, hence, saw no end to the production potential of the "modern" industrial (factory) organization of work. The problem was that his mind, like the minds of economists in general, was shaped in terms of the firm as a factory, producing increasing tonnage of a homogenous product ("steel"). Marx, then, of course had to explain why production was limited, and, hence, borrowed an old idea from Adam Smith, again restated by Stigler in 1951, about the market as the limiting factor. What Marx missed was the *quality dimension* of output. Quality removed the market restriction to economic growth. There may be a limit to how much "quantity" ("steel") you can

consume, but not to how much quality you can consume (French village wine vs Chateau Margaux), only a competence limit to how much you can enjoy the quality.

4.1 The three axioms of the experimentally organized economy

This revised notion of output changes the unlimited productivity potential of Marx into an for all practical purposes *unlimited set of business opportunities*, where unlimited *quality differentiation* constitutes the important expansionary element.

The Smithian market limit is now replaced (Eliasson 1988a, 1990b) by a *local, competence limit on the supply side*, namely the local competence of the firm

- to create new qualities, including new competence *(innovation)*, and
- to receive new competence (*learning*).

Also this competence is characterized by extreme heterogeneity, making its quality dimension virtually incommunicable on coded form, i.e., as marketable information (type "instruction books").[2] This introduction of competence, rather than the market, as the limiting factor is more compatible with facts. It allows me to keep an open economic system very much as the pre-marginalist economists did (see Loasby 1991), but still bound the economy by local competence and known technology.[3]

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[2] Please, note that this is the only type of knowledge recognized by classical theory, including so-called "efficient market theory".

[3] This is also the design of the Swedish micro-to-macro model on which much of my reasoning is based (Eliasson 1991c). The reader should note that with the marginalists of the late 19th century the business opportunity set has been defined such that local agents operate on its frontiers (fully informed agents). This takes all dynamics out of the economy, except the exogenous shifting of the opportunity set on the production frontier.

Having come this far we can summarize the fundamental assumptions of the experimentally organized economy as follows (Eliasson 1991c):

I *State space*, or the (international) opportunity set, is for all practical purposes unlimited[4].

II *Behavior* of agents is characterized by
– bounded rationality
– tacit knowledge;
add to this (remember my introduction)

III *free access* to state space or the set of business opportunities (free competitive entry),

and the model of the experimentally organized economy emerges. The free entry clause is imperative. It allows anyone who feels competitive to enter the market and take on incumbents. The *deregulation* of markets, needed to occasion this competition, was exactly what took place in Europe just about the time the industrial revolution started, which it did only in those economies where the lid was taken off (Eliasson 1991a).

In the experimentally organized economy a large number of *locally competent* firms search into (or compete their way into) a vast space of opportunities. The individual outcome of such *technological competition* depends on their initial competence endowment and *how* they search.

New opportunities arise as a consequence of existing opportunities being created. This means that the economy is not open-ended at each point in time, only as a consequence of time and resource-using learning. But the opportunity set is at each point in time sufficiently large, to make its outer limits uninteresting for most agents in the market. It may be expanding or

[4] For a discussion see Eliasson (1987, 1988a, 1990b, 1991c).

contracting as a consequence of its exploitation. But the limits will only be approached in the very long run, *if* they are approached. Economic dynamics is thus a positive sum game, very much like the pig Särimner in the Viking saga, that was eaten for supper, but returned next morning to be eaten again (Eliasson 1987, p. 29). At each point in time the opportunity set is large enough to be always impossible for each agent to see through and understand as a whole. This vastness of the opportunity space can be illustrated even within the relatively restricted environment of the Swedish micro-to-macro model MOSES (see, e.g., Eliasson 1991c).

In this model, as well as in reality the competitive situation is such that the firms are normally more or less wrong in their decisions, *business mistakes* being the cost to society to make room for business successes ("creative destruction"), needed to achieve economic growth. In addition, mistakes are part of the on-the-job (economic) learning process of firms, and of society contributing to the updating of the *organizational competence memory* of firms and the economy at large.

In this competitive market environment no firm, no (small) economy, not even IBM is safe.

The experimentally organized economy is borne out by statistics. Jagrén (1984) demonstrates how even the largest firms, when observed over a sufficiently long time disappear from the "Fortune list", and even altogether as independent firms. He selected a random sample of some 150 Swedish firms from a register in the 20s and followed them into the 80s. By the mid-80s only 21 independent firms remained and most of them (19) had not grown very much in terms of employment during the period. Despite this, total employment of the remaining firms each year had grown faster than aggregate manufacturing employment (and output). The reason – of course – is that two firms, that Jagrén had selected by chance – Electrolux and Bofors – had grown extremely fast. We would, however, on the basis of the EOE, expect total employment or output of a randomly selected sample of some 100 to 500

firms some 50 to 100 years ago to grow somewhat more slowly than the corresponding total of all manufacturing, the difference being accounted for by entry. The theory of the experimentally organized economy, however, predicts that most of the incumbents at the time of the random selection some 50 to 100 years ago would no longer remain as independent firms. Some would have been shut down, some would have been acquired by other firms. The bulk of output would be accounted for by new firms and by a small group of remaining firms (Eliasson 1991a). In addition to this, I have to add (Eliasson 1990b, c) that the growth of the total industry aggregate is not independent of the "business mistakes" occurring along the way.

The point of my argument is that no individual firm can feel comfortable and safe in the creative, destruction process of the experimentally organized economy. An economy in which the majority of firms remain after a 50- to 100-year period is not a viable growth economy. The ultimate aim of policy making has to be to organize the economy such that no agent can escape the competitive pressure of the EOE, and to design a commercially minded culture that makes people capable of coping with this dynamic environment. This is the exact opposite to the classical, static model of economics and its materialization in the form of a centrally planned command economy. In such an economy you can predict, but there is nothing to look forward to.

4.2 Firm dynamics as the driving force in the Swedish micro-to-macro model MOSES

The Swedish micro-to-macro model MOSES emulates the dynamics of the experimentally organized economy. Rather than exhibiting the optimal allocation of a given endowment of resources over a given technology structure, economic development is seen as an ongoing learning process through state space or the investment opportunity set. In the process new resources and new technologies are created. This positive sum economic game is characterized by the investment/growth mechanisms of Table 3. Together

these mechanisms explain all investment activities behind economic growth.[5] The bulk of production growth occurs through the *reorganizing* and *rationalizing* of existing firms (items 2 and 3). The exit of low performers is a *divestment* activity that makes room for the expansion of high performers, not in the least through releasing labor and competence resources at reasonable costs. The productivity effects of exit are immediate. Reorganization and rationalization investments affect growth fast. In fact, most of the growth inducements in Swedish industry of the 80s came through the reorganization and rationalization of existing large firms. The entry mechanism is, however, critical in the long run. Without entry existing industrial structures will not be upgraded and modernized effectively (Eliasson 1991a) and especially not through the injection of new technologies not related to investments in existing industrial facilities. Innovative entry works in the very long run. It is highly experimental, the average performance of entrants being lower, rather than higher than that of the average incumbent (Eliasson 1991a) but the spread being much wider. Hence, the exit rate among new entrants is extremely high; and the viable market economy has to learn to live with (1) the exit of incumbents forced by successful entry, (2) the high failure rate of entrants, and (3) the long waiting time needed to see the few successes mature and grow sufficiently to influence macroeconomic behavior.

The time dimensions of the entire investment process are critical for understanding economic growth. The welfare of the current generation has been developed in a historic perspective, not over the last few years. Table 3 has been drawn on the premise that the firm is well defined, which is of course not the case. One particular dimension of long-term economic growth occurs in the intersection of the four investment categories, partly through changing the definition of the firm as a financial unit (mergers, acquisitions, divestments), partly through the formation of what Erik Dahmén (1950) called *development blocs*. A development bloc is based on vertical and horizontal

[5] All being also represented in the Swedish micro-to-macro model (Eliasson 1978, pp. 52 ff., 1985c, 1991c).

synergies or scale economies *between* firms, and the creation of new business opportunities for entrants within this synergy structure. The entire industrial revolution can be seen as such a development bloc created around the new machine tools developed some 150 years ago (Eliasson 1992c). The automobile and all that came with it is another such development bloc structure, as is the electronics-based information industry. Development bloc formation is a form of infrastructure entry that works in the very long run.

While mainstream economic analysis focuses on items (3) and possibly on (4) in Table 3 among a given number of existing firms, the experimentally organized economy as represented by the Swedish micro-to-macro model (see below) emphasizes all four elements of change, and is fully capable of embodying development bloc formation (Carlsson–Eliasson–Taymaz 1993), creating very different long-term macro dynamics.

(Table 3 in here)

5. The firm in the experimentally organized economy

The managing director of each firm would prefer to look forward to a long and successful business life, without the hazards of the EOE. Even though his horizon is considerably shorter than the life already realized by *Stora* (see Figure 2, the world's oldest joint stock company), survival and growth (for ever) as a portfolio of wealth is, and has to be the goal of a firm. Management, however, prefers a pace of competition that is comfortable and not unduly risky. Hence, it doesn't feel at ease in a viable, experimentally organized economy. In the classical model firms can plan (in principle) to achieve the state of full information, and this theoretical possibility of the classical economic model exerted significant intellectual influence on business administration literature of the 60s and early 70s, which abounded with treatises on "business planning" (see Eliasson 1976), until reality struck back

in the form of a series of macroeconomic crises. This literature, and its promotion of formal, long-range business planning is now gone.

(Figure 2 in here)

In the experimentally organized economy, and in reality, each firm has to reckon with the presence of many competitors aiming for its market niche through technological product competition (Eliasson 1987). The set of business opportunities is huge and mostly non-transparent to the individual firm. A firm that wants to survive cannot wait to compute its fully informed plan of what to do. Such a plan is unfeasible by definition (in the experimentally organized economy). More to the point, however, if the firm does not act prematurely on a very incomplete information base, it can be sure that one of its many competitors will score a success, because he happened to approach the opportunity set from the right angle.

So top firm management had better be equipped with a good *sense of direction*, which is the first, dominant competence requisite for success at all (see items in Table 4). If it doesn't, it will fail anyway. Hence, a firm will have to demonstrate itself to outsiders as a gambler, taking on seemingly large risks. With a good "sense of direction", however, the true risk exposure to the insider management is very much smaller. It should in fact be normal to define the competence of the firm in terms of its ability to transfer uncertainty in Knight's (1921) sense, into (for its own management) computable risks.

(Table 4 in here)

There are nevertheless learnable administration techniques to minimize the costs of mistakes. Techniques can be developed that make it possible to take on (reduce the risk of taking on) large risks, i.e., a technique to manage in situations when the first competitive requisite (intuition) has failed. This management technique consists of two elements; to *identify* mistakes early, and to *correct* mistakes immediately (Eliasson 1990a). Once these tests (elements

3 and 4 in Table 4) have been passed and the firm can set out to sea, another, and quite different element of competence has to be clicked on; the ability to *operate* the firm *efficiently* on a day-to-day basis and to feed experience back to the top (learning). A different group of people is normally responsible for managing this task. This orientation of administrative technique is apparent from an ongoing study of business information systems in practice (Eliasson 1990c). This organizational technique dominates when firms have found themselves in the right market for a long time and in high-volume activities. The larger Swedish multinationals have been very successful in this field in the 80s. The problem is that too much success in routine volume management is normally detrimental to the earlier "innovative" tasks, and even very large firms are at peril in the EOE.

6. Market dynamics and macroeconomic performance

We have been made to believe that "perfect markets" or the fully informed "competitive market" represent the invisible hand of the market economy. This is wrong. The competitive market of mainstream theory is nothing but a set of conditions describing the resting point of, the equilibrium of, or the solution to an equation system, representing an economy in which no innovative behavior occurs. This is not Adam Smith's idea of the invisible hand. But it has gradually become the idea of the invisible hand among economists after Jevons and Walras. Even Schumpeter embraced the market representation of Walras. He liked to start his analysis with a disturbance (by the entrepreneur) of a Walrasian equilibrium. His worried conclusion about the non-survival of a competitive market economy because of the ever increasing concentration that would come out of its successful performance has so far been refuted by reality. With the notion of the EOE in the background, it can be safely oncluded that Schumpeter's notion of for ever successful, routinized or planned innovation is not of this world. In an experimentally organized economy there is no routine management method to achieve the long-run

success of *Stora* (in Figure 2), even though this can be demonstrated to be feasible under the limiting assumptions of the static, classical model.

Market rivalry à la Smith (1776) and Schumpeter (1942) through innovative product development, i.e., through innovative *entry*, contrasts clearly with the classical Ricardian idea of markets, where prices are set at the margin where the worst performer earns no profit. In the experimentally organized economy the best performers raise product quality through innovation or lower prices such that the worst performers have to leave the market. Since this is an ongoing process and innovations cannot be predicted by definition, there is no well defined equilibrium in the EOE. I will use the Swedish micro-to-macro model to illustrate the incentive and competitive push mechanisms that keep a sufficient number of agents all the time on tip toe, competing for improved wealth positions in markets, and why they cannot lay back and relax, or in short, to understand the process of economic growth (Eliasson 1991c).

6.1 A generalized Salter curve analysis of innovative learning and enforced competition

A market, or the entire economy can at each point in time be represented by a distribution of potential performance characteristics, like the rates of return over the interest rate ($\overline{\varepsilon}$) in Figure 1.A. These types of distributions – especially if presented as productivity rankings of establishments (Figure 1.B) – are often referred to as Salter (1960) curves. Each firm is represented in this curve by a ranking on the vertical axis (the columns in Figures 1), the width of the column measuring the size of the firm in percent of all other firms. Figure 1.A shows that even though the firm in the model has increased its rate of return between 1983 and 1990 it has lost in ranking. Figure 1.B shows the same firm's labor productivity and wage cost positions. Finally, each firm has its own productivity frontier, under which it is operating to position itself on the productivity and rate of return rankings of the industry. This is still actual ex post performance 1983 and (simulated) 1990. The dynamics of

markets on the other hand is controlled by the potential ex ante set of distributions, that capture the planned action 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*. In the real world of the experimentally organized economy, as well as in its model approximation, the Swedish micro-to-macro model shows large *divergencies between actual and perceived positions*.

The ex ante distributions tell the potential for the firm to outbid all other firms in wages, or in paying a higher interest rate.

Learning about ones competitive situation – in reality or in theory – occurs in different dimensions. Prices offered in the market tell something about how other firms – notably the best firms – view their competitive situation. Competition, production, hiring etc. can also be directly observed. The firm, finally, learns directly itself, when it enters the market. The critical learning experience to observe in this context occurs when firms observe that competitors can do better. Firm management then knows that this *can be done* and that it had better improve in order not to be pushed down, right along the Salter distribution, and, perhaps, out.

Similarly, when the firm finds itself at the top, or close to the top, it knows that a whole lot of "closely inferior" firms feel threatened, and are taking action to better their positions through innovation or imitative learning.

The conclusion is that if potential Salter distributions are sufficiently steep and if all firms know it, firms – and especially the top left-hand group – will feel sufficiently threatened to actively aim for improving their positions on the Salter curve through innovation. If such innovative activity, notably through innovative entry in markets, is freely allowed, necessary conditions for maintaining sufficiently steep Salter distributions to move the entire economy through a selfperpetuated competitive process have been established (Eliasson

1985a, 1991a, c). These conditions become both necessary and sufficient if the opportunity set (Eliasson 1987) is sufficiently large. This also establishes the link between dynamic competition through the Schumpeterian (1912) entrepreneur and innovative entry, argued by Smith (1776) to be the critical function behind economic growth, that perpetuates a disequilibrium economic process type Wicksell (1898). A sufficiently large and heterogeneous state space, boundedly rational behavior on the part of agents, and sufficiently free innovative entry are the small modifications of the classical model that create the experimentally organized economy.

The Swedish micro-to-macro (M-M) model exhibits these features. Dynamic competition as described above determines entry and exit and hence the selection process that creates a path-dependent evolution, and non-stationary behavior that prevents classical learning. This is so, even though the M-M model for all practical purposes is deterministic. If you have the code of the M-M model, you can of course predict through deterministic simulation. The question was whether you would also be able to learn the structure of the model (to perform that prediction), without access to the code from observing the output from a large number of simulations, and with such precision that it would predict over a chosen future period, barring a predetermined stochastic error. This question reduces the problem; (1) to find an acceptable, estimable approximation of the M-M model, and (2) to estimate the parameters of that approximate model. If (3) the error terms between the M-M simulation ("reality") and the corresponding computed model values pass a test for randomness over any chosen simulation period, classical learning is not feasible and the particular behavioral characteristics of the firm of the EOE should exhibit themselves. This happens, for instance, if the technology or organization of learning in the economy affects economic growth as in Antonov–Trofimov (1991). The seemingly erratic behavior exhibited by the model economy, like major macro collapses that occur out of the blue (Eliasson 1983, 1984a, 1990c) all originate in the endogenous changes of the Salter distributions, characteristics that are impossible to reproduce in a predictable way by known estimable modeling techniques. This is sufficient to

rule out classical learning in the experimental setting of the M-M model. [I could also add the amusing experience we have had over the many years of modeling work. If you sit down at the computer and attempt to correct unexpected, disruptive and "socially undesirable macro behavior" by using its almost full assortment of traditional policy parameters, you tend to create more and stronger disruptive macro behavior of the same kind at some later period (Eliasson 1985a, pp. 78 ff.)]. The bounded rationality of Government in the experimentally organized market economy is obvious from simulations with the Swedish micro-to-macro model (Eliasson–Taymaz 1992).

The M-M model is a highly simplistic dynamical systems representation of the real market economy. Even though individual mechanisms are traditional and can be understood partially, the dynamics of the evolving system prevents classical learning. Reality, of course, requires that much more complexity be coped with.

6.2 *Innovative entry is the key to macro dynamics*

The critical understanding of markets, hence, comes with understanding the nature of competitive, innovative entry and the dynamic market process that innovative entry keeps in motion. This understanding requires a broad definition of entry, from the launching of a new product, via the establishment of a new company to the merger of two large companies, with the purpose of improving long-run profit performance.

Experience would suggest that small firms are superior to large firms as innovators, even though the consensus is not 100 percent (cf. Holmström 1989 versus Granstrand–Sjölander 1990). The large firms, however, together spend significantly more on R&D than do small firms. New entry is not always in the form of new firm entry. It can occur through the establishment of a new business activity within a large firm, or through the introduction of a new product. As I said, the merger of two large firms exercises market effects

similar to that of new entry (Eliasson 1991a), and the formation of synergistic development blocs exercise long and lasting effects on the entire economy (Carlsson–Eliasson–Taymaz 1993).

The role of small firms and new entry should be seen in the context of the following three observations:

1) The direct macroeconomic effects will be very slow in coming (Eliasson 1991a). Empirical evidence shows very small effects after a 10-year period.

Simulations on the Swedish micro-to-macro model show a significant direct macroeconomic influence only after some 20-30 years.

2) New entry in a broad sense preserves structural diversity, making faster growth feasible (Eliasson 1984a, 1991a). Even if entrants are on the average no better than incumbents, the spread in performance among them is larger. Since only the best survive, in the long run, viable entry and exit preserve diversity of structure.

Above all, however,

3) new innovative entry in a broad sense serves as a competitive force to shake up incumbents and move the market from Ricardian to Schumpeterian type competition.

Hence, understanding competition requires understanding the forces that drive new entry, and this is not easy. With the average new entrant being rather somewhat inferior to the average incumbent – if performance is measured by labor productivity or the rate of return (Granstrand 1986) – but the spread in performance being much wider, most new entrants will soon fail and exit.

The Swedish micro-to-macro model (Eliasson 1977, 1978, 1990c) embodies the type of competition that is generated by new entry and exit in the EOE. Such competition occurs in the "broad-based Salter (1960) landscape of firms" described above, depicting the distribution of productivities or rates of return over the firm population. Entering firms are represented by a "smaller such Salter distribution" with a much wider spread, disrupting the balance on the margin in the tail end of incumbent firms, where the marginally worst producer just covers wage costs.

Marginal incumbents exit and new product and factor prices are established at levels where most of the new entrants will soon perish and exit.

Many large incumbents will, however, be shaken by the remaining supreme entrants and be forced to shape up their competitive performance in order not to lose market shares, which presumably correspond to the size of their installed capacity to produce.

In the very long run the remaining, superior new entrants will begin to exercise a direct influence at the macro level. Performance characteristics after a 30-year simulation shows the upper left, "supreme" corner of the Salter distribution to be occupied by the new, now old entrants (Eliasson 1991a).

As most analytical results, this one is, however, obvious from the assumptions I have made. The critical issue is to understand *why* firms enter the market in large numbers despite being inferior, and do it repeatedly.

Such phenomena cannot be explained within the static, full information general equilibrium model, and not within an asymmetric information version of the efficient market theory, so popular in financial economics. It fits, however, nicely into the EOE. Under the assumptions of the EOE the entrants perform an experiment, the outcome of which cannot be assessed until it has been tested. The EOE has to possess a sufficiently large number

of such potentially competent and optimistic entrants or experimentators for the growth process to occur.

At first sight it is tempting to approach this problem as a lottery with known, or exogenously given odds. This is the standard procedure in R&D rivalry games which address similarly formulated problems. This is unacceptable for two reasons. First, the inclination of actors to play the lottery has to be explained. Second, the business lottery is a game where you can learn to improve your odds, and this learning will affect the willingness to participate in the game. The standard lottery of economics (R&D rivalry and efficient market theory) has no learning of that kind. It is a stationary process, that is unaffected by the ongoing business. Once learning to improve your competence to participate in business is introduced, the path-dependent, non-stationary economic growth process of the Swedish micro-to-macro model emerges.

7. Cases in support of micro-macro economics

The previous sections have been concerned with establishing the logics of the decentralized market economy that we have called the experimentally organized economy. It includes a statement of the assumptions needed to generate endogenous macroeconomic growth. To understand, however, you have to explain *how* the innovative activity occurs that upgrades the Salter curves at the upper left-hand corner of Figure 1 and that moves economic growth in the micro-to-macro model. This upgrading occurs through new entry, or through innovative reorganization and rationalization of existing firms. This innovative capacity depends on the competence of firms to exploit the international opportunity set. R&D expenditures in firms are to a large extent invested in the accumulation of such *receiver competence.* Even though the logical foundation of the experimentally organized economy should be sufficiently convincing empirically, I will conclude by illustrating some of these innovative and learning processes through case presentations. The micro-

macro model in fact can be seen as a method of generalizing case studies to the macro level. I will concentrate on the problems large firms encounter when they attempt to learn and/or innovate (items 2 and 3 in Table 3) to demonstrate that these attempts are not sufficient to carry economic growth in the long term. Viable entry and effective exit (items 1 and 4) are needed and have to be facilitated and supported by policy.

7.1 How do large firms learn to stay ahead?

Big firms devote increasing resources to different organizational learning activities. Some are directly measurable, others are integrated with work, like on-the-job training and systematically organized executive careers (Eliasson 1990c, d). For the large firms to succeed in the long run innovative learning will have to be organized as a steady, routine activity. One question is whether this is most efficiently organized in many small firms or in a few, very large firms. There are three principally different ways for the large firm to learn.

a) Analytical learning methods – "technology management"
b) External learning in markets
c) Internal learning
d) The career organization

The close to steady growth rates that were established during the 60s gradually lulled firms and Governments into a plannable steady state idea of the future market economy. This came to an abrupt end during the crisis years of the 70s with major business failures. Formalized planning came into disrepute and is now more or less eliminated from strategic business decision making in firms. Instead *analytical methods have been geared to the task of monitoring ex post development for the purpose of identifying and correcting mistakes*. This is a good example of organizational learning (Eliasson 1984b, 1990c). The central planning idea, however, persists among decision makers and has returned

among policy makers and business executives under the new label technology management and technological policy.

7.2 *The development of specific business competencies*

The best business school is the open market itself, where firms are confronted head on with the best performers. Stepped up global competition in markets for sophisticated engineering products in particular, and the dramatic developments on the international financial scene have made firm executives acutely aware of "the potential steepness of Salter curves in their market" and the necessity of acquiring competence to learn and to innovate. The introduction of new technology has been accelerated in the 80s, and many firms find that they do not possess the *receiver competence* necessary to learn efficiently from their competitors. For large firms this spells potential disaster and in the last decade attempts to acquire firms with the needed competence have been stepped up dramatically. The whole mechanical engineering industry is on tip toe to acquire electronics competence it does not possess, on the notion that it is needed to stay innovative in product development. The experience of such ventures is yet to be evaluated. In most cases the new acquisitions are not performing in ways intended. The difficulties of blending different corporate cultures and communication and learning codes exhibit themselves in these acquisition experiments. Failure is frequent. The theory of the experimentally organized economy, however, predicts that failure is a standard ex post macroeconomic cost for economic development, i.e., for achieving one or two accidental success stories. The number of very large firms is, however, limited. As large firms fail, over time the stock of large firms has to be replenished. New entry and growth of many small firms are needed to accomplish that task.

Green house diversification programs (notably of successful firms with large cash flows) are a systematically organized learning activity for the firm to be prepared whenever its main business lines begin to weaken. Again, such

systematic forms of organizational, *internal* learning have also usually failed. The actual acquisition of industrial knowledge cannot be efficiently organized as an academic exercise protected from competition. It must occur through competition in markets.

There is a growing evidence (Eliasson 1991d) that the international organization of a large firm is not only a "technique" to overcome trade barriers to earn rents from international trade, but also – as the firm grows in size – a technique to *learn about the global opportunity set* or "the global Salter structure" in the relevant international markets.

A particular and sometimes successful form of organizational learning that fits the experimentally organized economy takes place in well managed firms in mature product markets that have specialized in efficient operations management (routine product development, factory processing and global marketing). The standard story tells how such firms fail, not only to develop new products but also to introduce already developed new products into their flow efficient business organizations (Eliasson–Granstrand 1985). A systematic, organizational, learning activity that has been increasingly observed in such firms is to *develop the receiver competence*, to efficiently introduce new products into their organization related to their market knowhow but developed by other firms, and to shop for new innovative firms with products ready and tested in the market, being prepared to rapidly step up volumes to global industrial scale. If well done, such acquisitions can grow rapidly on the cash flow of the large corporation, supported by its experienced operations management being rapidly globalized through an already existing marketing and distribution organization. Granstrand– Sjölander (1990) show that a broad internal technology base makes the firm more efficient in acquiring and implementing new complementary knowledge. As this "learning activity" of large corporations grows, one would expect that viable acquisitions markets for innovative firms be spontaneously created. Increased competition for such firms will not only raise their market price, but also the incentives to start and build such firms (Eliasson 1986). In this case the situation is different. The

large international firm offers a "technology" that the small innovative firm does not have, and has large difficulties obtaining, namely, global marketing and distribution knowhow. If the two competencies are combined a new global business may arise. Sometimes this works, sometimes not. If not some other competitor has succeeded. When failure occurs, new businesses have to step in to fill the gap, illustrating again that entry and growth of small firms have to be viable to support continuing long-term growth.

7.3 *The accumulation of general competence through the career organization (the competent team)*

Organizational learning is a matter of people that learn and form different coalitions. Learning does not have to be focused on a particular business solution. The long-term success of a large business organization is rather a matter of the *general competence characteristics* of its staff, and its organizational competence to cope with new market situations. The business firm should therefore be regarded as a competent team rather than a portfolio of particular business assets (Eliasson 1990b). When the team fails, the firm fails. Team competence is updated through organizational learning. Such learning can take place (Eliasson 1990d) in external markets through the hiring of talented people, through the acquisition of human-based talent when buying entire firms, or in internal job markets through the career. The *career* is the by far most important learning process in big business organizations. Do the conclusions on organizational learning change if we refocus from the planning idea of aiming for a particular business competence to methods of keeping the organization staffed with competent people?

The tacit nature of critical top business competence is vested in teams of people with a varied composition of talents, rather than in individuals. The content of competence needed cannot be prescribed in advance. Thus, the career organization of the firm is its most important learning vehicle and the most important factor behind the development of the unique, organizational

competence characteristics of firms. For the firm, the ability of its employees to form and to operate in teams is more important than specialized skills. Specialized skills can be hired in markets. Hence, learning at this level is necessarily experimental, and occurs as a consequence of a *varied career*, which reveals intellectual business capacities both to the individual and to his or her superiors. The bulk of measured educational costs in a large firm is therefore allocated on talented people in the career.

The first observation is the enormous variation in skill composition needed to carry out various tasks in large firms. Complexity and variation increase with advancement, but the exact needs are never the same. This means that the ability to organize one's mind to get a messy business situation structured is highly valued. Such abilities only exhibit themselves by testing people on increasingly difficult tasks. Many large firms are doing this deliberately, arguing that the risks, and the costs of getting the wrong person too high up in the organization are larger by several orders of magnitude, than of low-level decision mistakes made by people on their way up. To dare to decide and act is a necessary element of high-level competence but also the ability to identify, accept and brutally correct a mistaken business situation. The latter only comes with practice. And without the knowledge that you can deal with mistakes, you rarely venture to act daringly (cf. Table 4). Hence, part of the education provided by a varied career is to learn about yourself, and for the top competent team to learn about you. This selection mechanism exhibits certain similarities with the principal agent monitoring literature even though you would not, having read this literature, go and look for the things I am telling you about. Part of the educational technique, furthermore, is to establish the appropriate internal business mentality and attitudes to risktaking (Eliasson 1990d). Obviously, what is appropriate varies from firm to firm and from market to market. Compare, for instance, the need for experimentation in the U.S. Supreme Court with the corresponding needs in the PC market.

Most of the learning in a career is *on-the-job learning* or *organizational learning*, a joint production activity (Rosen 1972) producing both value added

and (an intermediate product) added competence. The technology of learning is therefore embodied in the organization of people in the firm. This organization is in turn constantly changing, making also the knowledge to organize improvements in organizational learning subject to improvement. Learning through experiments is the adequate term to identify this intellectual process in large business organizations.

One could say, at this stage, that firms that have not designed their organization for general competence upgrading well will rarely possess the *receiver competence* needed to acquire new specific business competencies and will sooner or later fail.

7.4 Organizational learning occurs at the level of the economic system as well as of the individual firm

The general experience from the learning and innovative activities of existing, notably large firms is that however large resources they spend they normally fail when their markets are subjected to radical, technological change. Hence, it is dangerous to build long-term industrial policy on the presumption that existing large firms will carry the economy forever. In the experimentally organized economy the acquisition of new technology and long-term growth will have to originate through the entry and exit mechanisms. While organizational learning is normally associated with the firm this conclusion places emphasis on a higher order of *economic systems learning* as entry and exit affect the organization of the entire economy (see Eliasson 1992b, pp. 36 f.). It therefore becomes important to think about how the institutions of the economy are structured to support incentives for entry and the ability of the political system of the economy to cope with unexpected local change (Eliasson 1992c, 1993a).

7.5 *Development bloc formation*

Development bloc formation is a particular form of entry that operates in the very long run, and exhibits, if it succeeds, an accelerating growth pattern over a very long period. The development bloc forms spontaneously around synergies associated with several technologies that interact. The development bloc includes the economic exploitation of opportunities created within the bloc. If the critical technology mass needed for take-off or acceleration fails to develop, the beginning bloc formation will collapse prematurely. An example of that is the fact that (barring telecommunications) Europe has so far failed to build a viable electronics/information industry development bloc. This is so despite enormous policy efforts and subsidies on the part of European Governments to create such a development potential. In the United States with limited political ambitions to assign or build specific development blocs the electronics/information industry today occupies a very large part of manufacturing.

Could one reason be that European policy makers have focused their attention on the conservative knowledge base of existing producers and transferred industrial welfare subsidies to them in the hope that they become innovative players in new technology fields, while U.S. policy so far has been to force firms to learn through competition in open markets, allowing bad innovators and learners to be eliminated?

The firm, especially the large firm, can be seen as a particular form of development bloc, exploiting internal technical synergies to achieve economic objectives. In that vein mergers, acquisitions and divestments to achieve another, restructured and more efficient and profitable firm also become a special form of development bloc formation, the difference between the more widely defined development bloc of Dahmén (1950) being that the new firm can be controlled financially through ownership, while the development bloc is held together through technical synergies and joint business opportunities.

As you move from the little one-product one-technology firm, to the giant international firm and on to the more loosely structured development bloc, the potential for central control diminishes even though the joint interest to preserve the opportunities and rents associated with the firm and the development bloc is everywhere present. The more loosely structured the firm/bloc organization the less can be done centrally to save the organization if it encounters problems in competitive markets. The more loosely structured the more scope for free competitive entry, and the closer to the level of a national economy the development bloc.

Once this distinction has been made between traditional learning within existing business organizations and national economic systems learning through entry and exit (selection) certain guidelines for industrial policy become clear that differ radically from the existing industrial policy repertoire of Governments. We have now also understood that neither innovative entry nor economic growth can ever be understood through a theory that does not explicitly explain dynamic and selective micro behavior in markets (like failure and exit) and aggregating such micro behavior through dynamic markets to the macro level. A micro-macro theory of markets and firms is needed.

8. Conclusions on policy in an economy dominated by selection mechanisms

Apparently the growth mechanisms of an economy is partly dependent on the competitive interaction of new innovative entrants, embodying new business technology and large players in mature markets, competing on the basis of economies of scale, but trying at large costs and rare success also to be innovative. Selection mechanisms dominate long-term industrial development.

The big players dominate the short- and medium-term social employment and production variables. The small players dominate very long-term economic growth and employment. Long-term growth, however, all the time requires that low-performaning players, whether big or small, be forced to exit or

reorganize completely. Most big firms will eventually be competed out of business.

Underlying this growth process is the steady learning of firms to create and to master new business technology. The most important learning mechanism is participation in market competition with the best producers. If such organizational learning by firms is interrupted the entire growth process of the economy is also interrupted. Empirical evidence, however, shows that learning will never be sufficient to save a sufficiently large number of the existing firms to support long-run growth. New entry and small firm growth will have to fill in as the big firms fail (Eliasson 1991a). This replenishment of the stock of ongoing businesses at the high end requires a very much larger stock of smaller businesses at the small end, since very few of them will succeed and become big.

The effects of a slower new business formation at the high end, and fewer exits at the low end of the Salter curve therefore are not only a less efficient long-term allocation of existing resources, but also a deficient accumulation of new resources. The macroeconomic effects, however, take decades to show significantly. This selection process can be seen as a case of organizational learning for the entire economic system (Eliasson 1992c, p. 36 f.). The policy implications are serious. There exists no political system capable of taking responsibility for such a long-term horizon. The political system therefore cannot operate efficiently through industrial or technological policy makers to achieve specific business outcomes. The time horizon is too far off for them and the centralized competence base is insufficient. The only policy method to deal with this dilemma is to be concerned about the institutions of the economy upon which incentives to innovate and competition are based.

Three final observations should therefore be made in this context. *First*, big firm management and central policy makers suffer from the same problem, centrally accumulated knowledge becomes too remote and academic for effective innovation guidance and has to draw on secondhand sources of

existing, already old organizational experience (Eliasson 1984b). Inevitably, such decisions will be conservatively inclined and prone to failure in viable and quick innovation markets. Here IBM and European electronics industry have a common problem.

Second, while technology is international, policy is by definition national. This constitutes an intellectual conflict that surfaces most clearly in the international firm. The international firm is a local competence (or policy) system that has gone beyond the national boundaries to efficiently access the international set of business opportunities (Eliasson 1991d). The international firm can be regarded as a technological and economic development bloc.

Third, and finally, the international firm can still pursue specific firm technological objectives. It will succeed or fail in the market. A formerly planned economy faces the very similar problem of transforming itself into a growing industrial nation. Should it do that by assigning specific technological targets like a firm? It should not, and for three reasons. Governments lack the central operational knowledge needed to have a reasonable change of choosing the right target. Governments should not take the risk of radical failure. Even if failure is moderate, democratic Governments do not have the political decision capacity to efficiently correct mistakes (Eliasson 1990b). Hence, Governments in Western industrialized countries as well as formerly planned economies should focus on getting their incentives right and market competition in place; i.e., on building the right institutions (Eliasson 1993a, c).

Figure 1 **Salter curve structures illustrating the dynamics of the Swedish micro-to-macro model**

Figure 1.A Excess rates of return ($=\bar{\varepsilon}$) distributions 1983 and 1990.

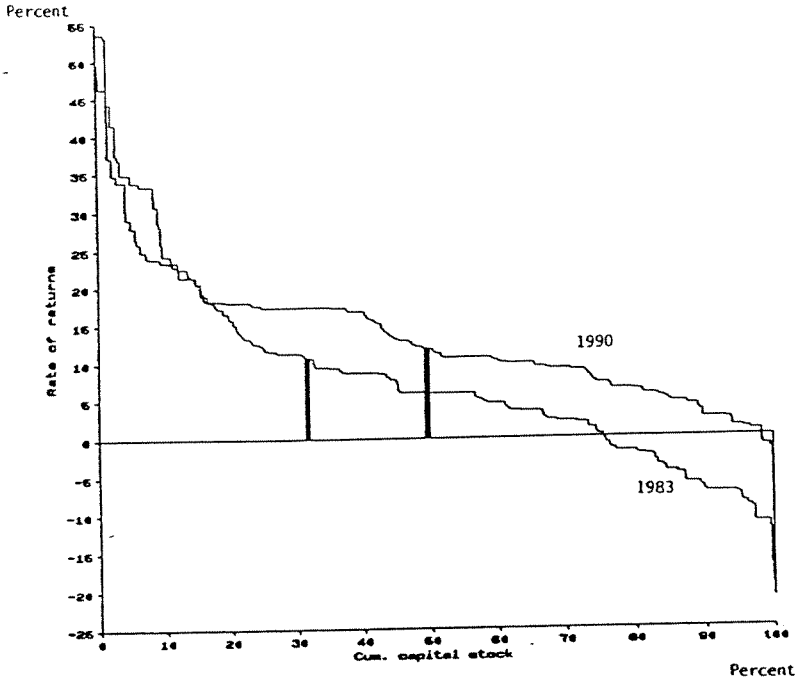
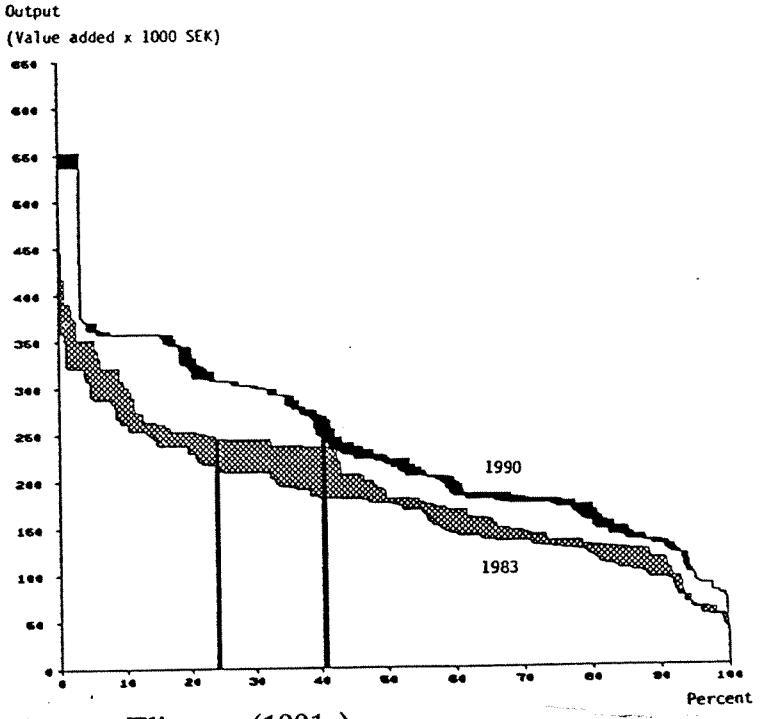


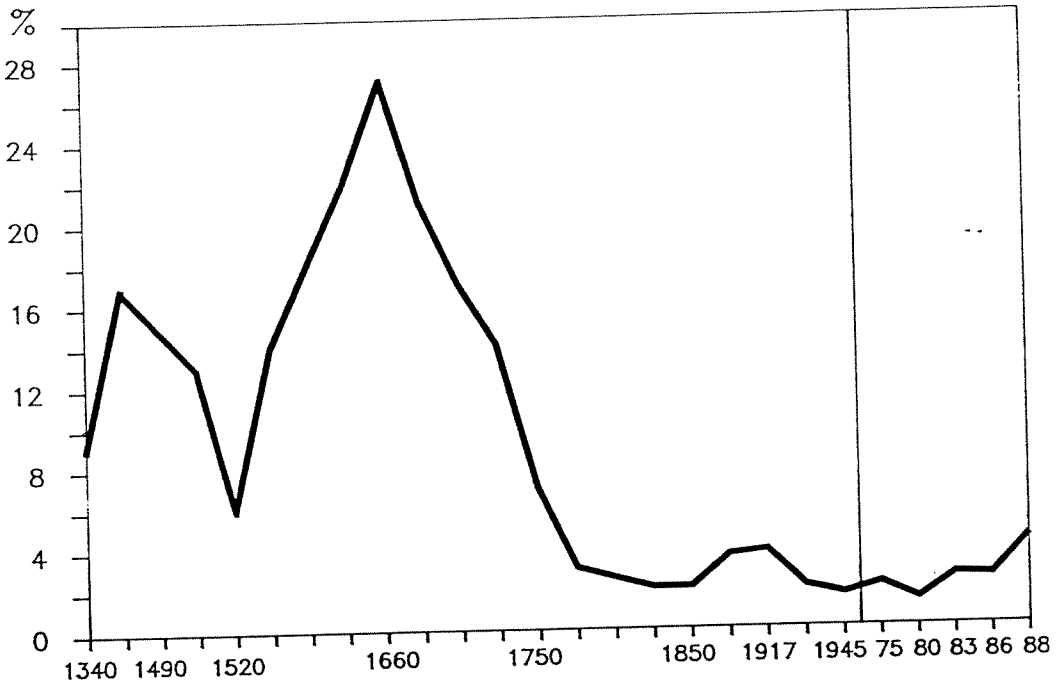
Figure 1.B Actual and potential labor productivity distributions 1983 and 1990. [Shaded areas denote unused labor capacity (labor hoarding)].



Source: Eliasson (1991c).

Figure 2 **The share of total Swedish manufacturing employment of *Stora* 1340-1988**

Company turn-over in per cent of total manufacturing & mining production.



Source: See Introduction by Gunnar Eliasson to Day–Eliasson–Wihlborg (eds.), *The Markets for Innovation Ownership and Control*, IUI, Stockholm and North-Holland, Amsterdam, 1993.

Table 1 **The four basic economic activities in the knowledge-based information economy**

1. COORDINATION (organizational structure)	The invisible and visible hands at work – competition (in markets, Smith 1776) – management (of hierarchies, Chandler 1977)
2. INNOVATION (exploring state space)	Creation and exploitation of new business opportunities (Schumpeter 1912) – innovation – entrepreneurship – technical development
3. SELECTION (organizational change)	Incentives for change – entry – exit – mobility
4. LEARNING	Knowledge transfer (Mill 1848) – education – imitation – diffusion

Source: *The Knowledge Based Information Economy*, IUI, Stockholm, 1990, p. 73.

Table 2 **Dominance of the 10 largest Swedish corporations**

In 1965, 1970, 1974, 1978, 1986 and 1990 the ten largest Swedish multinationals accounted for (percent of):

	1965	1970	1974	1978	1986	1990
Swedish goods exports	19	25	27	31	37	34
Foreign Swedish employment	78	73	75	69	75	85
Manufacturing employment in Sweden	16	19	23	24	31	27
Including also indirect employment with subcontractors	–	–	–	ca 31	–	–
Total manufacturing R&D	42	–	52	44	74	72

Note: Data on the ten largest manufacturing firms each year, by employment. ABB excluded in 1950.

Source: Eliasson (1991d), MOSES Database, IUI, 1992, and the 1990 IUI Survey of Swedish multinational firms.

Table 3 The four fundamental investment/growth mechanisms

(1) *entry*, new innovative establishments
(2) *reorganization* of existing firms
(3) efficient *management* of existing firms
(4) bankruptcy, *exit* or creative destruction

Source: Eliasson (1993b).

Table 4 **Competence specification of the experimentally organized firm**

1. Sense of direction (intuition)
2. Risk willing
3. Efficient identification of mistakes
4. Effective correction of mistakes

- - - - - - - - - - - - - -

5. Efficient coordination
6. Efficient learning feedback to (1)

Source: Eliasson (1990a).

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