Finland's Path to the Global Productivity Frontier through Creative Destruction

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ABSTRACT

The marked acceleration of Finnish productivity growth since the mid-1980s is attributable to intensifying *creative destruction*, understood as the joint effect of market entry and exit as well as resource reallocation between continuing plants and firms. This acceleration coincided with the economy-wide deregulation, liberalization, and the opening up of Finland, which provided new incentives and opportunities, thus enabling individuals and businesses to capitalize on intangible capital accumulated via sustained investment since World War II. The "Nokia effect" was particularly important in the latter half of the 1990s, but productivity-enhancing restructuring has been more widespread. Developments in Finland are contrasted to those in Japan, Sweden, and the United States.

RÉSUMÉ

L'accélération marquée de la croissance de la productivité en Finlande depuis le milieu des années 80 est attribuable à l'intensification de la destruction créatrice, c'est à-dire l'effet conjoint de l'entrée et de la sortie sur le marché, de même que de la nouvelle répartition des ressources entre les usines et les entreprises qui se maintiennent. Cette accélération coïncide avec la déréglementation de l'ensemble de l'économie, la libéralisation et l'ouverture de la Finlande, facteurs qui procurent de nouveaux stimulants et possibilités, de sorte que les particuliers et les entreprises sont en mesure de tirer profit du capital incorporel accumulé par des investissements soutenus depuis la Seconde Guerre mondiale. L'"effet Nokia" a été particulièrement important dans la deuxième moitié des années 90, mais la restructuration favorable à la productivité a été plus répandue. L'évolution en Finlande est mise en parallèle ave celle qui s'est produite au Japon, en Suède et aux États-Unis.

FROM 1970 TO 2007, FINLAND'S real GDP per capita grew 2.6-fold and labour productivity grew 3.0-fold; in the market sector, labour productivity grew 4.0-fold.[2] The country's stellar performance partly reflects success in catching up from an initially poor starting point. Even the manufacturing sector, with more exposure to global competition and more intense cross-border technology trans-

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2 Data sources: OECD and EU KLEMS (www.euklems.net).

fer, suffered from competitive weakness in terms of productivity: in 1970, the level of labour and total factor productivity (TFP) in manufacturing was only 60 per cent of the level in the United States (Maliranta, 1996). Since the mid-1980s, plant- and firm-level creative destruction has played an important role in the catch-up process, particularly in manufacturing but also in the market sector as a whole.

Creative destruction, the term initially coined by Schumpeter (1942), is a popular concept to describe the micro-level dynamics of economic growth. In this article, the term refers to productivity-enhancing restructuring at the plant or firm level through entry and exit as well as resource reallocation among continuing plants or firms.

We acknowledge that Schumpeter's concept misleadingly suggests that "destruction" is "creative". Modern Schumpeterian growth theories state that innovations bring about new business opportunities and eventually create new jobs in the units (plants or firms) exploiting them; in the process, innovations also make some of the old units and their technologies obsolete and destroy jobs (e.g. Aghion and Howitt, 2009). Therefore, "destructive creation" (induced by innovations) might be a more appropriate term.

As an empirical matter, we find that productivity-enhancing restructuring was already intense before the Finnish great recession of the early 1990s and during the recovery after the recession. Destruction *per se* is not a necessary or sufficient condition for creation when it comes to innovation; it is rather an outcome.

Without its intense restructuring since the mid-1980s, Finland would have replicated Japan's *lost decade* instead of having its now stellar performance. Whereas the role of Nokia, and the Finnish information and communication technology ICT industry more generally, has been justly emphasized (Hyytinen *et al.*, 2006; Lind, 2008), creative destruction has been more widespread. Indeed, the extent of its role is fully revealed only by studying the micro-level plant data.

The change in Finnish productivity growth dynamics coincides with economy-wide deregulation, liberalization, and the opening up of Finland. While mismanagement of this process also contributed to the bust of the early 1990s (Honkapohja *et al*., 2009; Jonung *et al*., 2009), this policy shift is a key explanatory factor of the subsequent boom (Honkapohja *et al.*, 2009). By intensifying competition in both input and output markets, it provided new incentives for both individuals and companies; by relaxing resource constraints, improving allocative efficiency, and expanding markets, it brought about new opportunities.

However, incentives and opportunities are not enough. The thrust of Finland's ability to make the most of the changing circumstances is in the steadily deepening intangible capital accumulated via an increasing stream of public and private investments in education and research since World War II (Asplund and Maliranta, 2006; Dahlman *et al.*, 2006). Public support for private innovative efforts was consolidated with *Tekes*, the National Technology Agency, established in 1983. Since then, Finland has been quite active in enterprise-side innovation policy (Ylä-Anttila and Palmberg, 2007).

Creative destruction necessarily induces adjustments involving shorter-term personal costs. Cumulative longer-term (net) costs relate to how these changes are handled and what kind of opportunities they open. Despite becoming more market-oriented and having more intense restructuring, Finland has maintained its egalitarian values, active social dialogue, and extensive social safety nets, which have undoubtedly reduced the immediate costs of market-induced turmoil. Besides the obvious longer-term economic gains, there is also some indication of broader benefits. Finnish life satisfaction has *not* gone down in the era of more intense restructuring, and Finland has steadily improved its position in

international rankings of perceived happiness (e.g. the World Values Survey). Despite the Finnish economy contracting by 8 per cent in 2009, a recent survey by the European Commission (Eurobarometer 72) suggests that Finns are the most optimistic about their future among the EU-27 countries.

In this article, we extend in three ways the earlier analysis by Lind (2008), who studies the role of ICT production in explaining productivity trends in Finland and Sweden. First, to obtain a broader picture, we include Japan and the United States in our comparison. Japan is a particularly interesting case because it demonstrates that a crisis is not necessarily followed by a recovery. Instead, a crisis might result in prolonged stagnation in productivity development and economic growth when some vital ingredients of growth are missing. Second, while Lind (2008) emphasizes restructuring between industries, we study changes hidden in micro-structures, that is, in plant and firm dynamics. Lind attributes an important part of the Finnish productivity catch-up to the reallocation of employment towards Nokia-dominated electrical engineering. Our analysis shows that productivity-enhancing micro-level restructuring was in fact considerably more widespread. Third, we demonstrate that the mid-1980s was a fundamental turning point in the Finnish productivity trajectories. Indeed, we argue that the foundations of the late 1990s productivity surge date back to the early 1980s and even to earlier decades.

Our findings point to the importance of education and innovation policies as longer-term factors and to the importance of financial development and market competition as more immediate causes of productivity and economic growth. In three of the related four policy domains, Finland forged important new paths in the early 1980s. We will not discuss in detail the relatively stable education policy at that time, even if we wish to acknowledge its crucial impact in postwar Finland.

Lind (2008), Jalava (2007), and Aulin-Ahmavaara (2009) have recently considered restructuring and productivity performance in Finland. Contrasting their findings to those of Maliranta (2003) suggests that, even at a quite detailed industry-level, productivity-enhancing restructuring has been stronger *within* the Finnish manufacturing industries than between them. This is in line with the recent job creation and destruction literature, which documents the prevalence of simultaneous job increases and losses among producers in the same industry (e.g. Davis and Haltiwanger, 1999).

The rest of this article is organized as follows. In the first section, we study the development of aggregate productivity levels in Finland. In the second section, we employ the traditional growth-accounting approach. In the third section, we consider an alternative micro-level decomposition approach. The fourth section discusses developments in three policy domains. The fifth section concludes our analysis.

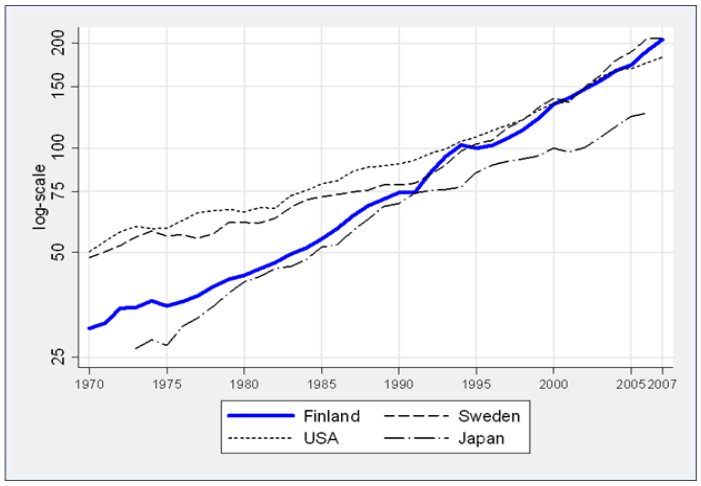
Aggregate Productivity Development

In this section, we focus on the market sector because the inclusion of the non-market sector distorts international comparisons (Smith, 2004; Hartwig, 2006). We consider manufacturing and services separately due to differences in, for example, the competitive environment.

Chart 1 illustrates the "great leap" in the Finnish manufacturing labour productivity (indicated by the thick solid line).[3] In the mid-1980s, Finland and Japan had much lower levels of labour productivity compared to Sweden and the United States, which at that time were clearly at the global forefront (van Ark, 1993). Both Finland and Japan advanced well in the latter half of the 1980s, but in

3 The relative productivity levels of these countries in the year 1987 were obtained from the comparisons of Groningen University (see http://www.ggdc.net/databases/icop87.htm). Other years were extrapolated by using a productivity time series obtained from the EU KLEMS database (see http://www.euklems.net/).

Chart 1
Labour Productivity Levels in Manufacturing
(Finland 1995=100)



Sources: Groningen University, EU KLEMS, Maliranta (2009), and authors' calculations.

the early 1990s, only Finland forged ahead and caught up with the global productivity frontier.

Table 1 presents the same data as in Chart 1 as annual averages over three periods. The acceleration of the Finnish productivity in the mid-1980s is remarkable both against the country's own history and in the international comparison. While still being brisk by international standards, the growth rate since the mid-1990s has been somewhat more modest, even with the peaking "Nokia effect" in the latter half of the 1990s.

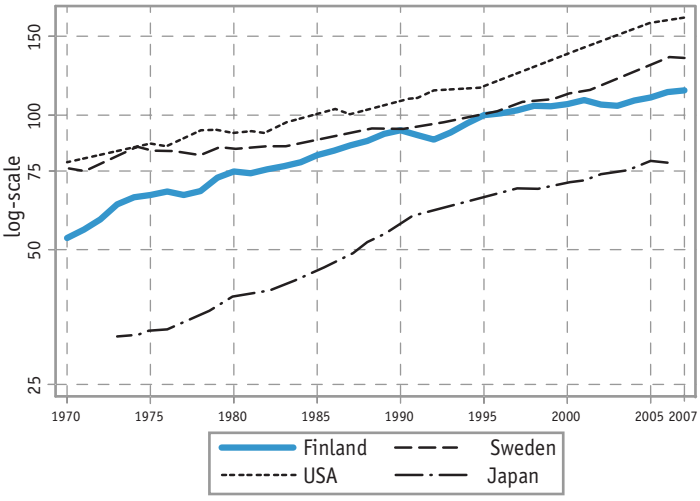
Chart 2 considers market services.[4] Finland and Japan, the latter having a clearly lower productivity level, narrowed the gap to Sweden and the United States until the early 1990s. Since then, however, the gap for Finland seems to be widening, which is in part attributable to issues with the EU KLEMS data and underlying national accounts; particularly in financial intermediation,

Table 1
Labour Productivity Growth in Manufacturing
(average annual rate of change in per cent)

	Finland	Sweden	USA	Japan
1970-1984	3.9	2.8	3.0	5.6
1984-1994	7.1	3.3	3.3	5.0
1994-2007	5.6	6.0	4.4	4.2

Source: EU KLEMS database.

Chart 2
Labour Productivity Levels in Market Services
(Finland 1995=100)



Sources: Inklaar and Timmer (2008), EU KLEMS, and authors' calculations.

there are great difficulties in measuring nominal output (not to mention volume).

As can be seen in Chart 3, in financial intermediation, Finland narrowed the gap up until the late 1990s, which is consistent with intensifying competition and restructuring as well as with the adoption of new information and communication technologies in the sector.[5] In our opinion, however, the subsequent developments are implausible. According to the EU KLEMS, the volume of

4 The relative productivity levels in the year 1995 were obtained from the study by Inklaar and Timmer (2008). Other years were extrapolated by using the productivity time series obtained from the EU KLEMS database (see http://www.euklems.net/).

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Table 2

Growth Accounting Decomposition of Labour Productivity Growth in the Market Sector

(per cent or percentage points per year)

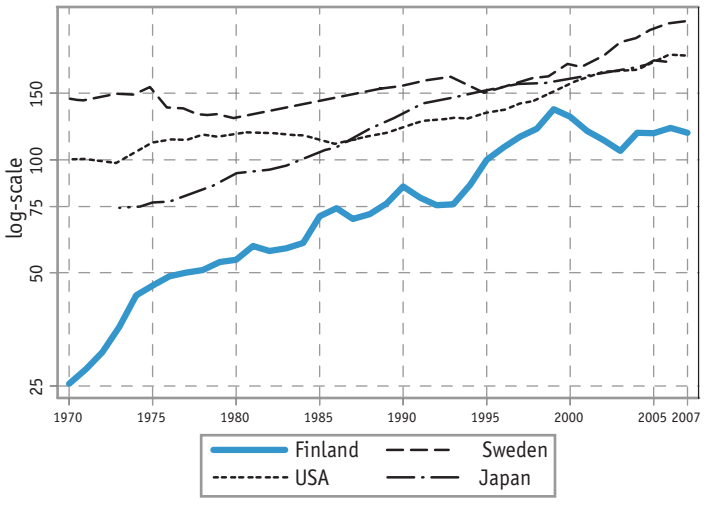
	Labour productivity	Contribution of (percentage points)			
		Labour composition	ICT capital per hour	Non-ICT capital per hour	TFP
	(1)=(2)+(3)+(4)+(5)	(2)	(3)	(4)	(5)
Finland					
1970-84	3.2	0.7	0.4	1.1	1.1
1977-84	3.4	0.8	0.5	0.7	1.4
1984-94	3.2	0.5	0.4	0.4	1.8
1994-07	3.5	0.1	0.6	0.2	2.5
United States					
1977-84	1.6	0.1	0.8	1.0	-0.4
1984-94	2.6	0.2	0.7	0.6	1.1
1994-07	2.9	0.3	1.0	0.5	1.1
Sweden					
1994-07	3.5	0.3	0.7	1.2	1.4
Japan					
1977-84	4.1	0.5	0.4	1.1	2.1
1984-94	3.9	0.2	0.4	1.6	1.6
1994-06	1.9	0.4	0.4	0.6	0.5

Source: EU KLEMS. Note that the components may not always add up due to rounding.

Chart 3

Labour Productivity Levels in Financial Intermediation

(Finland 1995=100)



Sources: Inklaar and Timmer (2008), EU KLEMS, and authors' calculations.

output (value added) decreased 8.4 per cent from 1999 to 2007, while our observations point to simultaneous improvements in customer offerings and efficiency gains in providing them. It seems likely that, in this particular sector, quality improvements are not fully captured in the Finnish National Accounts. In the same period, the Swedish output volume in financial intermediation increased 45.2 per cent. This cross-country divergence becomes especially puzzling after observing that several major financial institutions operate in both countries with similar business concepts. Against this backdrop, also Chart 2 has to be taken with a grain of salt.

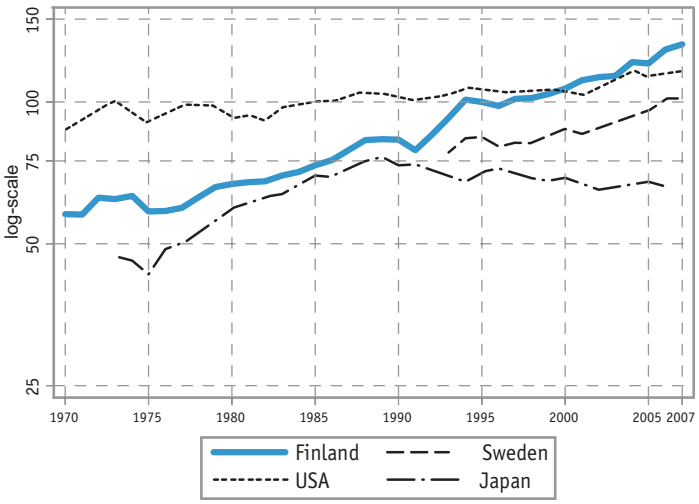
A careful study on international productivity differences in distributive trades by Timmer and Ypma (2006) shows that Finland's strong productivity performance is not restricted to only a few manufacturing industries. The results for the total trade sector in 2002 indicate that Finland's level of

labour productivity was 16 per cent higher than that of the United States, 35 per cent higher than that of Sweden, and 147 per cent higher than that of Japan. Only Luxembourg and the Netherlands were found to be ahead of Finland. The trade sector is particularly interesting for two reasons. First, in this sector, international productivity comparisons are more reliable than in most of the other service industries. Second, it is among the sectors where the use of ICT plays a decisive role in determining productivity (van Ark *et al.*, 2003). Observing that Finland has been able to the exploit the productivity potential of ICT in different (non-ICT) industries is comforting, because ICT can still be expected to be among the key drivers of future economic growth.

Macro-level Sources of Productivity Growth

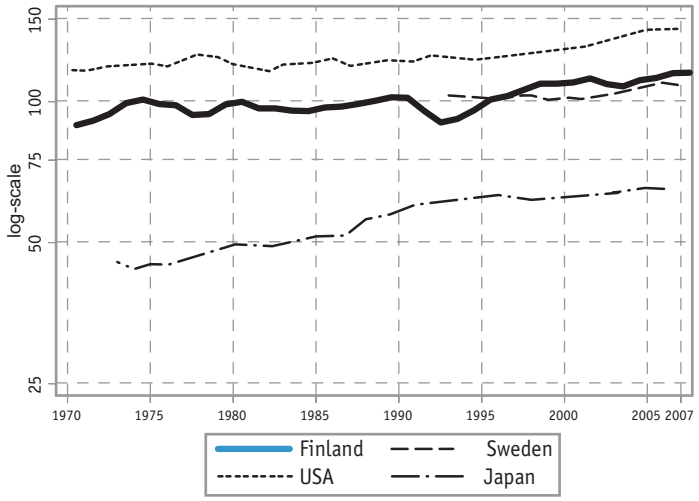
Table 2 presents a breakdown of how various factors – labour composition, capital intensity (both ICT and non-ICT), and total factor productivity (TFP) – contribute to labour productivity growth (e.g. Jorgenson *et al.*, 2002).[6] Five aspects are noteworthy.[7] First, Finland has had high and reasonably stable labour productivity growth in the market sector since the early 1970s (the first column). Second, the contribution of TFP has been high and growing (the fifth column). Third, both labour productivity growth and the contribution of TFP have continuously been higher in Finland than in the United States. Fourth, in contrast to Finland, the contribution of TFP has continuously declined in Japan. In fact, the recent miserable labour productivity growth in Japan can largely be attributed to the depressed contribution of TFP. Fifth, the contribution of ICT has been important across all countries and periods and particularly so in the Unites States.

Chart 4
TFP Levels in Manufacturing (Excluding Electronics/ Electrical)
(Finland 1995=100)



Sources: O'Mahoney and Timmer (2009), the EU KLEMS database, and authors calculations.

Chart 5
TFP Levels in the Market Service Sector (Excluding Post and Telecommunication)
(Finland 1995=100)



Sources: O'Mahoney and Timmer (2009), EU KLEMS, and authors' calculations.

6 An internationally comparable growth accounting information on the components of labour productivity growth is readily available in the EU KLEMS database.

7 Sub-periods were partly determined by data availability. For the United States and Japan, growth accounting information has been available since 1978 and for Sweden since 1994 in the EU KLEMS database.

Rapid TFP growth may be an indication of a catch-up process. Chart 4 suggests that this is indeed the case for Finnish manufacturing, even after eliminating the "Nokia effect". By the new millennium, Finland had reached the frontier in terms of TFP as well.

As a comparison of Chart 4 and 5 confirms, TFP growth tends to be lower in services than in manufacturing. In services (Chart 5), the Finland–US gap has remained about the same in recent decades, although the aforementioned data concerns also apply here.

While growth accounting is a useful descriptive tool, it has some inherent problems: it does not convincingly identify causal relations. Many important contributing factors, such as various forms of intangible capital, are not (explicitly) considered. Furthermore, by embodying the idea of a representative firm, the potentially important and highly policy-relevant role of creative destruction is ignored; that is, the effect of entry of new units (plants or firms), exit of older units, and reallocation of resources between continuing units remain unrecognized. In the following section, we explicitly isolate the contributions of these factors.

Micro-level Sources of Productivity Growth

Digging Beneath the Aggregate Productivity Numbers

As shown above, labour productivity growth in Finnish manufacturing accelerated in the mid-1980s, and the new steeper trajectory was sustained throughout our remaining observation period, which is primarily attributable to TFP growth. Japan, however, has suffered from weak productivity growth for almost two decades.

In this section, we exploit two recent micro-level decompositions (Maliranta, 2009; Hyytinen and Maliranta, 2010) to gain insights into the forces driving favorable developments in Finland that seem to have been absent in Japan.

Micro-level Decomposition

The results for micro-level sources of labour productivity growth are based on the method originally proposed by Vainiomäki (1999), who uses it to analyze skill upgrading. In productivity analyses, similar methods have been used in previous studies (Maliranta, 1997, 2003; Böckerman and Maliranta, 2007; Diewert and Fox, 2009). They differ from alternative methods (e.g. Baily *et al.*, 1992; Griliches and Regev, 1995; Haltiwanger, 1997; Balk, 2003) in three ways: First, in computing the entry component, the productivity level of the new producers is compared to that of the incumbents in the same year. Second, the within component indicates the (weighted) average productivity growth of the producers staying in the industry. Third, the between component indicates the contribution of restructuring among the incumbents. In addition to sound economic interpretation, the method used here has a solid theoretical justification (Diewert, 2005).

The index of the industry productivity level is defined as $\ln P_t = \sum_i w_{it} \cdot \ln P_{it}$, where $\ln P_{it} = \ln \frac{Y_{it}}{L_{it}}$ is the index of unit's *i* labour productivity,[8] which is the log of value added Y_{it} per labour input L_{it}, and $w_{it} = \frac{L_{it}}{\sum_j L_{jt}}$ is the weight of unit *i* as measured by its labour input share. We define the industry productivity index in the initial year correspondingly: $\ln P_{t-1} = \sum_i w_{i,t-1} \cdot \ln P_{i,t-1}$. Because productivity is measured in log-units, the difference in the industry productivity index $\Delta \ln P_t = \ln P_t - \ln P_{t-1}$ reflects the productivity growth rate of the industry.

External Restructuring

Units that can be found either in year *t* and/or *t*-1 can be classified into three mutually exclusive

8 A unit may refer to either a firm or a plant depending on which type of data are used.

sub-groups (*C,E,D*): the sub-group of the *continuing* (or incumbent) units (*C*) consists of those found in the both years, the sub-group of the *entrant* units *(E*) consists of those found in year *t* but not in *t*-1, and the sub-group of the exiting (or *disappearing*) units (*D*) consists of those found in *t*-1 but not in *t*.

For the surviving units ($i \in C$), it is possible to define a productivity growth rate $\Delta \ln P_{it} = \ln P_{it} - \ln P_{i,t-1}$. To obtain a measure of productivity growth within units, denoted here by *WH*, we use a discrete Divisia index and in this way link the productivity decomposition to the index number literature:

$$WH_t = \Sigma_{i \in C} \bar{w}_{it}^{C} \Delta \ln P_{it} \quad , \qquad (1)$$

where

$$\bar{w}_{it}^{C} = \frac{1}{2}[w_{it}^{C} + w_{i,t-1}^{C}] = \frac{1}{2}\left[\frac{L_{it}}{\Sigma_{j \in C} L_{jt}} + \frac{L_{it-1}}{\Sigma_{j \in C} L_{j,t-1}}\right]$$

is the average labour input share of unit *i* in years *t*-1 and *t* among the continuing units ($i \in C$). When defined as a weighted average productivity growth as above, the within component captures the productivity growth rate of an average labour input in the industry. The difference between the industry productivity growth ($\Delta \ln P_t$) and the within component indicates the effect of *external restructuring*, denoted here by *STR*, on industry productivity growth:

$$STR_t = \Delta \ln P_t - WH_t \qquad (2)$$

STR is the sum of three components (see Vainiomäki 1999):

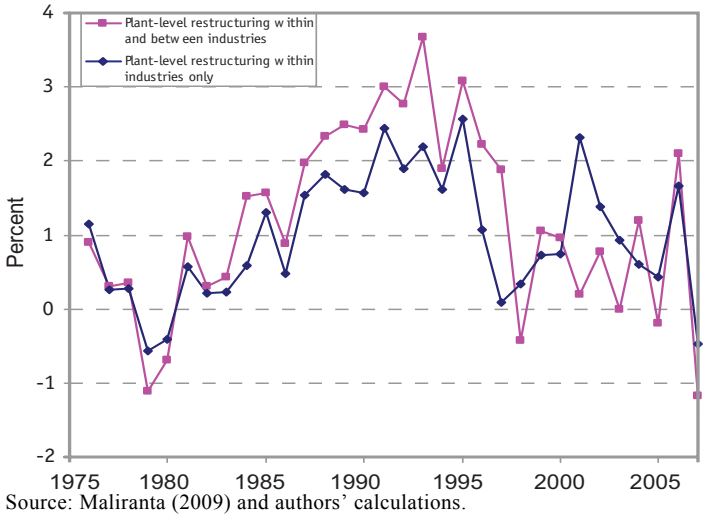
$$STR_t = \underbrace{S_t^E [\ln P_t^E - \ln P_t^C]}_{Entry} + \underbrace{S_{t-1}^D [\ln P_{t-1}^C - \ln P_{t-1}^D]}_{Exit} + \underbrace{\Sigma_{i \in C} \Delta w_{it}^C [\overline{\ln P_{it}} - \overline{\ln P_t}^C]}_{Between} \qquad (3)$$

where $\Delta w_{it}^C = \frac{L_{it}}{\Sigma_{j \in C} L_{jt}} - \frac{L_{i,t-1}}{\Sigma_{j \in C} L_{j,t-1}}$ is the change in the labour input share of continuing unit *i* among all continuing units, $\overline{\ln P_{it}} = \frac{1}{2}[\ln P_{it} + \ln P_{i,t-1}]$ is the average productivity of unit *i* in years *t*-1 and *t*, $\overline{\ln P_t}^X = \Sigma_{i \in X} \frac{L_{it}}{\Sigma_{j \in X} L_{jt}} \cdot \ln P_{it}$ is the aggregate (i.e., weighted average) productivity level of the sub-group $X \in \{C, E\}$ in year *t*, $\overline{\ln P_{t-1}}^X = \Sigma_{i \in X} \frac{L_{i,t-1}}{\Sigma_{j \in X} L_{j,t-1}} \cdot \ln P_{i,t-1}$ is the aggregate productivity level of the sub-group $X \in \{C, D\}$ in year *t*-1, $S_t^E = \frac{\Sigma_{i \in E} L_{it}}{\Sigma_{j \in E \cup C} L_{jt}}$ is the labour input share of the entrants among all of the units in year *t*, and $S_{t-1}^D = \frac{\Sigma_{i \in D} L_{i,t-1}}{\Sigma_{j \in D \cup C} L_{j,t-1}}$ is the labour input share of the exiting units among all of the units in year *t*-1.

The first component on the right-hand side of (3) is the entry component, which is positive when the weighted average productivity level of the entrants is larger than that of the continuing units in year *t* (i.e., $\ln P_t^E > \ln P_t^C$). The magnitude of the effect depends on the labour input share of the new units S_t^E. The entry component indicates how much higher (or lower) industry productivity growth would have been if none of the new units had made their entry in the period from *t-1* to *t*.[9] The second component is the exit component, which is positive when the weighted average productivity level of the exiting units is lower than that of the continuing units in year *t*-1 (i.e., $\ln P_{t-1}^C > \ln P_{t-1}^D$). The third component is the between component, which measures the productivity-enhancing restructuring of labour input shares among the continuing units. It is positive when those units that increase their share (i.e., $\Delta w_{it}^C > 0$) have a higher productivity level (the average in year *t*-1 and *t*) than the weighted average of the incumbents (i.e., $\overline{\ln P_{it}} > \overline{\ln P_t}^C$) or when those producers that lose their share (i.e., $\Delta w_{it}^C < 0$) have a lower productivity level (the average in year *t*-1 and *t*) than

9 It is worth noting that, in an accounting computation, it is not possible to take into account a possible indirect effect of the entrants on the industry productivity growth because they might affect the behavior of the incumbents. On analyzing the indirect effects of entry, see Aghion *et al.*(2009).

Chart 6 Productivity-Enhancing Restructuring in the Finnish Manufacturing Sector (percentage points)



Source: Maliranta (2009) and authors' calculations.

the weighted average of the incumbents (i.e., $\overline{\ln P_{it}} < \overline{\ln P_t}^{C}$).[10]

Creative Destruction in Finnish Manufacturing

Maliranta (2009) applies formula (2) in two ways; first, he does so by performing a decomposition of labour productivity growth for all manufacturing plants together. In this case, the *STR* component (that is, the entry, exit and between components together) captures plant-level restructuring both within and between industries. The contribution of this component to annual labour productivity growth is shown in Chart 6 (the line with cubic markers). Three points are noteworthy. First, the productivity growth effect of creative destruction, which is measured by the *STR* component from equations (2) and (3), began to strengthen in the early 1980s, that is, before the crisis. Second, in manufacturing, the effect was also very strong both before (1987–1990) and after the recession (1994–1995).[11] Third, the effect of creative destruction decreased considerably by the end of the 1990s but was still considerable, varying around 1 percentage point per year.

The computation using formula (2) was also performed separately for fifteen manufacturing industries. The industry-level results were then aggregated to the level of the total manufacturing industry by using the industry's share of the total hours worked as a weight.[12] In this way, the productivity effect of changing industry structures was eliminated. These results are also shown in Chart 6 (the line with diamond markers). The most important additional finding that can be made now is that productivity-enhancing restructuring between plants within industries has been more important than productivity-enhancing restructuring between industries, which represents the difference between the two series shown in Chart 6.

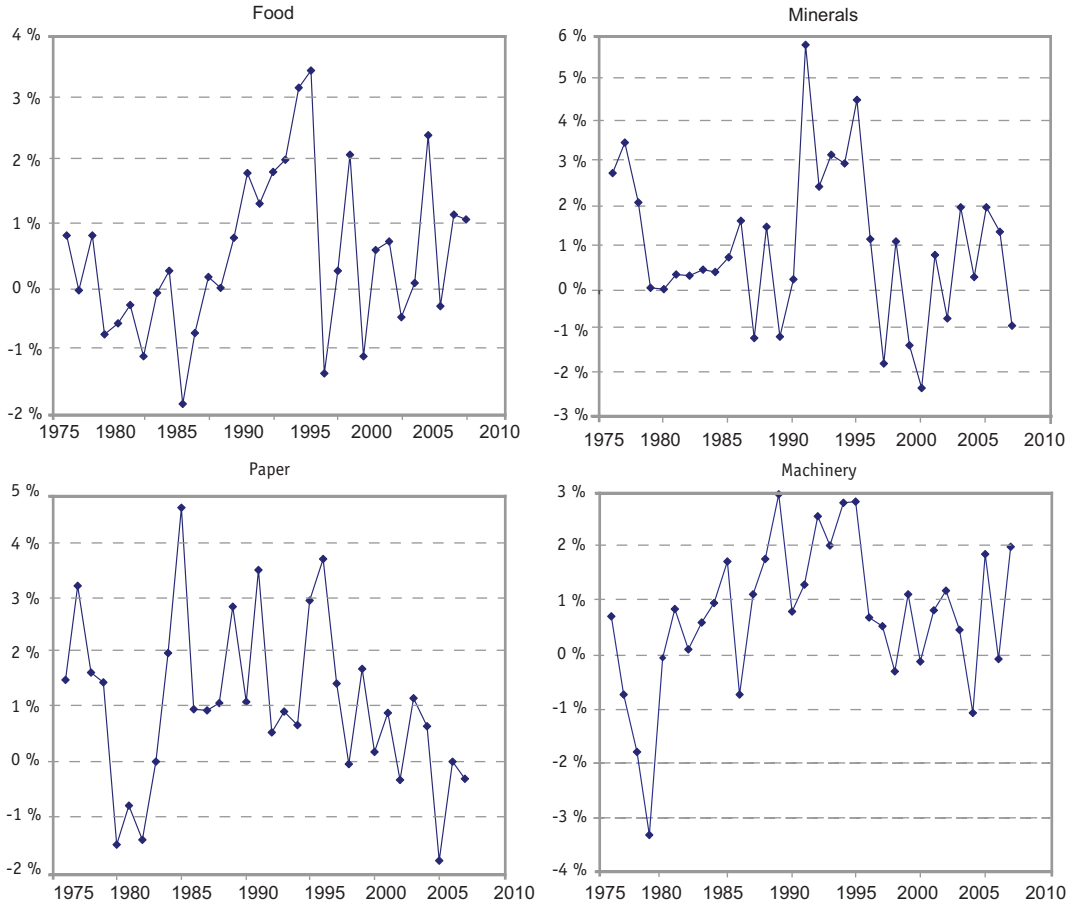
Earlier analyses (Maliranta, 2003, 2005, 2009) have shown that similar patterns in creative destruction can be found in several manufacturing industries. Furthermore, it has been found that that creative destruction is positively related to the industry's R&D intensity with a lag of a few years and to international trade with a somewhat shorter lag. The results for selected industries in Chart 7 show that, although some differences can be found in the intensity and time patterns, productivity-enhancing restructuring has clearly been an impor-

10 It should be noted that the term $\overline{\ln P_t}^{C}$ appearing in the between component is here redundant because here it holds by definition that $\Sigma_{i \in C} \Delta w_{it}^{C} = 0$. However, this formulation helps in interpreting the component; for instance, a firm contributes positively to the between component when its average productivity level (i.e., $\overline{\ln P_{it}}$) exceed that of the industry (i.e., $\overline{\ln P_t}^{C}$), and the firm increases its input share among the continuing firms (i.e., $\Delta w_{it}^{C} > 0$).

11 At its peak, the annual contribution of creative destruction was 3 percentage points. According to the EU KLEMS data, the average annual labour productivity growth rate in Finnish manufacturing was 5.4 per cent in 1970–2007.

12 To be more precise, each industry is weighted on the basis of its average share of total hours in *t*-1 and *t*.

Chart 7
Contribution of Creative Destruction (*STR* component) to Labour Productivity Growth in Selected Industries
(percentage points)



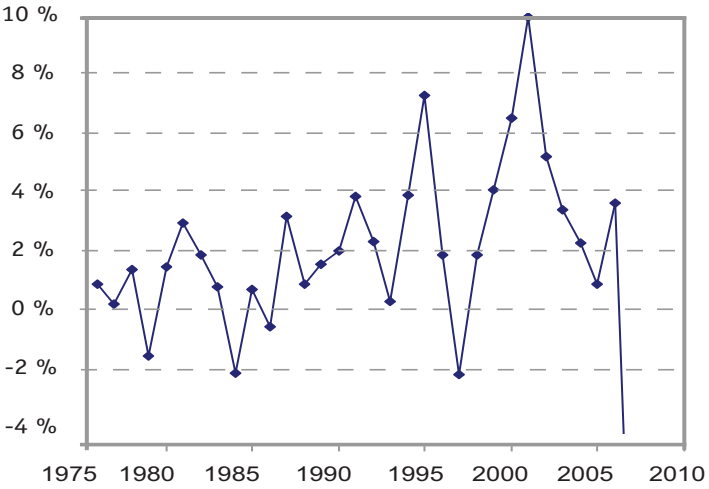
Source: Maliranta (2009) and our own calculations.

tant mechanism of labour productivity growth in different industries. Due to its importance in Finland, Nokia, and the manufacturing of telecommunication equipment in general, deserves special attention (Chart 8). Creative destruction has shown an increasing tendency since the mid-1980s, that is, also before Nokia's global breakthrough in the latter half of the 1990s.

Chart 9 shows the sub-components of creative destruction in manufacturing, which show strong year-to-year variation. The *exit* and *between* components are positive and increasing until the mid-1990s. The negative contribution of the *entry* component decreased until the early 1990s and has increased (i.e. become more negative) since then. Overall creative destruction and thus productivity dynamics have changed considerably in the observation period.

Maliranta (2009) as well as Hyytinen and Maliranta (2010) find that younger plants and firms (especially those that have been in existence for five years or less) have disproportionally large positive contributions to the exit component. This is due to both a high exit rate (as measured by employment share) and a relatively low productivity level of younger units. All in all, findings for the entry and exit components partly reflect a "revolving-door" mechanism, which may be con-

Chart 8
Contribution of Creative Destruction (*STR* component) to Labour Productivity Growth in the Manufacture of Telecommunications Equipment
(percentage points)



Source: Maliranta (2009) and authors' calculations.

Table 3
Aggregate Average Labour Productivity Growth and its Components by sub-Periods in Finnish Manufacturing, Annual Within-Industry Averages
(percentage points)

	AGG	WH	STR	ENTRY	EXIT	BETWEEN
1975–1983	3.7	3.5	0.2	-0.3	0.3	0.2
1983–1994	6.1	4.6	1.6	-0.2	1.0	0.8
1994–2007	4.4	3.5	1.0	-0.7	1.1	0.6

Note: Figures refer to the averages obtained from computations performed separately for 15 manufacturing industries. See text for further details.

sidered an indication of intense market experimentation. The process, however, is time-consuming; a unit's contribution to the exit component seems to decline steadily over the first 10-15 years of the life cycle. In other words, there is also a learning process in the early part of the life cycle. Some younger units find themselves to be competitive and thus expand, while less successful ones shrink (and eventually disappear). Because these mechanisms take place among continuing units, they are captured by the between and within components. The above explains the strong co-movement of the exit and between components in Chart 9; both are indications of creative destruction, even if they capture somewhat different aspects of it. Finally, Chart 9 shows that the entry component has grown more negative and the exit component more positive since the mid-1990s. In accordance with modern growth theory (Acemoglu *et al.*, 2006), we interpret this as intensifying experimentation in the Finnish manufacturing sector.

Similar to Table 1, Table 3 shows *within-industry* labour productivity growth rates and their micro-level sub-components. Four aspects are noteworthy. First, echoing Table 1, labour productivity growth picked up between 1975-1983 and 1983-1994.[13] Second, now we observe that increased creative destruction (that is, the *STR* component) has substantially contributed to the acceleration of industry productivity growth. Third, both the exit and the between components are important aspects of productivity-enhancing restructuring. Fourth, a decrease in the entry component in the years from 1995-2007 has made an important contribution to the slowing-down in industry productivity growth.

Chart 10 replicates Chart 1, with an additional line indicating what the development in Finland would have been without creative destruction.[14] It indeed seems that the mid-1980s was a decisive point as far as productivity dynamics in Finland are concerned. Since strictly comparable decompositions are not available for other countries, we are unable to add their counterfactual trajectories. However, as for the between component, Baily *et al.* (2001) present comparable results for the United States (see, in particular, their Figure 2).

13 Note that Table 1 and 3 are not strictly comparable; Table 1 originates from the Finnish National Accounts, whereas Table 3 employs plant-level data, which naturally is the basis of compiling the National Accounts.

14 The index of the within component is defined as $IND_t^{WH} = exp\{ln(IND_{t-1}^{WH}) + WH_t\}$ with $IND_{1975}^{WH} = 35.2$ (the actual relative productivity level in 1975).

The between component in US manufacturing was close to zero with some cyclicality but without any other distinctive time-patterns from 1973 to 1989; a comparison to Chart 9 suggests that productivity-enhancing restructuring between continuing plants has been much more intense in Finland. Additionally, an OECD study[15] suggests that creative destruction has made a much larger contribution to productivity growth in Finland than in the United States (or in a number of other countries included in the study) (OECD, 2003).[16] Evidence on creative destruction in Japan is briefly discussed below.

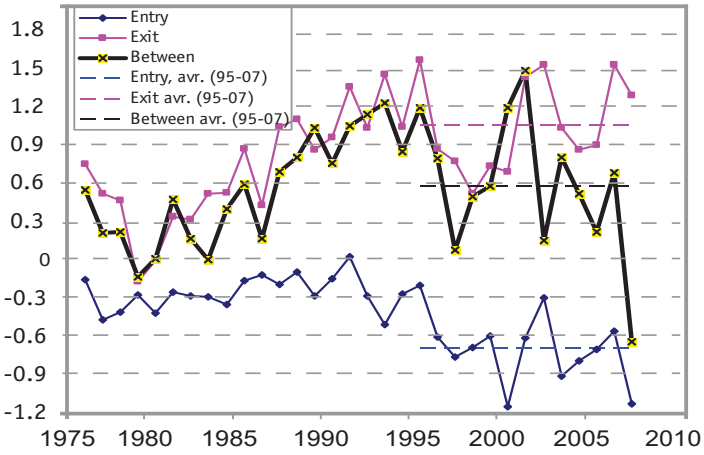
The *within* plants component constitutes two thirds and *creative destruction* the remaining one third of the overall labour productivity growth in Finnish manufacturing, when between-industries restructuring is taken into account in addition to within-industry developments. While the within component is plainly more important, its contribution is far from the 100 per cent implicitly assumed in growth accounting. Furthermore, as can be seen from Chart 10, virtually none of the acceleration of the Finnish productivity growth since the mid-1980s is attributable to the within component.

Maliranta (2009) also performed analyses with a TFP measure. On the whole, the results were similar, except that creative destruction components were somewhat larger both in absolute and relative terms, indicating that reallocation of both labour and tangible capital play a role in the micro-level restructuring.

Creative Destruction in Finnish Services

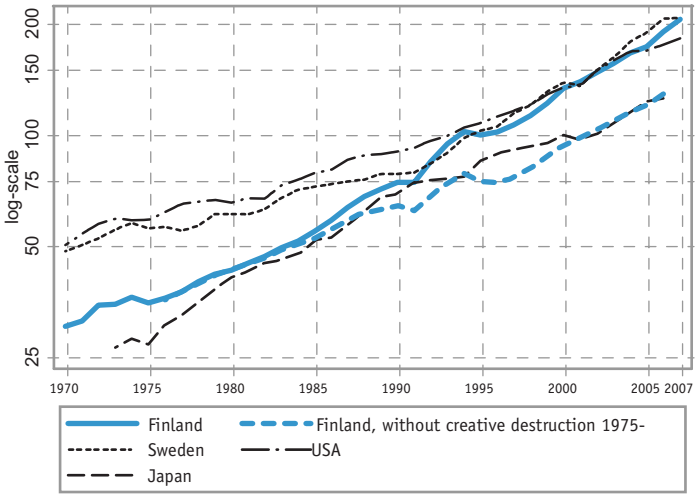
In Finnish manufacturing, global competition destroyed low-productivity jobs and supported the global expansion of high-productivity firms. This does not seem to be the case in services, although data constraints limit our analysis somewhat (we resort to firm-level data, which are only available since 1995).[17]

Chart 9
Components of Creative Destruction within Manufacturing Industries
(percentage points)



Source: Maliranta (2009) and authors' calculations.

Chart 10
The Role of Creative Destruction in International Comparisons of Aggregate Labour Productivity in Manufacturing
(Finland 1995=100)



Source: Maliranta (2009) and authors' calculations.

15 A methodological caveat of the OECD study is the following: the within component of the methods employed in the study (and in many others) gives a downwardly biased estimate of the average productivity growth of the continuing units because the sum of the weights is less than one.

16 Unfortunately, Sweden and Japan were not included in the OECD (2003) study.

Table 4

Decomposition of Labour Productivity Growth by *Firm-level* Sources, 1995-2007

(percentage points per year)

	Industry	Firm	Creative destruction	Components of creative destruction		
				Entry	Exit	Between
	(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)
Services	1.2	1.7	-0.4	-1.2	0.9	-0.1
Manufacturing	4.3	4.0	0.3	-0.4	0.4	0.3
Manufacturing, excluding electronics	3.1	2.9	0.1	-0.3	0.3	0.2

Source: Hyytinen and Maliranta (2010) and authors' calculations. The components may not always add up due to rounding.

Table 4 shows that, in services, the overall labour productivity growth rate (1.2 percentage points) is below the within-firm productivity growth (1.7 percentage points), implying a negative contribution of creative destruction (-0.4 percentage points).[18] This is mainly due to a negative entry component (-1.2 percentage points). Additionally, Table 4 suggests that the "Nokia effect" has had an important role since the mid-1990s but is not the whole story in Finnish manufacturing.

Note that the manufacturing figures provided for comparison differ from the ones above because they are based on firm- rather than plant-level data. To be more precise, firm-level analyses do not capture productivity-enhancing restructuring taking place *within* multi-unit firms as they establish and expand more productive businesses and divest less productive ones (Maksimovic and Gordon, 2002), a strategy that has been highly important for Nokia and many other Finnish conglomerates.

The effect of financial deregulation and liberalization is arguably symmetric in manufacturing and services. At least in the case of Finland, however, the outcomes are quite different. We attribute the difference to the asymmetric impacts of opening-up and end-market competition in the two sectors; developed financial markets seem to be a necessary but not sufficient condition for intense creative destruction.

Japanese Creative Destruction

Recent research has tried to find reasons for the prolonged slow productivity growth in Japan since the early 1990s; the lack of creative destruction is one plausible explanation. Fukao and Ug Kwon (2006) find that the reallocation of resources from low to high productivity firms has been marginal in Japan. Peek and Rosengren (2005) and Caballero, Hoshi, and Kashyap (2008) come to similar conclusions, which both studies attribute to malfunctioning financial markets patronizing inefficient incumbents and discouraging entry.

Economic Policy in Finland

Major shifts in economic policy and related changes in firms' operating environments have a vital role in the Finnish productivity surge. In considerable part, thanks to the powerful forces

17 As compared to plant-level data considered so far, firm-level data have both strengths and weeknesses (Syverson, 2010). One advantage is that a firm can usually be considered to be a natural decision unit. One weakness of firm-level data is that mergers, acquisitions, and "artificial" entries (because of the changes in firm codes in the context of organizational restructuring) may distort decomposition results. As a robustness check, Hyytinen and Maliranta (2010) perform decompositions with both plant-level and firm-level data (the latter results are reported in Table 4). Both yield similar results in the Finnish case (the results with the plant-level data are available upon request).

18 Productivity decompositions are performed separately for each pair of consecutive years and for twelve service industries. The results are then aggregated to the total service sector level by using employment weights so that the results gauge productivity-enhancing restructuring within industries.

Table 5
Aggregate Product Market Regulation
(a lower number indicates less regulation)

	1998	2003	2008	Improvement 1998–2003	Improvement 2003–2008
Finland	2.078	1.297	1.188	0.781	0.109
United States	1.283	1.007	0.841	0.276	0.166
Sweden	1.933	1.494	1.302	0.439	0.192
Japan	2.188	1.409	1.112	0.779	0.297

Source: Extracted on September 17, 2010 from OECD.Stat. The indicator represents the stringency of overall product market regulation on a scale from 0 to 6, with higher numbers associated with policies that are more restrictive to competition; see Wölfl *et al.* (2009) for details.

unleashed during the late 1980s, Finland was able to recover surprisingly quickly from the crisis of the early 1990s, which (at that time) was the deepest faced by any OECD country in the postwar era. The Finnish experiences indeed hold important lessons for other countries, especially in these turbulent times.

Between the early 1980s and early 1990s, Finland went from a relatively closed mode of operation to a completely open one. Simultaneously, the "public planning" mentality gave way to market orientation. Major parts of these processes were the dismantling of the heavily regulated bank-centric financial system and the removal of restrictions on cross-border capital and trade flows. These factors, together with the collapse of the Soviet Union, changed the competitive landscape, particularly in manufacturing. The necessary adjustments of both individuals and firms were assisted by education and innovation policies, which also sped up the transition from an (physical) investment-driven economy towards a leading knowledge society, which Finland is today.

Product Market Competition

Increased product market competition influences productivity in two major ways. First, the empirical literature suggests that there is typically a positive relationship between competition and innovation (for a review, see Sharpe and Currie, 2008). Second, reducing product market regulation (PMR) has a positive effect on employment (e.g. Nicoletti and Scarpetta, 2003).

OECD considers PMR in three domains: the extent of state control, obstacles to entrepreneurship, and barriers to investment and trade. These indicators show a global trend towards more competition. In the mid-1980s, Finland ranked poorly among the OECD countries, and by the mid-1990s, it ranked favorably, especially when it came to the lack of obstacles to entrepreneurship. Therefore, the absolute and relative change in Finland has been exceptionally large. In more recent years, both Finland and Japan show marked improvement (Table 5).

Deregulation and Liberalization

The first steps towards liberalization of the domestic financial markets were taken in the early 1980s. By the mid-1980s, bank lending rates were deregulated, and private sector foreign borrowing was allowed. Capital movements were liberalized, and the central bank no longer regulated company credit. Consequently, there was a huge influx of foreign capital and a sizable domestic credit expansion, as in Sweden (Jonung *et al.*, 2009). This led to overheating and contributed to the crisis of the early 1990s, but through a wave of mergers and acquisitions and new entry, it also led to reorientation and restructuring of the business sector. Even if, in hindsight, the liberalization process was mismanaged, there is no doubt about its

longer-term economic benefits not only in the transitory period but also more permanently because resources continue to be mobilized more efficiently (Hyytinen and Pajarinen, 2003).

Throughout the 1980s, the Finnish foreign trade regime also experienced a major shift, particularly when it came to the peculiar trade arrangement with the (former) Soviet Union. Finland's exports to its eastern neighbor peaked at over a quarter in the early 1980s; the share bottomed out at less than 5 per cent in the early 1990s. Despite some doubts, the Finnish businesses with significant exports to the former Soviet Union were able to reorient themselves towards Western markets with relative ease.

There is some evidence that the removal of entry barriers and liberalization of financial markets have increased entry and exit of plants and intensified job creation and destruction, at least in the manufacturing sector. Maliranta (2003; 2009) finds that an increasing number of new jobs were created in new plants and an increasing number of older jobs were destroyed due to exits after the mid-1980s. In addition, Maliranta (2003) shows a marked increase in dispersion of employment growth rates between the continuing plants at the same time. In other words, policy changes seem to have been associated with increased restructuring at the plant level. Productivity decompositions shown in the previous section, in turn, indicate that much of this restructuring has been productivity-enhancing implying that many new high productivity jobs were created alongside destruction of less productive ones.

Innovation Policy

Throughout the 1980s, diversifying the industrial base became the focal point of (what at that time was called) science and technology policy (Ylä-Anttila and Palmberg, 2007). *Tekes*, the National Technology Agency, was established to funnel public support for private R&D. Both public and private R&D grew rapidly, and by the late 1990s, Finland had surpassed the OECD-average R&D intensity. Currently, the total R&D expenditure in relation to GDP is approaching 4 per cent, which puts Finland among the top three countries in the world. While we attribute a part of this progress to public efforts, we wish to emphasize that the private sector finances roughly three quarters of R&D conducted in Finland, which is one of the largest shares among the OECD countries.

The role of public efforts in nurturing certain inputs (particularly a capable pool of engineers)[19] and in boosting the total amount of R&D conducted is relatively easy to document. It is, however, much harder to isolate their role in promoting longer-term productivity growth in the business sector. The available evidence nevertheless suggests that innovation policy has had a significant independent and positive role (Ylä-Anttila and Palmberg, 2007; Veugelers *et al.*, 2009), although deregulation and liberation as well as both domestic and foreign competition seem to have been necessary preconditions for it to materialize.

Conclusion

Finnish business sector productivity has soared in the past few decades. In addition to macro-level sources of productivity growth and within-unit developments, our analysis shows that *creative destruction* has a vital role.

Entry, exit, and resource reallocation among continuing plants explain about one third of the overall productivity growth in Finnish manufacturing since 1975 and virtually all of the productivity acceleration since 1985. The main explanatory factors are increased competition and Finland's deepening integration into the global economy, assisted on the "supply side" by education and innovation policies.

19 The Finnish educational sector is almost completely public and virtually all of its services are provided free of charge, even at the post-secondary or university level.

In a frontier economy, creative destruction is about experimentation, reallocation, and selection among individuals (particularly managers) and businesses. Consequently, it brings about some personal discontinuities and uncertainties. It would, however, be a mistake to assume that creative destruction would have longer-term negative effects on life satisfaction. At least in Finland, it seems that restructuring has rather promoted perceived happiness. Finns arguably seem to understand that creative destruction provides new opportunities.

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