

Transformation pressure and growth – a missing link in macroeconomics¹

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(February 27, 2001)

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Abstract

Economists and politicians in Sweden stated in the early 1990s that devaluations of the country's currency had lessened the external pressure on manufacturing and led to a delay in structural change and rationalizations. The theory of transformation pressure generalizes the idea that productivity growth in firms is promoted by intense competition, cost pushes and low product demand. The main challenge faced by such a theory is to explain why it seems that an immediate threat is needed to get a productive response from firms. Three separate explanations are presented here emphasizing either the value of waiting to get more information about potential threats, the irrational tendency to ignore threats until they show up or the stimulation of individual creativity when firms are put under real pressure. But productivity growth is not always promoted by tight external circumstances. Growth may be maximized if pressure in each period is moderate or if periods with strong pressure are followed by periods of financial and technical consolidation, scale advantages and lesser needs to spend resources on rationalization in order to survive.

JEL classification: D24; D81; L16; L21; N64; O31

Keywords: Transformation Pressure; Competition; X-inefficiency; Innovations; Productivity; Growth; Irrationality; Uncertainty; R&D investments

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¹ Previous versions of the paper have been presented at a conference on the history of economic thoughts October 22-24 1998, at the Stockholm School of Economics November 17 1998 and at the Trade Union Institute for Economic Research (FIEF) 7 April 1999. I am particularly grateful for the comments by Erik Dahmén, Martin Dufwenberg, Rolf Henriksson, Lars Jonung, Hans Lind, Håkan Lindgren, Eva Skult, Hans-Michael Trautwein and three anonymous referees. The research has been funded by the Swedish Council for Planning and Coordination of Research (FRN).

1. Introduction

Average labor productivity growth was relatively low in Swedish industries from the mid-1970s to the early 1990s.² A government expert commission emphasized in the early 1990s that productivity growth had been low in Sweden because of a weak transformation pressure. Above all, repeated devaluations of the Swedish crown (SEK) had delayed rationalization and structural change in the exposed sector (Produktivtetsdelegationen, 1992). The conclusion was based on some crude indicators but also on time series analysis showing that actual profits had a delayed negative effect on labor productivity in several industries on the two and three-digit levels (Erixon, 1991b, pp. 349-356). Devaluations in the early 1980s had led to a profit boom in Swedish manufacturing.

In the early 1990s, Swedish politicians, including those who had been responsible for economic policy in the two preceding decades, unequivocally accepted the hypothesis that productivity growth in Sweden had been hampered by devaluations. They used the concept transformation pressure when arguing for a hard-currency policy and also for deregulations, EU integration and a more rigorous anti-trust legislation. A political resistance to reductions in pay-roll taxes and floating exchange rates until late 1992 was *inter alia* based on a conviction that transformation pressure must be kept high to raise productivity growth. The resistance was later accused of having contributed to the sharp decline in Swedish GDP growth 1991-1993. But the argument for transformation pressure was confirmed by a remarkable recovery in labor productivity growth in Swedish manufacturing in the first half of the 1990s; the deep recession, the high rates of interest and the hard-currency policy induced the firms to use the large potentials for rationalization that had been built up in the 1980s and to speed up the introduction of new work organizations. Further, an exceptional elimination of low-productivity units took place in Swedish manufacturing in the early 1990s, contributing, although to a lesser degree than rationalization (and labor substitution), to the recovery in labor productivity growth (Erixon, 2001).

² Sweden also experienced large losses of market shares, e.g. for R&D-intensive products, in this period despite relatively low unit labor costs (Erixon, 1989, 1991a,b and Edquist, 1991). Sweden's

Attempts were made by Swedish economists in the 1990s to formulate a theory of transformation pressure including a theory of a relationship between exchange-rate policies and productivity growth (Erixon, 1991b, 1995 and 1998). The theoretical work was facilitated by a unique Swedish tradition in economics integrating business cycle and growth analysis with Johan Åkerman, Erik Dahmén and Ingvar Svennilson as outstanding representatives (see Åkerman, 1960, Dahmén, 1970, Svennilson, 1954, Carlsson and Henriksson, 1991). The notion of transformation pressure was first used by Dahmén in distinguishing prime driving forces in an evolutionary process. The Swedish postwar model of economic policy – the Rehn-Meidner model - also influenced the development of a theory of transformation pressure. The model assumes that profit squeezes through solidaristic wage policy and fiscal restraint will speed up structural change and put a rationalization pressure on ineffective firms (Erixon, 2000, 2001).

Investments may be enhanced by a reduction in expected and actual profits in the theory of transformation pressure. In contrast, investments are generally stimulated by high expected profits in modern macroeconomics. Further, in Keynesian models, high actual aggregate demand and profits have a positive impact on capacity-augmenting investments reflecting the importance of the accelerator, backward-looking expectations or the desire of self-finance. Devaluations and other expansionary stabilization-policy measures can then start a continuous recovery process and even a virtuous growth circle (Kalecki, 1965, Harrod, 1970, Steindl, 1979, Greenwald and Stiglitz, 1993). Besides, total factor productivity is stimulated if static scale advantages prevail or if investments embody new technologies and products (dynamic scale advantages). Thus, in Keynesian models, high actual profits and demand will stimulate, not impede, productivity growth as in the theory of transformation pressure.

The new growth theory scrutinizes the role of ‘opportunities’ rather than ‘pressures’ exactly as the Keynesian growth theory. For example, new-growth theorists focus on the market-enlarging and cost-reducing, not the market-rivalry, aspects of a relationship between trade and growth. Extended markets through trade will increase the amount of R&D investments leading to higher sustainable growth rates through

slow productivity growth and losses of market shares were modest, however, if Japan is excluded from the group of reference countries.

non-diminishing returns in R&D activities, knowledge spillover effects and learning by doing or learning by using effects (Romer, 1990, Rivera-Batiz and Romer, 1991, Grossman and Helpman, 1991, 1994).³ Trade will even promote growth in a small country by stimulating the R&D sector according to Gene Grossman's and Elhanan Helpman's growth model. But the expansion of the R&D sector is here caused by a release of resources (skilled workers) from other sectors leading to lower innovation costs, not by a stronger transformation pressure. On the contrary, R&D investments will be depressed, *ceteris paribus*, by international competition; the profitability of R&D decreases when foreign competition is intensified, a relationship that for a small country will outweigh the positive trade effects on this profitability from enlarged markets.⁴

The theory of X-inefficiencies, and the related principal-agent theory, assumes that tighter external circumstances (mostly harder competition) lead to stronger efforts in firms to increase productivity. But the theory does not emphasize, as the theory of transformation pressure, that external threats must be *immediate* to adjust firm behavior to profit maximization. Moreover, the focus in the X-inefficiency literature is on allocative inefficiencies and on individual firms and industries, not on innovations and national growth (cf. Leibenstein, 1979, Frantz, 1992). Neo-Schumpeterians and other industrial economists have argued in X-inefficiency terms that firms suffering from a hard competitive pressure are enforced to be more innovative in order to survive. But they rather stress that intense competition has a negative impact on innovations. R&D investments will be low when the number of (small) producers is large and entry barriers are low since expected innovation profits and the probability of being the successful innovator become too small and the costs of failure too large. Further, the efficiency of R&D investments is hampered by fierce competition (potential or real) if there are significant returns to scale in R&D or a

³ A market-enlargement argument for a positive relationship between economic integration and productivity can also be found in (Horn, Lang and Lundgren, 1995). The authors refer, from a principal-agent perspective, to the extended use of X-inefficiencies. The reference is controversial - it is 'pressures' rather than 'opportunities' that lead to stronger efforts in the theory of X-inefficiencies.

⁴ Grossman and Helpman (1991, pp. 152-154 and Ch. 9, 1994, pp. 38-41). Grossman and Helpman do discuss a case where trade stimulates growth through intensified competition. But the argument that trade will result in stronger incentives to invent unique products concerns the *efficiency* of R&D investments - a duplication of research can be avoided - not directly the amount of R&D investments.

duplication of R&D projects (Scherer, 1984, p. 291, Scherer and Ross, 1990, pp. 637, 643, Scherer, 1992, p. 1420, Aghion and Howitt, 1992).⁵

In the exceptional cases of macroeconomic analysis by neo-Schumpeterians, higher aggregate demand and profits will mostly *stimulate* productivity growth not curb it as in the theory of transformation pressure. Neo-Schumpeterians have a strong preference for Jacob Schmookler's invention theory – high demand will promote R&D investments (and other inventive activities) through its positive effects on expected sales but also by improving the capabilities of self-financing (Schmookler, 1966, 1972, pp. 76-77). In the Nelson-Winter model of virtuous growth circles for firms, initial innovation profits will lead to new innovations by facilitating R&D spending (assuming scale advantages in R&D), not reduce the incentives and efficiency of R&D investments as suggested in the theory of transformation pressure. The ultimate purpose of the Nelson-Winter model is to explain macroeconomic growth; the role of 'opportunities' is accentuated here by the assumption that innovations by leading firms are gradually imitated by other firms (see Nelson and Winter, 1978, pp. 525-541, Nelson, 1981, p. 1060, Nelson, 1995, pp. 68-72).

The integration of neo-Schumpeterian and new-growth models in recent years has meant a growing support to a theory that more competition is growth enhancing. The idea that firms' R&D efforts to get a lead over market rivals will increase if (neck-and-neck) competition is intensified (Aghion, Harris and Vickers, 1997, Aghion and Howitt, 1998) is compatible with the theory of transformation pressure. Further, empirical studies have uncovered the importance of either domestic competition (Porter, 1990) or global competition (Baily and Gersbach, 1995) for international competitiveness and differences in productivity between countries. There is also scope in (Aghion and Howitt, 1998, Ch. 8) for a 'Swedish' hypothesis that devaluations, or other stimulants of aggregate demand, will hamper economic growth. But there is no general theory of transformation pressure in the Anglo-Saxon growth literature. Finally, modern growth theory has not yet considered the qualitative

⁵ In addition, investments in R&D may be stronger on markets with few producers if the possibilities to benefit from positive spillovers between various R&D programs, spread risk and raise (cheap) external capital are larger in big companies (Scherer and Ross, pp. 652, Scherer, 1992, p. 1422).

difference between actual and expected threats as a trigger of productivity-improving measures.

Some basic notions and assumptions are presented in Section 2. A microeconomic theory of transformation pressure is then outlined in Section 3. My aim is to give a microeconomic contribution to the theories of Åkerman, Dahmén and Svenilsson. The possibility that firm's productivity growth is stimulated by a higher actual pressure is explained in terms of human behavior, skill and creativity. Here I am inspired by the theory of investment under uncertainty (Dixit and Pindyck, 1994, Hubbard, 1994) and by a psychological research that has attracted the interest of modern choice theorists (see Rabin, 1998, Rabin and Schrag, 1999, O'Donoghue and Rabin, 1999) but not yet that of modern growth economists. Further, growth models have yet not explored the possibility that the productive capacity of individuals can be improved by troublesome external conditions. Objections by psychologists and economic historians to an absolute theory of transformation pressure are presented in Section 4. The objections are reasonable enough to justify the formulation of a modified theory of transformation pressure in Section 5. In fact, the main contribution of Swedish industrial economics is not the theory that productivity growth is encouraged by hard external circumstances but the distinction between positive and negative driving forces in growth studies.

2. Central concepts and assumptions in the theory of transformation pressure

The central hypothesis in this paper is that firms' productivity growth will be raised by a harder transformation pressure but only if this pressure is manifest or within near sight. This hypothesis constitutes the 'theory' of transformation pressure together with a subset of related hypotheses and explanations primarily based on psychological and historical evidence. The notion of 'transformation' covers the introduction of new products, production technologies and work organizations but also new modes of management, marketing, distribution, stock keeping, administration and finance. The definition is akin to the one of innovations in industrial economics - it only includes changes in firms that, more or less intentionally, lead to increases in total factor

productivity.⁶ But ‘transformation’ also includes rationalization, thus (every-day) efforts by firms to raise total factor productivity within the existing structure of products, technologies and organizations.⁷

A transformation is possible either through a major change of product patterns, technologies and organizations or by following a familiar growth trajectory. The first strategy is defined as a radical transformation (strategic reconstructing) and the second one as a status quo strategy. Firms following a status quo strategy are occupied with rationalization and small changes in products, technologies and organizations. The question is kept open whether the transformation process is shaped by a status quo strategy or by attempts to generate and adopt radical innovations. Both strategies lead to sustainable productivity growth in a country if there are non-decreasing returns on R&D investments in single firms or knowledge spillover and learning effects. But the spillover and learning effects are supposed to be stronger with a radical transformation. It can even be questioned that rationalization will lead to any sustainable growth at all. However, downsizing may facilitate the financing of R&D investments and also be associated with organizational changes that raise the incentives and acceptances of technical change in the firms. Besides, rationalization can be decisive for measured productivity growth during a particular decade.

Transformation pressure will increase if competition in product markets is intensified, for instance if other firms become more capable or willing to produce and use new ideas. A harder transformation pressure can also reflect a reduction in exogenous product demand or stronger customer claims on better products and services. Finally, a stronger pressure will emerge if prices on labor, raw materials, energy and capital are raised by other reasons than the firm’s own demand for production factors. In the case of exogenous nominal wage increases, the firm has strong incentives not only to

⁶ Switches to new regional markets are excluded by this productivity criterion unless they are associated with scale advantages or improvements in product quality. The criterion also excludes attempts by firms to circumvent external threats by market collusion or political actions to get subsidies, tax redemption or sheltered market positions. Further, mergers and take-overs to exploit economies of scale within industries are not counted as transformation from my microeconomic perspective.

⁷ Schumpeter probably considered rationalization as an example of organizational innovations (cf. Schumpeter, 1962, p. 66). However, labor substitution is not covered by my notion of rationalization above.

substitute machines for labor in production and to upgrade labor by on-the-job training. Limited mark-up possibilities may also induce the firm to raise total factor productivity by innovations or reductions in internal inefficiencies through either general measures or specific ones to economize on labor.

The three dimensions of transformation pressure – competition, cost pushes and low (and qualified) product demand - can be affected by economic policy or by regulations such as environmental and anti-trust legislation. A necessary condition is that disequilibrium states caused by separate policy measures, or exogenous market changes, will last for a relatively long time due to rigidities on commodity, labor and financial markets. For example, lower profits in the exposed sector through a revaluation are not supposed to be offset at once by lower nominal wages.⁸ Further, I will not assume that exogenous changes in product and factor markets are immediately counter-balanced by exchange-rate adjustments in a system with floating exchange rates.

Hence, firms suffering from a tougher environment are not supposed to get any immediate relief by offsetting political measures or market adjustments. Productivity growth will then increase according to the theory of transformation pressure. In fact, aggregate productivity growth will increase whether the firms are transformed or not. A phasing-out of business activities and an elimination of firms (and production units) because of negative external events will release resources to be used by firms (and production units) with higher productivity levels or productivity growth. I will not pay any further attention to this uncontroversial (orthodoxian Schumpeterian) explanation for a positive relationship between external pressure and productivity. The focus in this paper is on the productivity performance of individual firms.

A central assumption in the theory of transformation pressure is that future threats against the firms are inevitable. For example, monopolists will face future challenges in the form of product substitution and higher factor prices associated with the expansion of new firms. However, firms are supposed not to react on outside threats

⁸ For instance, it took more than half a decade before the profits from the Swedish devaluations in the early 1980s were eliminated by increases in nominal wages (cf. Lindbeck, 1993, pp. 81-82).

until they had shown up or are within near sight. The hypothesis is controversial since it seems that rational managers and owners ought to take steps already in good times to ensure the survival of the firms when future threats are inevitable.

3. Microeconomic foundation

A theory of transformation pressure must be build up in two steps. First, I have to explain why productivity growth in a representative firm is stimulated by a decline in expected profitability. I will concentrate here on the possibility that investments are promoted by lower expected profits; I assume throughout the analysis that investments lead to higher total factor productivity. Second, I must demonstrate why an *immediate* external threat, leading to a reduction in actual profits, is needed to get a productive response from firms.

I will briefly explore three explanations for why investments can be stimulated by a reduction in expected profits. First, firms can meet worse prospects on particular product markets by investing in other product areas. A firm's total investment expenditures may increase if the transition to new markets is associated with high fixed costs. Second, investments can be promoted by discouraging prospects if investments are strategic. Since investments are then governed by an ambition to stay in business they may be unaffected and even promoted by negative net present values. Strategic investments can reflect the prevalence of specific goals and competencies of managers and other employees. Established owners may also strive for the survival of the firm if they fear losses of prestige or have feelings of affinity.

Third, a negative relationship between expected profitability and investments may reflect that the search for profitable investment options is stimulated by expected challenges. Such efforts may in turn reflect the existence of firm and industry specific goals and abilities (see above). Principal-agent models offer another explanation. Fiercer competition may intensify the search for new investment opportunities if managers' expected income is a function of expected profits and income effects dominate over leisure-substitution effects (cf. Scitovsky, 1943, Hermalin, 1992).

But the theory of transformation pressure is more than an explanation for a positive relationship between expected threats and productivity growth. A basic hypothesis is that firms will only transform if the challenges are instantaneous. I will present three explanations for why a threat must be real to be productivity-enhancing. The first two explanations concern the incentives of managers, owners and workers while the third one concerns the abilities of firm actors.

3.1. The value of waiting

A hypothesis that firms must experience an obvious threat to rationalize, reorganize or introduce new techniques and products is compatible with an assumption of rational behavior under genuine uncertainty. A firm that waits and sees until the threat shows up cannot be accused of being passive when future is veiled in complete obscurity. A perfect certainty that threats will appear, in some disguise, is not enough to induce a rational firm to transform. Managers' and owners' option to rule their thumbs until the threat appears is probably the best choice when the character and extent of the challenges are unknown. For example, the risk is impending that impatient firms will make the wrong decisions (investments) in the light of subsequent decisions by competitors; established firms might have put all their R&D resources in product differentiation on markets where new process technologies later appeared to be the big challenge by newcomers. I will consistently assume in this section that switches from one transformation strategy to another are associated with heavy investments and long delays and that investments are irreversible (have sunk costs).

Hence, rational firms will not transform until a negative event has actually taken place if the character and size of future threats cannot be accurately predicted. It may even be rational to continue waiting after the appearance of the threat. The nature of a challenge is not always unveiled by its appearance. A firm must find out whether a negative demand or cost shock is firm specific or industry specific and also whether the threat is temporary or permanent. For example, a revaluation of the currency is only an incentive for transformation if it gradually becomes obvious for the firms that market adjustments will be slow or that new revaluations will occur. Rational firms may even postpone reacting when the character of a threat has been revealed by its appearance. The *extent* of a challenge cannot always be distinguished at once. For

example, entry by a new innovative firm is not automatically a threat to established firms. A response by the latter firms is only necessary if it successively becomes clear that the new firm has a large market potential (Utterback, 1994, pp. 162-163).

The theory of transformation pressure above does not exclude that rational firms will transform even if the true nature and consequences of the external challenges are not fully known. Firms must often respond before having complete information about the character and scale of competitive challenges since the risk may be overwhelming that they react too late. (See the assumption above that strategy changes are costly and slow.) Further, firms may take productivity-improving measures if they expect that a revaluation will be followed by new ones or that the following wage adjustment process is slow or incomplete. Hence, I do not preclude the possibility that firms make decisions on the basis of expectations. The assumption is made in this section that firms are rational in the sense that they learn from new experiences. This assumption is also made in the rational-expectation theory in macroeconomics and also in Herbert Simon's theory of *procedural rationality*. According to Simon, firms are rational if they learn by experience, that is, if they make better decisions when the consequences of their older ones have become obvious (Simon, 1978, pp. 8-9). But the theory of transformation pressure in this section also claims that investments are delayed by rational decision-makers who want to get more information about the true nature and consequences of a potential threat. The hypothesis that firms in a world of large uncertainties will improve the quality of their decisions by waiting has no correspondence in the rational-expectation theory or in Simon's theory.⁹

Uncertainty can explain the value of waiting for a real external pressure but also the choice of a status quo strategy instead of a radical transformation. Firms may avoid the latter option if they are risk averse at the existence of *instrument uncertainty* thus, at difficulties to predict the consequences of their own actions. Managers and owners

⁹ Simon's theory gives a larger room than the rational-expectation theory for decisions that appeared to be wrong in retrospect. It is unlikely that firms will make the best decisions if the economy is characterized by large uncertainties and difficulties to foresee the consequences of their actions. Simon refers here to *substantive* irrationality, not to probabilities and attitudes to risk, which makes this part of his theory similar to Keynes' view in the *General Theory* (Keynes, 1936, Ch. 12). The theory of transformation pressure, however, makes a clear distinction between the cases of genuine uncertainty and irrationality. In next section, I will explain a positive relationship between an immediate outside threat and productivity in terms of (substantive) irrationality. Here, waiting will not improve the quality of decisions as in the section above.

have often more information about the effects of a status quo like strategy than of a radical transformation (cf. Greenwald and Stiglitz, 1993, p. 28). However, a status quo option may be less attractive for a risk averse firm if uncertainty about the associated external threats and their consequences is high compared with that at a radical transformation.

The theory of transformation pressure in this section has strong resemblance with the theory of investment under uncertainty. The theories share the assumption that investments are irreversible and possible to postpone. The assumption in the theory of transformation pressure that threats are inevitable in the future has a clear correspondence in the theory of investment under uncertainty. In the latter theory, the change in the value of an investment V over a time interval dt can be expressed as follows:

$$dV = \alpha V dt + \sigma V dz - V dq,$$

where α is a constant showing trend value growth, dz is the increment of a continuous-time stochastic Wiener process (Brownian motion) and σ is a constant showing the degree of uncertainty about future returns (net benefits). dq is the increment of a (non-continuous) Poisson process, permitting ‘downward jumps’ at some random point in time in the value of an investment V through negative events with a mean arrival rate λ (dq and dz are assumed to be independent). Negative events such as entries and innovations by incumbent firms lead to a fall in q by some fixed percentage ϕ (where $0 \leq \phi \leq 1$) with probability 1. Thus, V will decline with probability λdt to $(1 - \phi)$ times its original value. Firms get information over time by observing changes in V , but V s in future periods are always uncertain (Dixit and Pindyck, pp. 63-65, 95-97 and Ch. 5).

The criterion for investing now in the theory of investment under uncertainty is $V > I + F(V)$ where I is the sunk costs of an investment and $F(V)$ the value of an option to invest, an opportunity that is lost when the investment is made. The date when the option should be used can be determined by dynamic programming. The optimal

value $F(V)$ is determined as $F(V) = A V^\beta$ where A is a constant and β (>1) depends on the parameters α , ϕ , λ and σ (and the discount rate).

The description of the theory of uncertainty above gives a representative picture of the theory of transformation pressure in many respects. Both theories say that it may be rational to postpone an investment to get more information about future demand, cost and competitive conditions. For example, more uncertainty about the trend and temporary components of a change in net benefits will increase the value of waiting. In formal terms, a rise in uncertainty about future returns (σ) leads to a higher $F(V)$ which will cause a delay in investments given the values of V and I . Further, the assumption in the theory of transformation pressure that future (competitive) threats are inevitable is covered by the special case $\lambda = 1$ in the theory of investment under uncertainty. But there are some differences between this theory and the theory of transformation pressure.

In the theory of investment under uncertainty, a negative event ($\lambda > 0$), or a higher probability of a negative event (a higher λ), in a certain period will *reduce* the value of waiting. It is true that the variance of changes in V will increase leading, *ceteris paribus*, to an increase in $F(V)$. But this tendency at a negative event to wait rather than invest now is more than offset by the fact that the expected value of an investment will decrease (from α to $\alpha - \lambda$) which reduces $F(V)$ that means a smaller opportunity cost of investing now rather than waiting – a delay would have meant that the reduction in the cost of the investment (see the discount factor) had become smaller (at a positive α) than the decrease in net benefits (Dixit and Pindyck, pp. 171-172). However, the theory of transformation pressure pronounces more strongly than the theory of investment under uncertainty that the character and consequences of possible threats are uncertain. For instance, in the latter theory, firms know from the start whether a shock is industry specific or firm specific (cf. Dixit and Pindyck, Ch. 8). Further, the assumption that a fall in q (and therefore in V) at a negative event occurs at a fixed percentage ϕ (see the equation above) excludes the possibility that the negative profit effect is stochastic. The arguments for a delay in investments would have been strengthened if the size of the fall in q was a random variable. The possibility of a stochastic Poisson process is discussed in the theory of investment

under uncertainty, but the calculation of the optimal investment rules is seen as too complicated in this case (Dixit and Pindyck, pp. 85 and 173).

Another difference between the theory of investment under uncertainty and the theory of transformation is that investments in the former theory can be promoted by a reduction in expected profits ($V > I$ is not even a necessary condition for investments) even though it may be rational to delay investments to get more information. Stiffer competition, lower product demand or higher variable costs may engender managerial efforts to find new investment options or stimulate investments in new product markets or in established ones in order to remain in business (see above). The theory of investment under uncertainty claims on the other hand that investments will unambiguously be hampered by the decline in expected profits when negative events become more frequent, but also that this decline may be fully offset by an increase in trend value growth (by an increase in α). In this case, an increase in λ will lead to a delay in investments ($F(V)$ will rise) exactly as in the theory of transformation pressure (Dixit and Pindyck, 172-173).

A theory of transformation pressure saying that firms will postpone a reaction on future threats to get more information has some limitations. First, the extent and character of some future challenges can be predicted with a relatively high degree of precision; the firms will not get any further information by waiting. Second, a radical transformation may be a virtue even at genuine uncertainty. Firms' competitive strength is to a large extent defined by their ability to adjust instantaneously to unexpected events. By the introduction of flexible technologies and organizations, a firm shows good *preparedness* to meet potential threats rather than good predictability. Thus, it may be logic to claim that foreseeing investments *have* been made in this case despite the fact that firms will not react on external events before they are in near sight. A theory that firms will not invest in new products, technologies and organizations until the threats have shown up because of large uncertainties cannot be *the* theory of transformation pressure. It remains to explain, for instance, why some firms postpone the introduction of flexible technologies and organizations to a date when the external pressure is actually raised. A general theory of transformation pressure must refer to a psychological mechanism that makes firm

actors too optimistic about a status-quo strategy, too inclined to take risks by choosing this strategy or simply make them unwilling (and even unable) to fully consider the long-run gains from other strategies unless the firm is put under a stronger real pressure.

3.2. *The psychology of a resistance to change*

The second explanation for why external threats must be manifest to encourage productivity growth represents a challenge to conventional maximization models in economics. The resistance to change in this section is synonymous with a resistance to a radical transformation bearing in mind that a status quo strategy can include measures to increase productivity growth. Psychological research provides explanations for why firms may have a bias for a status-quo strategy. Under uncertainty, managers and main owners may overestimate the profitability of a status quo strategy, especially if the firms have been successful in the past, and choose a risky status quo option that is inferior in terms of expected profitability. Further, managers may resist, emotionally or by indolence, a radical transformation that will increase not only profits and the probability of survival of their firm but also their intertemporal well-being. The notions of *self-deception*, *risk seeking* and *irrationality* are crucial at my second attempt to explain why a transformation will not occur until the firms are obviously put under an external pressure. I will first discuss the possibility that firm actors make too optimistic judgements of a status quo strategy, especially when actual profits are high.

Assume that firm actors initially choose a status-quo strategy on ‘instrumental-certainty’ grounds, hence, the choice is basically explained by employees’ and main owners’ knowledge of existing technologies, products and organizations. This assumption is justified by psychological studies emphasizing the importance of habits (and unity) in decision-making (Eiser and Pligt, 1988, Ch. 2, Yates, 1992). But managers and main owners may be too confident about driving the firm into old wheel-tracks. A reasonable hypothesis is that people, once having made a strategic choice, will ignore new information or stop searching for other options even if information costs are negligible. Further, people may interpret additional information in a way that confirms the chosen strategy thus, they have a confirmatory bias. Both

hypotheses are supported by psychological studies. There is also evidence in the psychological literature that the confirmatory bias makes individuals too confident about the chosen strategy. (See the literature survey in (Rabin, pp. 26-32) and (Rabin and Schrag, pp. 37-47).) The tendency to overestimate the profitability of a status quo strategy is probably accentuated if the firms have been profitable in the past. Owners and managers may be stunned by earlier successes and lulled into a sense of security when historical profits are high; for instance, main owners may not endeavor to find out whether the success of the firms is due to favorable external conditions or management competence. Firm actors may also be overconfident about their ability to ward off potential threats when actual profits are high.

The risk that firm actors will overestimate their abilities and become intoxicated by earlier successes is probably higher if high historical profits depend on favorable external conditions, such as an undervalued currency, rather than on a radical transformation in the past. Easily earned incomes can easily be confused with incomes from a dynamic behavior. For example, firms may become too confident about the prospects of a status quo strategy after a devaluation. They may overreact on 'excess profits' and neglect their short duration. Psychological experiments have confirmed that people put too much weight on extreme and recent events and also on events of short durability (Kahneman, 1994). It is true that recent outcomes would have been a rational basis for expectations if they were not exceptional. For example, the choice of a status quo strategy is rational in the devaluation case if firms have learnt that any tendency to a profit decline will always be met by new devaluations. However, there is no strong evidence in the psychological literature that the estimation biases above will be corrected by learning, not even by experts, when predictability is low (Rabin, pp. 31-32).

The theory of transformation pressure claims that firm actors will abandon a propensity to ignore and misinterpret new information and an ungrounded sense of stability and personal quality favoring a status quo position when their firms are actually put under a stronger external pressure. A full (or almost full) certainty of a threat is thus assumed to be the only effective mean of sobering down. For example, new information about the profit consequences of different options will not be misread anymore when a threat has actually appeared. The sobering-down process

will lead to a radical transformation if firm actors see this strategy as the correct one in light of the unambiguous signals of tighter external circumstances (cf. Rabin and Schrag, pp. 48-62).

The psychological studies cited above confirm that firm actors can be too confident about a chosen status quo strategy especially if the firm has been successful in the past; expected profits from this strategy are overestimated by self-deceptive actors. But firms may also sustain a status quo strategy that is inferior in terms of expected profitability if the actors are extremely risk-prone. It is possible that firms are more willing to choose a risky status quo option if they have been profitable in the past. The psychological literature emphasizes that attitudes to risk may be influenced by earlier choices (see Eiser and Pligt, and Yates, Ch. 2 cited above). Empirical studies have not unambiguously shown that well-performing organizations prefer options that are more risky (Kahneman and Tversky, 1979, pp. 286-288, Davis, Kameda and Stasson, 1992, pp. 191-192). But a theory of transformation pressure claiming that decision-makers become more risk averse under pressure is supported by psychological evidence (Mann, 1992, pp. 213-215).

Psychologists often refer to Pearl Harbor of December 1941 when illustrating a status quo bias in decision-making. The U.S. Naval Commander (and his advisors) resisted a full alert and an evacuation in spite of a high probability of a Japanese attack. The Commander's choice of status quo showed that he underestimated the risks and costs of an attack. Further, by choosing the status quo, the Commander took up a risk-prone attitude. He put a low decision weight on the certain costs of an evacuation but underweighted the much higher costs of a probable attack (cf. Davis, Kameda and Stasson, pp. 189-190).¹⁰

However, there is no need yet to completely abandon the assumptions of profit and utility maximization. The choice of a status quo position in the firm case can reflect that profit expectations are distorted, which certainly is true when strategy decisions

¹⁰ The status quo position by the U.S. Navy at Pearl Harbor has been explained in the psychological literature (see Davis, Kameda and Stasson) by 'groupthink', that is by conformity pressures and shared illusions within a small cohesive group. The risk of groupthink is overwhelming if the group is dominated by powerful leaders or lacks clear decision-making procedures. Psychological studies have shown that decisions by (small) groups may be more extreme (risk-prone) than individual decisions.

are based on exceptional outcomes in the past, but decision-makers may at least have had the ambition to maximize expected profits and also utilities. Further, the choice of a risky status quo alternative despite low expected profits may not challenge the principle of profit and utility maximization but rather the conventional assumption of concave utility functions in economics which excludes options that imply a large risk for a considerable decline in utility.¹¹ (A concave utility function reflects that the utility gains from a higher income will gradually be smaller.) I will argue in X-inefficiency terms below that a profit decline is connected with a reduction in managers' consumption, comfort and prestige.

Psychologists have used the Pearl Harbor example to demonstrate that a status quo choice can be completely irrational. The decision to stay at the marine base was associated not only with a significant risk of human and capital losses but also with a reduction in the set of possible military actions in the future at a Japanese attack. It is obvious that the risk-inclined and overconfident attitude at Pearl Harbor favoring a status quo strategy largely reflected that other alternatives were associated with short-run personal sacrifices in the form of efforts and discomfort. It seems that the Commander (who was later dismissed) did not weight the disutilities of an alert and evacuation against the long-run gains of this option, *inter alia* for himself. There are other psychological evidence that people tend to put a too strong weight on initial utility losses in relation to long-term utility gains at a departure from status quo and to procrastinate options with immediate costs in general (Rabin, pp. 33-34, O'Donoghue and Rabin, 1999). Analogously, firm actors may overweight the short-run utilities of a status quo position, a tendency that *inter alia* could explain an overconfident and risk-prone attitude to this alternative.

¹¹ Here I also assume, in contrast to the psychologists Daniel Kahneman and Amos Tversky, that the room for 'framing effects' in market economies is small (cf. Kahneman and Tversky, 1987, pp. 87-88). Kahneman and Tversky emphasize the importance of framing effects in their experiments. People's ordering of options depends on whether the options are expressed in losses or gains reflecting that people are risk seeking in terms of losses but risk averse in terms of gains. These framing effects violate a necessary condition for rational behavior (see Kahnemann and Tversky, 1979, 1987, Kahneman, Knetsch and Thaler, 1991). The effects can be avoided in the firm case if comparisons of gains and losses are integrated by analyses of profits or the rate of survival. The choice situation has now become more transparent, that is, decision-makers can more easily survey and evaluate which alternatives are superior in terms of probabilities and outcomes.

The principle of rational behavior is satisfied if individuals with coherent and stable preferences maximize their utilities given a set of options. Expected utilities (and profits) are estimated by weighting the outcomes of different options with their respective probabilities. The maximization principle is not really challenged by Harvey Leibenstein in his criticism of conventional microeconomic theory. 'Selective rationality' does not reflect any irrational behavior, only that managers and workers abstain, under some circumstances, from profit maximization to satisfy their individual interests (cf. Leibenstein, 1979, pp. 484-485, De Alessi, 1983).

A central assumption in the X-inefficiency literature is that an outside pressure will reduce the divergence between profit and utility maximization behavior in the firms. Expected future threats will lead to stronger managerial efforts if managers' expected incomes are a function of expected profitability (see the introduction to this section). Further, managers' incomes, comfort and prestige in the long run may depend on the survival of the firm where he or she is actually employed; it can be difficult for managers to get well-paid jobs with generous fringe benefits in the future if their careers have been molded by closures. Thus, a utility-maximizing manager must have incentives to reduce the probability of closures (or hostile takeovers), for instance, by searching for the best investment options. But there is still too large scope for a divergence between profit and utility maximization in the X-inefficiency literature especially if future threats are supposed to be inevitable (see Section 2). First, a search for radical transformation alternatives and the choice of one of them may be necessary today to efficiently conquer threats of tomorrow if the effectuation of a new strategy demands heavy investments and long learning periods. Hence, an immediate radical transformation will probably increase the firms' chances of being profitable and alive. Second, high actual profits may enhance the possibilities to realize a radical transformation by raising firms' ability to finance investments by internal funds or (cheap) external capital.

It is true that firms often strive for high production growth or larger market shares at the expense of high actual profits for instance, by pursuing an aggressive price policy. But the ultimate aim of the strategy is presumably to increase expected profits and the chance of survival by eliminating actual rivals and deterring new ones. I will concentrate on the cases where long run profitability and the survival of the firm are

jeopardized by actual departures from profit maximization. Firm actors will not always make an attempt to maximize profits in practice even if they embrace the goal as a guideline by the simple fact that it is in their own interest.¹²

Assume that decision-makers can, if they make some efforts, acquire reliable information about the risks and profit consequences of different options and that they are risk neutral. Further, let us assume that expected profitability is higher with a radical transformation than with a status quo strategy and that the set of future options is enlarged if the firms pursue a radical transformation. A resistance to a radical transformation cannot then be labeled rational even if the change is strenuous and unpleasant. Managers (and also main stockholders) may have feelings of discomfort against a radical transformation that demands efforts to search for alternatives, reorganize the firm and create a consensus by persuading skeptical employees to accept a change. They may also find it emotionally unpleasant to establish relations to workers characterized by persuasions and threats *inter alia* of dismissals. Further, managers may have strong feelings against a transformation that will challenge old habits in the firm. For instance, habitual learning in the firms may reduce the willingness, and also capacity, to assimilate new products and technologies. (This negative aspect of learning by doing and learning by using is often overlooked in industrial economics.)

It would of course have been rational for managers to resist a radical transformation if the short run disutilities had outrun the long run utility gains. However, managers who depart from the principle of profit maximization are not maximizing utility in a dynamic perspective given the assumptions above and an earlier proposition that the postponement of a radical transformation makes it difficult to meet threats in the future. Managers' (and owners') resistance to a radical transformation may reflect the lack of self-discipline. The theory of transformation pressure claims that firm actors will regain their self-control first when the firm is hit by harder external circumstances.

¹² I will thus not stress the principal-agent relation in the theory of transformation pressure. However, I will not exclude the possibility, central in principal-agent models, that it is easier for owners to control (monitor) managers on competitive markets because of greater opportunities for firm comparisons. Under such market conditions, industry specific negative shocks will induce stronger managerial efforts through harder pressures from owners (Nickell, Nicolitsas and Dryden, 1997, p. 785).

Firm actors may also have difficulties to accurately predict their well being of a radical transformation in the long run. If a radical transformation has actually taken place, the remaining owners, managers and workers may gradually realize the benefits of the change and also become habituated to the new situation. Hence, a radical transformation, pursued by more self-disciplined decision-makers when the firm is suffering from a higher real pressure, may unanimously be supported *ex post* by the remaining actors. The adjustment process partly reflects that the actors' preferences have been altered at the departure from status quo hence, preferences are not stable as assumed in conventional microeconomics.

In light of the psychological literature, a tendency by firm actors to give up a reluctance to a radical transformation first when they experience a stronger external pressure primarily reflects that they are enforced to become more rational. But psychological studies cited above indicate that a radical transformation may also be undertaken by firm actors who remain irrational after the appearance of an external threat. As people tend to over-emphasize extreme and recent historical events and ignore their short run duration when expectations are formed, a radical transformation may be accomplished by firm actors who overreact on an actual decline in profits, especially if the decline is exceptional. For example, a revaluation may lead to excessive productivity-enhancing measures given the temporary character of the decline in actual profits.

3.3. Necessity is the mother of invention

The phrase that necessity is the mother of invention suggests that people becomes more creative when they are put under a pressure. A hypothesis that troublesome external conditions stimulate not only efforts but also creativity and skills is not far-fetched for anthropologists and historians. According to Arnold Toynbee, the development of higher civilizations has been stimulated, not hampered, by hard geographical and climatic conditions, persecutions and catastrophes (Toynbee, 1949). A corresponding hypothesis in growth economics says that the ability of new firms to produce, assimilate and use new ideas will increase at an immediate pressure. It is also possible that the innovative capacities of established firms are enhanced by hard

external conditions. Thus, all firms that experience a profit decline may become more capable combining productive forces in a way they have never thought of before. This regeneration of firms may, *inter alia*, have a positive effect on the amount and efficiency of R&D investments.

Conventional microeconomic theory considers that firms have incentives to use and develop technologies that economize on scarce resources. But the theory of transformation pressure takes a step further – it assumes that factor scarcity will stimulate the *ability* to develop and adopt resource-saving technologies and organizations. Industrial economists often refer to Japanese experiences - shortage of raw materials and capital after World War II speeded up not only the use but also the development of factor-saving technologies and organizations. Moreover, a theory that firm creativity is stimulated by external pressure is not restricted to the cases of resource scarcity and resource-saving activities. Firms are supposed be more innovative *in general* if they are put under an external pressure *whether its character*.

The idea that innovations are stimulated by negative external events can be added to other explanations for why the losers in World War II showed high economic growth in the early postwar period. Traditional (neoclassical) growth theory highlights that physical capital stocks were eliminated during the war, leading to high temporary labor productivity growth, and to investments embodying new technologies (Solow, 1956 and 1964). The new growth theory emphasizes ‘opportunities’ such as the survival of human capital when explaining a rapid recovery after a war (Barro and Sala-i-Martin, 1995, pp. 200-201). The theory of transformation suggests that the low productivity and welfare levels in Germany, Japan and Italy made the population more creative. A related, although bolder, hypothesis is that the defeat in World War II *per se* established a mental state that was favorable for industrial development. A country’s industrial success can be formed by national disappointments and defeats in general. An analogous microeconomic theory states that the mental strength of managers and workers is boosted by firm failures.

A hypothesis that negative external events make firms and individuals more creative is close to one saying that such events will increase the skill of managers and workers. Firm actors might, for instance, become more capable to meet new competition if they

have been persecuted by earlier threats. A positive relationship between experience and the quality of human capital *is* considered in growth economics. But the ‘opportunity’ notion of learning by doing (and learning by using) in growth economics must be supplemented with that of *learning by hardship*. The skills of managers and workers may be improved by the experience of producing but also by the experience of tough external conditions.

Innovations are engendered by transformation pressure both in the theory of an individual resistance to change and in the theory where necessity is the mother of invention. The difference between the theories is that efforts and attitudes of firm actors are centered in the former theory, not their creativity and competence as in the latter one. The proposition that individuals are strengthened mentally by disappointments and defeats shows that the difference between the two theories is not an absolute one. A separation between the theories is also difficult in practice, thus to decide whether innovations enforced by real external threats are an act of will or a reflection of enlarged abilities. Learning by hardship and creative thinking under the gallows may require efforts and also shape the values of firm actors.

4. Objections to a theory of transformation pressure

Despite my aim to formulate a general theory of transformation pressure, Section 3 does not cover all explanations for a positive relationship between transformation pressure and productivity growth of firms.¹³ But more important, the theory of transformation pressure is challenged by evidence of a *negative* relationship between external pressure and productivity growth. I have already presented arguments in industrial economics for a negative relationship between competition and innovations

¹³ Section 3 did not refer to the idea that the opportunity cost of productivity-improving measures such as reorganizations and training is reduced in a recession because of lower returns on productive activities (Hall, 1991, Aghion and Howitt, 1998, pp. 240-242). The explanations above also exclude that R&D efforts are stronger if there are many rivals because of greater prospects of temporary monopoly profits. The theory is based on an assumption of symmetric market positions - the innovator (first mover) will gain market shares in proportion to the total number of rivals (potential innovators). Further, my ‘threat perspective’ excludes, together with my focus on firm behavior, theories that the probability of a technological break-through will increase with the number of firms (Scherer and Ross, pp. 636 and 643).

- see the introduction. But there are also objections in psychology and history to an absolute theory of transformation pressure.

A serious competitive threat may weaken a firm's belief in the future and self-reliance leading to inactivity and feelings of inferiority among managers and employees. Further, intense competition, or other tight environments, may reduce the quality of management and labor. Firm actors may perform worse and make hasty decisions. One plausible argument, although infrequent in psychology and industrial economics, is that a tough competitive climate makes learning by doing more difficult. Managers and workers in industries characterized by a steady stream of innovations have no time, or capacity, to assimilate all new knowledge. A more common argument in psychology is that the quality of decision-making will deteriorate if managers become stressed by high risks of large losses or insufficient time to search for profitable options (cf. Mann, pp. 208-211). According to some psychologists, the stress from the threat of a Japanese attack explains why the U.S. Naval Commander wrongly chose an unnecessary risky option at Pearl Harbor (Davis, Kameda and Stasson, pp. 189-191, Mann, pp. 201-202). Hence, this interpretation of the U.S. passivity at Pearl Harbor put the blame on transformation pressure! However, the explanation is not confirmed by psychological studies showing that decision-makers become more cautious and risk averse under time pressure (Mann, pp. 213-215).

Swedish historians have claimed that decades with high transformation pressure are characterized by rationalizations and labor substitution rather than by innovations and capacity-augmenting investments (Schön, 1990, 1994, pp. 16-21). Hence, periods with a hard external pressure are dominated by measures leading to higher productivity levels rather than to sustainable growth. Some industrial economists support the view that the strategies are mutually exclusive. Firms must make a choice between 'differentiation' and cost effectiveness (Porter, 1990, pp. 37-38).¹⁴ The question is why rationalization seems to be chosen instead of a radical transformation

¹⁴ All industrial economists do not share the conclusion that the strategies are mutually exclusive. The conflict between rationalization and innovative efforts may be weakened (although not entirely eliminated) if the managers are foreseeing and competent enough to combine the two activities for instance by pursuing a 'mass customization' strategy. The strategy is based on flexible production techniques and the creation of unique products (Utterback, pp. 97-99). In fact, successful companies on world markets seem to be both cost effective and innovative in comparison to other companies (Ingenjörsvetenskapsakademien, 1991).

at a stronger external pressure. A conclusion that firms prioritize rationalization in this situation was in fact disputed in Section 3.2. Managers will abandon a tendency to be too optimistic about a status-quo strategy and too concerned about the short-run sacrifices of a radical transformation when the external pressure is tightened. Firms that remain irrational may also choose a radical transformation in periods of a hard external pressure. As managers tend to overreact on extreme and recent outcomes and disregard their short duration, a more radical change than necessary will occur if actual profits are drastically reduced in a recession.

Åkerman and Dahmén argue that firms become myopic in a recession. Many investments in the preceding boom are now considered as unprofitable since they were based on a too optimistic view of the pace of overall structural change. As firms have become more myopic, they will probably prefer short-run, cost reducing measures at the expense of a radical transformation in a recession. A stronger emphasize by firms on early returns can be represented by a higher discount rate at investment decisions (cf. Åkerman, 1942, pp. 41-42, Dahmén, 1970, pp. 48-50, Erixon, 1994, pp. 53-55).

The choice of a status quo strategy in a recession is perhaps better explained by imperfections on capital markets than by a shortening of time horizons in the firms. Firms' willingness and ability to invest, especially in R&D, will decrease when their profits and thus internal savings are reduced, particularly if the firms are risk averse. The possibilities to finance investments by external capital may also be reduced in a recession because of higher risk evaluations by banks. But more important, the theory of transformation pressure does not preclude that productivity growth is raised by rationalization rather than by a radical transformation. Rational firms may postpone a radical transformation to get more information about its consequences or simply reject it if the expected private rate of return is higher for a status-quo strategy - a profit decline in a recession is not necessary a long-run threat against a firm that follows this strategy. Moreover, risk averse firms may avoid a radical transformation if it is more risky than a status quo strategy. A theory of transformation pressure is only refuted if the attempts to increase productivity, by whatever means, are not intensified during a recession. The theory assumes that the use of production slacks and investment opportunities was deferred during the preceding boom. The recession *may* then be

dominated by status-quo choices since the potential for rationalizations is large and the needs to rely on such measures in order to survive become urgent if capital markets are imperfect.

The arguments in this section have not crushed the theory of transformation pressure. But they have put some doubts on a theory that a maximal pressure is always best for sustainable growth. Two conflicting theories of an optimal pressure are presented below. The first one assumes that productivity growth will increase at a more pressure but only up to a certain point. The other theory does not advocate that the pressure should be watered down, but that periods with a hard pressure are succeeded by periods in which positive driving forces are predominant.

5. Two views of the optimal transformation pressure

An obvious hypothesis is that the external pressure on firms in each period must be sufficiently hard to enforce the firms to be innovative and efficient but not so hard that their incentives and financial opportunities to make risky R&D investments are weakened leading, *inter alia*, to a strong dependency on rationalization in order to survive. Further, an exceptionally strong pressure may significantly reduce the possibilities to exploit scale advantages, spread risks and learn by doing. An extreme pressure may also produce defeatist attitudes and erode the quality of human capital and decision making in general. A hypothesis about an inverted U can be found in industrial economics. A stronger competitive pressure will first have a positive effect on the amount or efficiency of R&D investments although with diminishing returns. Still higher levels of rivalry will lead to lower innovations. As an approximation, innovation vigor will culminate under oligopoly conditions (Cohen and Levin, 1989, p. 1075, Scherer, 1992, pp. 1419-1420). A conclusion that the optimal pressure is moderate rather than maximal is, in fact, supported by Toynbee ('the Golden Mean') and by Leibenstein in his later writings (Toynbee, Ch. VIII, Leibenstein, 1980, pp. 94-96, 1984, p. 338). Psychologists have leaned to a similar conclusion - the quality of decision making is maximized at moderate levels of stress (Mann, pp. 210-211).

But a hypothesis that productivity growth is maximized at a moderate pressure on firms in each period is controversial. An exceptionally strong pressure may be required to make it worth for established firms to undergo a radical transformation since a switch to new products and technologies is often prevented by high sunk costs. A severe profit crisis may also be required to break a psychological resistance to change. For instance, an exceptionally strong competitive pressure may be needed to break the tendency to status quo because of habitual learning. Further, there is no general empirical support to a theory that the optimal pressure is moderate. The hypothesis of an inverted U is not even unequivocally confirmed for 'mature' industries where scale advantages and large R&D projects are often important (Cohen and Levin, pp. 1076-1078, Scherer and Ross, pp. 645-651, Geroski, 1990, pp. 594-597, 1995, pp. 26-27, Scherer, 1992, pp. 1423-1425).

The objections to a theory that productivity growth is maximized at a moderate pressure in each period must be taken seriously. Productivity growth may instead be maximized if periods with a hard pressure are followed by periods with a weak pressure. In tough periods, firms with low productivity are eliminated or rationalized and dead-end status quo strategies abandoned. New firms must then be formed and surviving firms offered a chance of financial and technical consolidation, using scale advantages and of escaping from one-sided rationalizations.

The thesis that productivity growth is maximized at periodical shifts between hard and weak pressure can be associated with the Swedish school of industrial economics. According to Dahmén's study of Swedish industries in the interwar period, productivity growth was high because of a hard transformation pressure in the 1920s and because of a *weak* pressure in the 1930s.¹⁵ In the 1920s, deflationary monetary and exchange rate policies resulted, together with fierce international competition - primarily through innovations by foreign firms and trade liberalization - in a rapid structural change of Swedish manufacturing and a modernization of leading export sectors. In the 1930s, a restructured manufacturing sector benefited from depreciations of the SEK, expansionary monetary policies, protectionism and inter-

¹⁵ The interwar period is often called the Golden Age of Swedish industry, since production and productivity growth in Sweden was high then in a historical and international perspective (Maddison, 1992, table 3.1-3.3).

industrial diffusions of technologies developed in the preceding decades (Dahmén, 1970, Ch. 3 and 16, 1998).

Svennilson's study of growth of European industries in 1913-1938 was clearly inspired by Dahmén's analysis of Sweden. Svennilson confirms Dahmén's view that periodical shifts between 'pressures' and 'opportunities' are growth enhancing. He expresses the duality in terms of low and high profits – profits must be low in an industry to avoid a survival of stagnating firms (and plants) but high to finance a modernization of remaining firms. A characteristic feature of the capitalistic system – the business cycle – solves the dilemma. Firms are eliminated during recessions when profits are low and modernized during peaks when profits are high (Svennilson, p. 35).

There is no room in Svennilson (1954), as in Dahmén (1970), for a hypothesis that a modernization (including a rationalization) of the firms can be delayed by high profits. Hence, Svennilson defines no microeconomic hypothesis of transformation pressure. On the contrary, Svennilson claims that profits in an industry might be too low in economic peaks.¹⁶ Moreover, he interpreted the positive correlation between productivity and production growth in the interwar period in countries like Sweden as a 'Verdoorn effect' – high output growth has led to high productivity growth and not the other way round (Svennilson, p. 57). Svennilson's Keynesian interpretation excludes the possibility that high demand resulted in serious X-inefficiencies but also that a successful economic development was established through structural change and modernization in the depressions. He claims that high demand and low unemployment will speed up modernization and structural change by raising profits, labor mobility and wage-earners' acceptance of technical change (Svennilson, pp. 24, 34-36, 46 and 49-50). Svennilson's general conclusion that the Verdoorn effect was decisive during the interwar period rules out a theory that Sweden experienced high growth in the 1920s because of negative driving forces. Thus, in contrast to Dahmén,

¹⁶ Svennilson (pp. 9-10 and 34-35). Analogously, in the opposite case of a recession, transformation pressure may be too weak. A desirable closure of companies is hindered by state subsidies, legislation, cartels, and labor militancy or by conservative managers/owners (Svennilson, pp. 10, 34-38 and 52).

Svennilson did not distinguish any qualitative difference in industrial dynamics between the 1920s and the 1930s.¹⁷

But Dahmén admits that opportunities must also exist in periods of a hard transformation pressure. Hence, firms must be relieved from pressure in some dimensions or favored by positive driving forces other than those that are simply the other side of 'pressures'. Swedish manufacturing experienced favorable growth conditions in the 1920s through the combination of hard transformation pressure and 'opportunities' such as high autonomous export demand growth and new knowledge through innovations abroad (Dahmén, 1970, pp. 386-393). These opportunities stimulated Swedish productivity growth both independently and in conjunction with a hard transformation pressure.

Dahmén's study of the Swedish interwar period also indicates that industry and firm specific conditions may be decisive for economic growth in periods of a hard transformation pressure. Swedish firms in manufacturing were fast adopters of new U.S. technologies and organizational models compared with other West European countries in the 1920s. It is true that the rapid diffusion of U.S. innovations in Sweden reflected a fundamental outward orientation of firms thus, that Swedish manufacturing was early exposed for international competition. But the early foreign orientation of Swedish companies cannot be understood without considering the strategies and skills of managers and owners or the product composition of the leading industrial sector. These firm and industry specific conditions are in turn explained by political, sociological and cultural characteristics of Sweden and by the nature of Swedish innovations (Erixon, 1997).

A possible objection to a normative theory of periodical shifts between weak and hard pressure is that large swings in economic activity levels, prices and profits will hamper economic growth through a negative relationship between investment and uncertainty (cf. Nakamura, 1999). But above I have emphasized that this theory must,

¹⁷ However, in the late 1930s and the early 1940s, Svennilson had formulated a microeconomic hypothesis about transformation pressure. He claimed that the prospects were good for Sweden despite a forthcoming recession since the creativity and energy of individuals (and political decision-makers) would be stimulated by 'increasing difficulties' (Henriksson, 1990, pp. 93 and 170).

as the competing theory of a steady moderate pressure, give room for ‘opportunities’ and also for industry and firm specific conditions (managerial competence and attitudes, work organizations, remuneration systems, terms of employment etc.). A strong SEK may have been productive in the 1920s because of a unique combination of industry and firm conditions and of outside pressures and opportunities. Such combinations may also explain why a weak SEK seems to have encouraged productivity growth in Swedish industries in the 1930s but not in the 1980s despite common profit squeezes in the preceding decades. It is perhaps a depressing conclusion for a macro economist that the optimal character and extent of the transformation pressure may vary between countries and from time to time.

6. The core and further development of the theory of transformation pressure

The theory of transformation pressure offers a uniquely Swedish perspective on economic growth and economic policy. An influential argument from the early 1990s stated that devaluations of the Swedish currency lessened the external pressure on manufacturing leading to a delay in structural change, innovations and rationalizations. Exchange-rate policies are mostly seen in modern economics as a mean to influence aggregate demand or to reallocate resources between the open and sheltered sector. The relationship between exchange-rate policies on the one hand and the incentives and abilities of firm actors to raise productivity on the other hand is seldom accounted for.

A fundamental idea in the theory of transformation pressure is that firms will only react to challenges that are close at hand or have already occurred. I have presented three separate explanations for why productivity growth will first increase when the external pressure has been obviously raised: firms have no reliable information about the nature and extent of inevitable threats until they show up, the psychological resistance to a (radical) transformation can only be broken by an immediate threat, and skill formation and creativity are stimulated by real difficulties - necessity is the mother of invention. However, an unconditional theory of transformation pressure must be refused on both principal and empirical grounds. Productivity growth is not always stimulated by harder external circumstances. A qualified theory of

transformation pressure says that the optimal external pressure in each period is moderate, a theory that is compatible with the inverted-U hypothesis in modern industrial economics. According to a rival theory, emphasized in the Swedish school of industrial economics, productivity growth will be maximized if there are periodical shifts between hard and weak pressures. For instance, firms must be pushed into a more favorable growth path and then be permitted to enjoy the virtuous circles of growth. However, a qualified theory must give room, even in periods of a hard transformation pressure, for positive driving forces and also for firm and industry specific conditions. A hard-currency policy is not a sufficient condition for high productivity growth; the policy may even be growth dampening if the proper incentives and capacities are missing in the firms.

A microeconomic perspective on the relationship between external pressure and productivity growth has some limitations and must therefore be combined with a structural approach. The structural analysis, which in fact is predominant in the Swedish school of industrial economics, can be industry specific or pursued in terms of changes in sectors' share of aggregate production. One example of a structural relationship between external pressure and productivity growth has already been mentioned - the stagnation and exit of firms that have been hit by external pressure but not succeeded to transform will free resources for the expansion of dynamic firms. But there are many other examples of a structural relationship between external pressure and productivity growth. Devaluations may influence overall productivity growth by their effects on, for instance, the relative size of the exposed, R&D and capital-intensive sectors and also on new firms' share of total production (Erixon, 1991b, pp. 294-302). New firms are not particularly favored by a devaluation since they, in general, are less exposed for foreign competition and also less benefited by higher aggregate demand - the formation of new firms is often prevented by entry barriers. New firms may on the contrary be disfavored by higher nominal wages and interest rates and by the fact that high profits make it easier for established firms to attract risk capital and credits at capital rationing (cf. Svenilsson, pp. 24, 34-36, 49-50). It is true that a devaluation can encourage productivity growth in a country by putting a stronger transformation pressure on new firms and extending the financial opportunities for established firms. But overall productivity growth is reduced *ceteris paribus* by a devaluation if new firms' share of total production declines and

productivity growth or productivity levels are higher in new firms than in established ones. The example shows that a general theory of why productivity growth is affected by transformation pressure must take account of changes not only in firm behavior and skills but also in industrial composition.

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