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# Internationalization via export growth in Finnish regions

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**Abstract**
Finnish regions have been increasing their exports in special industries in a persistent manner from 1999 to 2013, where the internationalization of industries in regions is measured by the adjusted Balassa's revealed comparative advantage index. However, innovation potential has not increased in recent years especially in firms with highest R&D that are export orientated. Organizational capital (OC) and information and communication technology (ICT) growth has concentrated in greater Helsinki areas and firms with highest OC or ICT per labor are more oriented to domestic market in their sales. Creative destruction has led to increase in tangible investment among the tangible capital intensive firms with relatively poor export performance. All these trends together with foreign firms not being more export oriented than domestic firms call for new industrial policy to maintain competiveness and export growth by the most R&D intensive firms in a small open economy like Finland.

**Keywords**
exports, trade openness, smart specialization, R&D, innovation
**JEL classification**
R11, O47, F20, O34, J24

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# Contents



# Tables

# 1 INTRODUCTION

This study analyses the internationalization and export orientation of Finnish regions at the Nuts-III (maakunta) level. The Finnish economy is small and highly open, with exports accounting for over 40% of GDP. This openness is explained by the evolution of knowledge and other factor input components of GDP. Regions have knowledge that is specific and shapes innovation activities and internationalization; therefore, location matters for innovation activity (Feldman and Florida (1994), Fritsch and Slavtchev (2011), Fritsch (2000) Fritsch and Slavtchev (2005). At least part of the relevant knowledge is specific to a certain region and shapes the innovation activities there. The main sources of this knowledge could be export-oriented firms, multinationals with research and development R&D activities, universities, and public research institutes, where the emphasis is on the export orientation of firms in a region. As regions have specialized, the type of innovative activity has come to differ considerably between geographic areas. The knowledge may also spill over from surrounding regions. Fritsch and Slavtchev (2011) also find interactions between private and public sector research and development. Somewhat surprisingly, they find that regions dominated by large establishments tend to be less efficient than regions with a smaller average establishment size, a question which is also tested here.

This study analyses exports, value added, broad intangible capital and labor productivity development in Finnish Nuts III regions and with a focus on three regions: Ostrobothnia (Pohjanmaa), Etelä-Pohjanmaa and Uusimaa. Ostrobothnia in Western Coast of Finland is an example of region with exports that rely on manufacturing with few big MNEs operating in the area. Etelä-Pohjanmaa is a neighboring region with good performance as a rural area in nature with a large agricultural sector and long tradition of small business. Uusimaa comprises the only area of greater metropolitan Helsinki with notable market services. All regions thus have a different composition of industries active in exports. The study is of high policy relevance National Technology Agency funding has been radically cut in recent years so that public R&D has decreased in recent years since 2009. Finnish public funding for research, development and innovation is less than a quarter of that of the US and half the EU average. At the same time there has not been any substantial cut in subsidies to corporates aiming to support (other) regional development. In Piekkola (2017) in the European comparison private R&D that includes in-house and purchased R&D has decreased by 3.9% per year in 2008-2013 in Finland while the European average growth is zero.

Foreign direct investment, measured here by foreign ownership, is an important determinant of export intensity. Using OECD Trade and Competitiveness Statistics, Nadim (2017) shows that in Finland as a whole, foreign value added is approximately 35%

of all value added to exports in 2009. The share is approximately the same in Sweden and Denmark (see Table A.1 in the Appendix). Exports by foreign MNEs also create additional gross operating surplus through services and income flows (divided in Figure A.1 in the Appendix between gross operating surplus and labor compensation). The total effect on domestic value added of exports is 13% in Finland and 20% in Sweden.

Figure A.2 in the Appendix from Nadim (2017) shows exports and value added by type of firm in Nordic countries in 2013. Value added includes indirect export flows via MNEs (domestic and foreign). An important difference comparing Finland and Sweden is that Swedish gross exports are dominated by foreign-owned MNEs. Sweden has clearly been the focus of foreign-owned MNEs that also produce 45% of all gross exports, while the share in Finland is 25%.

In this study exports are related to GDP growth divided into its components: labor and labor productivity growth. Smart specialization requires the identification of GDP growth factors that also lead to an increased share of exports measured by Balassa-index by Balassa (1965). Growth accounting is performed to analyze restructuring and other innovative factors that have improved labor productivity in Finland. Productivity improving intangible capital is thus identified with the novel idea to separate common growth for each factor input from changes in market structure with firms already intensive in some factor input increasing their input or creating destruction element that can be more procyclical. Common productivity gains due to innovation are thus separated from productivity gains related to specialization of firms that investment into the factor input or not. De Loecker (2011) finds the market share changes to lead also to substantial changes in prices of goods and services produced in a way that true productivity improvement is lower. Given that Finland is small open economy, these price changes can be lower as companies have limited market power in foreign markets. Shifts in the share of firms that use the factor input or not should not affect the price element of the goods and services produced. Common increase in ICs may be worldwide trend (not only in Finland in the industry) that may affect more the relative price of the factor input.

Data here rely on full corporate data of Finnish firms linked to employees' occupational data that can be used to determine innovative work and hence intangible factor inputs: Research & Development capital (R&D), Organizational capital (OC) by management and marketing work and information and communication technology capital (ICT). Study shows that tangible investment growth has been positive but not supporting exports. Innovation potential has not increased or rather decreased among the high IC intensity firms. Decreasing manufacturing and concentration of services in other than market services in greater Helsinki areas is also unlikely to boost growth.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 describes the data and Section 4 the methods for the composition of

relative export and import shares and growth accounting. The RCA (Balassa)-index introduced by Balassa (1965) evaluates the export shares of each industries at the Nuts III level relative to the average across Finland. Section 5 analyses regional trade openness and Section 6 exercises growth accounting for labor productivity and GDP growth before analyzing the determinants of industry-region specific export and import shares. Exports are closely related to imports and some intangibles such OC and ICT also rely substantially on intermediate inputs such as software and knowledge that are imported. Section 7 presents the study's conclusions.

# 2 LITERATURE REVIEW

Firm-level studies have found that innovation activity improves export performance, rather than vice versa (Wagner 2012). R&D is imported for exports in number of papers (Gourlay and Seaton 2004; Harris and Li 2008; Wagner 2006). Furthermore, innovation output indicators such as product and/or process innovations or patents are found to positively affect export intensity and/or the probability of firms becoming exporters (Caldera 2010; Ganotakis and Love 2010; Lachenmaier and Wößmann 2006; Rodríguez and Rodríguez 2005; Van Beveren and Vandenbussche 2010). A broad set of intangibles has been little studied thus far, although many researchers identify the organizational or firm-specific human and structural resources such as ICT as the largest subcategory of intangible investments (Bloom and Van Reenen 2010; Piekkola 2016; Van Ark et al. 2009). Lodefalk (2014) finds that both in-house service activity and service imports in manufacturing are important for Swedish exports. Much of the service activities relate to building up organizational and ICT capital purchased from IC-producing services, as analyzed using Eurostat input-output data by Piekkola (2017). Drenkovska and Redek (2015) find intellectual capital increases exports in Slovenia and not in other, more inward-oriented Balkan countries, and suggest that higher presence on global markets offer exposure to more advanced knowledge that firms cannot obtain domestically. Information Communication and Technology (ICT) and quality management contribute to the time delay and cost increment of exports, and Radzi et al. (2015) show these to improve exports of Malesian firms. This paper capitalizes on these various in-house IC investments to analyze the long-term benefits and follows the methodology by Piekkola (2016).

Intangible capital can be expected to have important regional spillovers and this paper integrates these benefits in the analysis by analyzing export levels at the regional level. Fritsch and Slavtchev (2005) analyze knowledge sources at the regional level in Germany: R&D employment, size of public research institutions by field of research (budget), amount of university external research funds from private firms, public departments, German Science Foundation (DFG), and other sources. The contributions of these knowledge sources are tested systematically on the level of German districts (Kreise). One main finding is that the quality of the university research makes some contribution to regional innovation, while the mere size of the universities is unimportant. They also find indications of benefits stemming from industry diversity. Therefore, both the Marshall-Arrow-Romer and Jacobs-externalities may play some role. Compared to studies conducted in the USA, the importance of university knowledge for innovative output seems to be relatively low in West Germany.

Lee (2011) regression results based on a sample of 71 countries since 1970 suggest that economies have tended to grow more rapidly when they have increasingly specialized in exporting high-technology as opposed to traditional or low-technology goods. In line with

Kaldor's (1966) Keynesian-oriented framework, endogenous growth models also allow for a role for foreign trade in domestic growth. In those models, exports open up opportunities for increased specialization, which in turn, leads to higher productivity.

D'Agostino et al. (2013) find that high-income regions would have a comparative advantage in high-tech R&D, while emerging economies would have an advantage in medium/low R&D. Altomonte and Ottaviano (2013), among others, show that internationalization is driven by innovations in the long term, and large and more productive firms are the primary drivers of internationalization. This study amends this literature by including ICT capital and organizational capital (management and marketing) as important determinants for innovativity and export performance. Survey-based R&D work overlaps with information and communication technology (ICT) activities as statistical offices often in practice proxy database and software expenditures by related ICT and R&D work expenses. Squicciarini and Le Mouel (2012) – published also as chapter in Knowledge-based capital study OECD (2013) – suggest that organizational and ICT investment (according to our definitions with organizational capital including marketing capital) is almost double to the around 2% of US GDP suggested by Corrado et al. (2005). Hence, over twice more workers are in organizational and related ICT work than believed to be in Corrado et al. (2005). It is also important to consider the innovative sector as a whole. Musolesi and Huiban (2010) find knowledge intensive business services, the core of market services, to be as innovative as manufacturing in R&D and patent activity and with strong and positive influence on productivity.

# 3 DATA

The linked employer-employee data (LEED) consists of Statistics Finland firm-level financial account data linked to employee data on incomes and occupations from 1999-2013 that cover financial crises since autumn 2008 and are divided into three periods 2000-2004, 2005-2009, and 2010-2013.[2] The data encompass private sector firms, and intangible capital (IC) relies on the measurement of innovative jobs from occupational data of workers with tertiary education in Finland. The full sample data cover over 80,000 firms per year in Finland and 213,030 firm-year observations for the 1995–2013 period have average employment between 11-5000 employees. Non-consolidated firm data on profits, value added, and tangible capital intensity are used.

The dataset linked with financial data is representative of manufacturing (NACE C), other production (NACE D, E) and market services (G, H, I, J, L, M, N) as a whole, excluding financial services (K). Incorporating market services in the analysis is especially valuable for IC producing services (J, L, M), as many technology firms in Finland were initially part of manufacturing firms. These are also the industries with double the R&D per employee compared to manufacturing. The data include a rich set of variables that cover compensation, education, and profession. White-collar employees are salaried, whereas blue-collar workers, who comprise half of all employed workers, receive an hourly wage; however, annual earnings are used for the analysis. The employee data in the sample cover an average of 700,000 employees annually in 1999-2013.

Occupations follow the International Standard Classification of Occupations (http://www.ilo.org/public/english/bureau/stat/isco/). Piekkola (2016) applies a similar method using occupational data from the Federation of Finnish Employers with a functional classification (e.g., management, research, development, computer, and marketing, combined with skill level of being at least expert). IC workers are divided into organizational capital (OC) workers related to management and marketing, R&D workers, and information and communication technology (ICT) workers. The belief is that R&D, OC and ICT work is augmented with related physical capital and intermediate inputs to create a measure of related IC investment. The proportions of labor costs, physical capital and intermediate inputs are the same within each firm as prevailing in the IC producing business services that have IC outputs. For example, the ratio of physical capital investment and intermediate inputs for organizational capital is the same in IC production as is prevailing in the output of related business services. Appendix A provides a detailed description of the innovative-work coding in intangible capital (IC) type work. Most of the occupations within the top three major groups (Managers, Professionals and Technicians

[2] The deep recession, with an 8% decrease in GDP in 2009, is also explained by collapses in the manufacturing of electronic equipment (mobile phone sales by Nokia) and the paper and pulp industry.

and Associate Professionals) are assumed to be engaged in IC activities that contribute to the accumulation of knowhow within the firm. Workers are switched to be ICT workers in certain IC occupations if their educational field (isced2011) is computing, to be OC workers if their education field code is Social Sciences and Business, and to be R&D workers if their educational field is technical.

# 4 MEASUREMENT OF RELATIVE EXPORT AND IMPORT SHARES

The RCA (Balassa)-index obtained in RCA analysis evaluates the export shares of each industry at the Nuts-III level relative to the average across Finland. The analysis also includes persistence analysis of the competitive positions, i.e., how the export shares have changed over time. Data cover all firms in the Ostrobothnia regions (excluding micro firms) from 1995-2013, a sample consisting of approximately 2600 firms per year and their exports that are positive in approximately 500 firms.

The methodologies used to examine the stability of trade patterns are briefly outlined here; see also Laursen (2015), Dalum et al. (1999) and Cantwell (1989). The RCA index is given by

$$RCA = \frac{X_{jk} / \sum_j X_{jk}}{\sum_j X_{jk} / \sum_j \sum_k X_{jk}} \tag{1}$$

where the numerator represents the percentage share of a given 2-digit industry j export in region k's total exports. The denominator represents the percentage share of sector j exports of all exports in Finland. RCA receives the value of one if the export share of industry i in region exports is the same as its share for Finland as a whole. The index is not symmetric around one because it cannot receive negative values, i.e., it ranges from zero to 1 if the region is less than other regions specialized in the given sector. RCA in regression analysis would give more weight to specialized sectors, where the value can range from 1 to infinity. Laursen (2015) suggests a symmetric RCA through a transformation:

$$RSCA = \frac{RCA - 1}{1 - RCA} \tag{2}$$

This symmetric RSCA index is used in analyzing persistence and specialization trends of RSCA using first the following regression equation across regions:

$$RSCA_{jk}^{t} = \alpha_j + \beta_i RSCA_{jk}^{t-1} + \varepsilon_{jk} \tag{3}$$

The superscript $t$ refers to time period, and $\alpha_j$ and $\beta_j$ are coefficients where the latter measures the stability of a region's specialization pattern over time. A high $\beta_j$ indicates a high degree of stability but if $\beta_j$ is not significantly different from 1, then the export share remain unchanged. $\beta_j / R$, where $R$ is the sample correlation coefficient between the observed outcomes and the observed predictor values, measures whether the level of specialization has gone up or down between the two periods. If $\beta_j / R > 1$, specialization has increased; if $\beta_j / R < 1$, then specialization has decreased. Development is analyzed in

four to five year periods since 1999 in three Nuts-III regions: Ostrobothnia, Etelä-Pohjanmaa and Uusimaa.

The GDP per employment growth is also divided into its components: growth in tangible capital per employment and growth in intangible capital per employment. These components are further divided into growth within firms and between firms. The latter composition is useful to analyze changes driven by regional structural shifts versus trends that are common to all firms. The structural change may also include random variation such as factory closings. An additional part of the analysis is to forecast growth in employment. Thus, employment, tangible intensity and intangible capital intensity are used to evaluate GDP growth, which is in turn used to evaluate the development of RCA.

Labor productivity growth is thus decomposed using a growth accounting framework to characterize the existing contributions of IC to labor productivity growth, see also Piekkola et al. (2011); Piekkola (2016, 2017). Intangibles are divided into R&D and knowledge capital, which depends on organizational and ICT capital (OC, ICT). Survey R&D covers approximately 10% of firms with an average size of 10 employees or more. R&D is underrepresented in services that typically have separate plans where R&D is performed. This analysis follows Piekkola (2016) and uses occupational information on R&D workers. Intangible capital type workers that have technical education are considered to contribute to R&D. Intangible capital workers also include organizational capital workers that perform management and marketing work and ICT workers. Not all working time, however, goes to investment activities or not all IC workers do innovative work. The combined effect of IC labor costs allocated to innovation activities is 20% in management, marketing work, 70% in R&D work and 50% in ICT work. These figures are the same as in Piekkola (2016) except double lower for OC. As discussed, this innovative work is combined with intermediate inputs and requires physical facilities where work takes place, where the shares are also taken from Piekkola (2016). With all these effects, combined R&D investments are equal to 110% of R&D labor costs, OC investments are 35% of management and marketing labor costs, and ICT investments are 70% of ICT labor costs. Such broad IC investment is close to 10% of value added in the private sector.

The decomposition of labor productivity growth is divided into that driven by common trend and creative destruction between firms. This creative destruction distinguishes the structural change in the region from trends that are common to all firms in region (or in Finland). For example, IC producing services, i.e., the business services industry, have become more important and GDP growth has faster than in other industries. The aggregate IC intensity has also increased. Creative destruction increases aggregate IC intensity when these industries that are already IC intensive firms invest even more to IC than other firms. A priori, however, it is unclear whether this improves the trade balance, as skill intensive industries may require intermediate inputs from foreign IC producing services.

Labor productivity growth is thus decomposed into the growth contribution of tangible capital and intangible capital (IC) (all per employment, $H_t$) and multifactor productivity growth $MFP_t$ (residual) (see Corrado et al. (2014) for details regarding this method). The decomposition by Diewert and Fox (2010) and Hyytinen and Maliranta (2013) separates the growth determined by internal growth within firms from that driven by changing market structures, which is called creative destruction (CD). The contribution to changes in labor productivity (value added per hours worked) of firm i in industry j and region k (subscripts j and k are suppressed here) can be decomposed as follows:

$$\Delta ln\left(\frac{VA_t}{H_t}\right) = \overline{S}_X \Delta ln\, X + \Delta ln\, RES_t, \text{ where}$$
$$\overline{S}_X \Delta ln\, X = \sum_i \overline{s}_{xit} \Delta ln\, X_{it}. \quad (4)$$

$VA_t$ is the value added in year t, including all capital investments in the industry j in region k (where subscripts j and k have been suppressed), $X_{it}$ is the summation over tangible capital $K_{it}$ and intangible capital, $IC_{it} = R\&D_{it}$ and $OC, ICT_{it}$, $H_{it}$ is the hours worked and $\Delta$ is the difference operator. $\overline{s}_{xit} = 0.5(s_{xit} + s_{xit-1})$ is the average two-period factor input income share of total value-added capital, with fixed tangible income K as the residual of firm-level factor inputs. $RES$ is the unadjusted residual that is not adjusted to fit income and physical products using a RAS method.[3] $RES$ is used as proxy for total productivity growth TFP after accounting for the reallocation effects in each factor inputs. It differs from traditional TFP measures given that extreme values of between effects of each inputs are ignored here so that random variation of it should be lower.[4] The growth accounting applies the user cost of IC that depends on the fixed rate of return of 4% and the depreciation of IC. It should be noted that there is not clear consensus on the depreciation of rate of OC and ICT in particular.[5] The difference to Hyytinen and Maliranta (2013) is that creative destruction (CD) is analyzed for the aggregate factor input contribution and not for aggregate labor productivity contribution. CD is positive if firms/industries invests more in the factor input and the firm/industry is already relatively more intensive in the factor inputs than other firms/industries in the region. Factor-specific CD thus shows the labor productivity effect of specialization to certain factor inputs rather than the aggregate effects on labor productivity when the firm size goes up

[3] The RAS method is an iterative method of biproportional adjustment of input-output rows and columns; see Un Handbook, 'Handbook of Input–Output Table Compilation and Analysis', *Studies in methods series F* (New York: United Nations, 1999).
[4] For firms with average less than 1400 workers observations note within 5% and 95% distribution of the aggregate factor intensity contribution is considered outliers. All observations with more than 5% contribution to aggregate OC and ICT intensity are also ignored.
[5] Depreciation rates are here 15% for R&D, 20-25% for OC (higher for services) and 33% for ICT.

for some reason. The focus here is thus more on the supply push than demand push that increased demand for final goods.

Aggregate figures at the country level can be decomposed into firm-level growth, showing the internal growth in continuous firms and figures driven by regional shifts in the relative size of the firms, i.e., CD. In accordance with Diewert and Fox (2010) and Hyytinen and Maliranta (2013):[6]

$$\begin{aligned} &\overline{S}_X \Delta \ln X_t = \sum_{i \in C} \overline{s}_{xit} \Delta \ln x_{it} + \Delta \ln X_t^{CD}, \text{ where} \\ &\Delta \ln X_t^{CD} \equiv \sum_i (\ln \overline{X}_{it} - \ln \overline{X}_t^C)(s_{xit} - s_{xit-1}) \end{aligned} \tag{5}$$

where $\ln \overline{X}_{it} = 0.5(\ln X_{it} + \ln X_{it-1})$ is the average two-period industrial value of $X_{it}$ and $\ln \overline{X}_{it}^C = 0.5(\ln X_{it}^C + \ln X_{it-1}^C)$ is the aggregate average two-period figure $X_t^C = \sum_{i \in C} X_{it}^C$ for continuing firms (C). The first term in (5) denotes the internal change in continuous firms, i.e., the productivity growth within each firm weighted by its value-added share. The term $\Delta \ln X_t^{\mathrm{CD}}$ in (12) is the creative destruction (CD) element showing the effects that arise from regional share changes, where $s_{xit} - s_{xit-1}$ is the change of variable $X$ shares with respect to the aggregate value added. CD is typically analyzed in the disaggregation of labor productivity growth into internal growth and changes in the market share of firms with different levels of labor productivity. Here, the common and CD growth are separated for each factor input. The entry and exit of firms is the final element of $\Delta \ln X_t^{CD}$:

$$\begin{aligned} \Delta \ln X_t^{CD} = &\sum_{i \in C} (\ln \overline{X}_{it} - \ln \overline{X}_t^C)(s_{xit} - s_{xit-1}) + S_{xit}^E \left( \ln X_t^E - \ln \overline{X}_t^C \right) \\ &- S_{xit-1}^D \left( \ln X_{t-1}^D - \ln \overline{X}_{t-1}^C \right). \end{aligned} \tag{6}$$

$\ln \overline{X}_t^C$ denotes the aggregate value of the factor input in continuing firms. The third and fourth terms denote the part of creative destruction that is explained by exiting firms (denoted by *E*) and entering firms (denoted by *D*), where $S_{xt}^D$ is the share of variables $K$, $R^{NEW}$ and $R^{OLD}$ in entering firms of the total value added in period t, and $S_{xt-1}^E$ is the equivalent for exiting firms.

The panel of 35 two-digit industries in production and market services in Finnish Nuts-III areas in 2000-2013 is in the final stage used in econometric analysis. A final regression explains the tangible and intangible intensities, growth accounting variables, firm size and the share of foreign operations. Log growth of RSCA is calculated separately for exports

[6] A programme for decomposing micro-level sources of labor productivity was provided by Mika Maliranta from ETLA, The Research Institute of the Finnish Economy.

and imports and explanatory variables include stock variables and their growth accounting CD effects:

$$\ln RSCA_{t+1} - \ln RSCA_t = b_0 + b_X \ln X_t + \Delta \ln X_t^{CD} + b_z \ln Z_t + \varepsilon_t \qquad (7)$$

where $X$ is tangible and intangible capital variables, $X^{CD}$ shows how these are interlinked with their CD restructuring effect on labor productivity growth, $Z$ is other controls, such as share of exports by foreign multinationals, total factor productivity growth and average firm size in regions, and $\varepsilon$ is residual at the regional level; $b_0$, $b_X$ and $b_Z$ are the respective coefficients. Year dummies are also included to control for cyclical effects. Estimations are performed with random and fixed effects with robust standard errors.

# 5 TRADE OPENNESS IN OSTROBOTHNIA AND PERSISTENCE

Table 1 shows summary statistics of average annual IC investment per employment (L), such as R&D, OC (organizational capital), ICT (information and communication technology), tangible capital (K) per labor (L), export value added share and operating profits per labor across Nuts-III regions in Finland.

**Table 1.** Summary of regional IC, exports and profitability in private sector in Finland 2000-2013

| Variable | R&D/L | OC, ICT/L | K/L | Export share | Operating profit |
|---|---|---|---|---|---|
| Ahvenanmaa | 1.1 | 3.1 | 152.3 | 31.8 | 11.2 |
| Etelä-Karjala | 3.9 | 3.1 | 171.7 | 98.5 | 16.4 |
| Etelä-Pohjanmaa | 2.8 | 2.9 | 111.2 | 30.2 | 8.4 |
| Etelä-Savo | 3.0 | 2.8 | 107.1 | 18.0 | 9.2 |
| Itä-Uusimaa | 3.2 | 3.6 | 223.8 | 39.9 | 6.9 |
| Kainuu | 2.7 | 2.2 | 165.4 | 42.1 | 8.5 |
| Kanta-Häme | 3.6 | 4.1 | 99.1 | 58.3 | 4.8 |
| Keski-Pohjanmaa | 3.0 | 2.4 | 143.2 | 101.4 | 8.1 |
| Keski-Suomi | 5.0 | 6.3 | 156.0 | 73.5 | -3.0 |
| Kymenlaakso | 4.0 | 2.9 | 210.5 | 64.4 | 8.7 |
| Lappi | 3.3 | 2.7 | 203.6 | 380.9 | -100.2 |
| Pirkanmaa | 4.6 | 6.2 | 110.7 | 52.9 | 10.4 |
| Ostrobothnia | 4.7 | 4.3 | 142.9 | 84.3 | 13.0 |
| Pohjois-Karjala | 2.7 | 2.3 | 119.0 | 39.6 | 11.2 |
| Pohjois-Pohjanmaa | 4.3 | 5.6 | 137.3 | 67.0 | 11.2 |
| Pohjois-Savo | 3.8 | 3.4 | 131.7 | 64.7 | 7.0 |
| Päijät-Häme | 3.0 | 3.2 | 111.4 | 34.0 | 9.7 |
| Satakunta | 4.7 | 3.0 | 120.6 | 67.1 | 7.7 |
| Uusimaa | 4.9 | 8.3 | 161.8 | 43.0 | 11.6 |
| Varsinais-Suomi | 4.8 | 5.5 | 149.1 | 54.0 | 14.8 |

Export share in percentage, R&D intensity R&D/L, OC AND ICTintensity OC, ICT/L and tangible capital intensity K/L thousand 2010€ and Operation profit hundred thousand 2010€.

Uusimaa with the Helsinki metropolitan area and other regions with bigger cities such as Pirkanmaa (home to Tampere) and Varsinais-Suomi (home to Turku) have average export shares of 43% of value added in Uusimaa to above average exports shares of 53-54% in Pirkanmaa and Varsinais-Suomi. These regions are also most intensive in R&D with 4.6-

4.9 thousand € per employee. Ostrobothnia (Vaasa), Keski-Suomi (Jyväskylä) and Satakunta (Pori) also belong to R&D intensive areas. Uusimaa separates out as the most intensive, with OC and ICT intensities of 8.3 thousand € per employee. In our areas of interest, the figure is half that in Pohjanmaa or one-third in Etelä-Pohjanmaa.

The west coast regions of Keski-Pohjanmaa and Ostrobothnia are open to international trade with 101% and 84% export shares of value added, respectively, while Etelä-Pohjanmaa has a lower export share, 30%. Business is most profitable in Etelä-Karjala, Varsinais-Suomi and Pohjanmaa with 16.4%, 14.7%, and 13.0% profit shares of value added, respectively. It is seen that Lappi and Keski-Pohjanmaa have relatively highest concentrations of export industry, while the average profitability of business is one of the lowest. In the Appendix, Table A.1 shows summary tables for Finland as a whole and for Ostrobothnia, Etelä-Pohjanmaa and Uusimaa analyzed with growth accounting.

Tables 2a-2c show the adjusted Balassa's comparative advantage measure RCA from (1) the Ostrobothnia, Etelä-Pohjanmaa and Pohjanmaa regions in 1999-2013. RCA is analyzed in three four to five year periods: 2000-2004, 2005-2009, and 2010-2013.

**Table 2a.** Revealed comparative advantage RCA in Ostrobothnia region in 1999-2013 using the adjusted Balassa's comparative advantage measure RCA

| Industry | RCA 2010-13 | RCA 2005-09 | RCA 2000-04 | Industry | RCA 2010-13 | RCA 2005-09 | RCA 2000-04 |
|---|---|---|---|---|---|---|---|
| Agriculture A | 2.94 | 2.00 | 1.02 | Wholesale, retail motor vehicles G45 | 0.13 | 0.09 | 0.21 |
| Food products C10 | 0.64 | 0.98 | 0.51 | Wholesale not motor vehicles G46 | 0.65 | 0.62 | 0.39 |
| Textiles, Wearing, Leather C13-15 | 0.62 | 0.61 | 0.65 | Retail trade not motor vehicles G47 | 1.19 | 0.65 | 0.32 |
| Wood and wood products C16 | 0.06 | 0.05 | 0.74 | Transport excl. Warehousing H49-51 | 0.03 | 0.52 | 0.03 |
| Paper and pulp C17 | 0.05 | 1.23 | 1.09 | Warehouse H52 | 0.04 | 1.19 | 0.91 |
| Printing C18 | 0.34 | 0.56 | 0.46 | Accommodation I53-56 | 0.11 | 0.09 | 0.07 |
| Chemicals, petroleum, pharm., rubber C19-21 | 0.17 | 0.36 | 0.95 | Publishing, motion picture I58-60 | 0.00 | 0.44 | 0.26 |
| Rubber and plastic C22 | 1.68 | 2.25 | 1.74 | Telecommunication J61 | 0.01 | 0.27 | . |
| Other non-metallic, basic metal C22-24 | 0.73 | 1.23 | 0.70 | Computer programming, consultancy J62 | 0.00 | 0.19 | 0.53 |
| Fabricated metal C25 | 0.82 | 1.70 | 1.52 | Information, financial service J63-64 | . | 0.32 | 0.24 |
| Computer, electronic and optical C26 | 0.40 | 0.04 | 0.00 | Real estate, legal, accounting J6-69 | 0.00 | 0.20 | 0.01 |
| Electrical equipment C27 | 7.25 | 3.88 | 3.94 | Head office activities 70 | 0.00 | 1.28 | 1.14 |
| Machinery C28 | 1.61 | 1.63 | 2.54 | Other technical, scientific M71-73 | 0.24 | 0.32 | 0.24 |
| Motor vehicles C29 | 1.86 | 1.52 | 1.09 | Architectural and engineering 74 | 0.68 | 2.30 | 0.99 |
| Other transport equipment C30 | 0.97 | 1.35 | 1.02 | Rental, leasing, employment M77-80 | 0.00 | 0.02 | 0.10 |
| Furniture C31 | 0.20 | 0.28 | 0.67 | Education N81-85 | 1.92 | 0.11 | 0.58 |
| Other manufacturing, mining C32 | 0.91 | 1.28 | 0.65 | Human health, social welfare Q | 0.00 | 0.01 | 0.00 |
| Electricity, gas, steam D35-37, E | 6.34 | 6.16 | 0.26 | Creative, entertainment, organiz. R | 4.71 | 1.08 | 0.06 |
| Construction F | 0.83 | 0.86 | 1.56 | | | | |

**Table 2b.** Revealed comparative advantage in Etelä-Pohjanmaa region in 1999-2013 using the adjusted Balassa's comparative advantage measure RCA

| Industry | RCA 2010-13 | RCA 2005-09 | RCA 2000-04 | Industry | RCA 2010-13 | RCA 2005-09 | RCA 2000-04 |
|---|---|---|---|---|---|---|---|
| Agriculture A | 8.59 | 39.92 | 20.65 | Wholesale, retail motor vehicles G45 | 0.28 | 0.08 | 0.78 |
| Food products C10 | 1.05 | 7.52 | 6.78 | Wholesale not motor vehicles G46 | 0.71 | 0.62 | 0.91 |
| Textiles, Wearing, Leather C13-15 | 11.39 | 7.78 | 4.01 | Retail trade not motor vehicles G47 | 0.64 | 1.50 | 1.36 |
| Wood and wood products C16 | 4.61 | 4.28 | 2.00 | Transport excl. Warehousing H49-51 | 0.27 | 7.24 | 0.47 |
| Paper and pulp C17 | 0.00 | 0.01 | 0.00 | Warehouse H52 | . | . | . |
| Printing C18 | 0.00 | 0.47 | 1.17 | Accommodation I53-56 | 0.74 | 0.55 | . |
| Chemicals, petroleum, pharm., rubber C19-21 | 0.02 | 0.03 | 0.03 | Publishing, motion picture I58-60 | . | . | . |
| Rubber and plastic C22 | 1.21 | 0.58 | 0.69 | Telecommunication J61 | . | . | 0.00 |
| Other non-metallic, basic metal C22-24 | 0.47 | 1.92 | 0.65 | Computer programming, consultancy J62 | 0.03 | 0.04 | 8.17 |
| Fabricated metal C25 | 4.11 | 2.46 | 7.31 | Information, financial service J63-64 | 0.00 | 0.00 | |
| Computer, electronic and optical C26 | 0.29 | 0.03 | 0.02 | Real estate, legal, accounting J6-69 | 1.04 | 3.35 | 0.02 |
| Electrical equipment C27 | 0.83 | 0.08 | 0.23 | Head office activities 70 | . | . | . |
| Machinery C28 | 1.34 | 1.44 | 2.70 | Other technical, scientific M71-73 | 0.14 | 2.57 | 0.31 |
| Motor vehicles C29 | 2.23 | 1.65 | 3.02 | Architectural and engineering 74 | 0.01 | 0.01 | . |
| Other transport equipment C30 | 4.47 | 2.76 | 0.97 | Rental, leasing, employment M77-80 | 0.20 | 0.00 | 0.20 |
| Furniture C31 | 8.60 | 4.34 | 7.04 | Education N81-85 | . | 0.01 | . |
| Other manufacturing, mining C32 | 0.00 | 0.82 | 0.22 | Human health, social welfare Q | . | . | . |
| Electricity, gas, steam D35-37, E | 9.77 | . | . | Creative, entertainment, organiz. R | 0.00 | . | . |
| Construction F | 1.90 | 1.29 | 1.98 | | | | |

**Table 2c.** Revealed comparative advantage in Uusimaa region in 1999-2013 using the adjusted Balassa's comparative advantage measure RCA

| Industry | RCA 2010-13 | RCA 2005-09 | RCA 2000-04 | Industry | RCA 2010-13 | RCA 2005-09 | RCA 2000-04 |
|---|---|---|---|---|---|---|---|
| Agriculture A | 0.07 | 0.47 | 0.69 | Wholesale, retail motor vehicles G45 | 1.72 | 3.37 | 2.38 |
| Food products C10 | 0.63 | 0.76 | 0.75 | Wholesale not motor vehicles G46 | 1.74 | 2.05 | 1.72 |
| Textiles, Wearing, Leather C13-15 | 0.41 | 0.67 | 0.43 | Retail trade not motor vehicles G47 | 1.31 | 3.23 | 2.36 |
| Wood and wood products C16 | 0.39 | 0.78 | 0.40 | Transport excl. Warehousing H49-51 | 1.27 | 4.77 | 3.07 |
| Paper and pulp C17 | 0.66 | 0.11 | 0.70 | Warehouse H52 | 0.68 | 1.24 | 0.39 |
| Printing C18 | 1.68 | 2.09 | 1.17 | Accommodation I53-56 | 2.77 | 2.89 | 1.44 |
| Chemicals, petroleum, pharm., rubber C19-21 | 2.60 | 2.83 | 1.76 | Publishing, motion picture I58-60 | 1.83 | 3.15 | 1.49 |
| Rubber and plastic C22 | 0.42 | 0.39 | 0.61 | Telecommunication J61 | 1.07 | 1.41 | 2.30 |
| Other non-metallic, basic metal C22-24 | 0.26 | 0.24 | 0.88 | Computer programming, consultancy J62 | 2.08 | 2.62 | 2.37 |
| Fabricated metal C25 | 0.42 | 0.92 | 0.68 | Information, financial service J63-64 | 0.86 | 2.65 | 1.96 |
| Computer, electronic and optical C26 | 1.38 | 0.95 | 1.35 | Real estate, legal, accounting J6-69 | 2.77 | 1.13 | 0.83 |
| Electrical equipment C27 | 0.48 | 1.01 | 1.53 | Head office activities 70 | 2.32 | 1.46 | 1.49 |
| Machinery C28 | 0.48 | 0.77 | 0.64 | Other technical, scientific M71-73 | 1.62 | 2.88 | 1.03 |
| Motor vehicles C29 | 0.06 | 0.10 | 0.37 | Architectural and engineering 74 | 3.05 | 4.21 | 2.83 |
| Other transport equipment C30 | 0.26 | 0.06 | 0.56 | Rental, leasing, employment M77-80 | 2.15 | 3.83 | 2.48 |
| Furniture C31 | 0.25 | 1.18 | 1.32 | Education N81-85 | 0.95 | 1.84 | 1.01 |
| Other manufacturing, mining C32 | 1.90 | 3.25 | 1.75 | Human health, social welfare Q | 3.20 | 3.70 | 2.72 |
| Electricity, gas, steam D35-37, E | 0.27 | 0.24 | 1.28 | Creative, entertainment, organiz. R | 1.51 | 2.17 | 1.01 |
| Construction F | 1.44 | 2.98 | 1.26 | | | | |

In 2010-2013, the Ostrobothnia region exported relatively more electricity (Nace D, E) electrical equipment, rubber and plastic, agricultural products and motor vehicles than the rest of the Finland. Electrical equipment (RCA 7.3) and electricity, gas, and the stem industry (RCA 6.3) are equally important in the period 2005-2009 and electrical equipment in 2000-2004. The manufacture of machinery and motor vehicles are also nearly twice as prevalent compared to Finland as a whole. Rubber and plastic, agricultural exports (fur industry) and electricity have been able to increase their export share noticeably from the level that prevailed ten years before in 2000-2004, and electrical equipment has strengthened its position. Ostrobothnia is thus an example of a highly export-oriented region that is R&D intensive with fairly stable employment of approximately 79,000 employees, where employment in manufacturing and market services has not decreased since 2002 as in the regions of Etelä-Pohjanmaa and Uusimaa (see later analysis of growth accounting for more details).

Uusimaa includes the Helsinki metropolitan area, which explains the leading position in exports in services including IC producing services. In manufacturing, the export share is above the national average in chemicals, petroleum, pharmacy, computers, electronic and optical equipment and other manufacturing. Exports from head office operations have been over double the national average since 2010. Uusimaa is the only region in Finland with a major metropolis and employment has increased from 700,000 in 2003 to 750,000 in 2013 (but not in the manufacturing and market services sectors considered here).

Etelä-Pohjanmaa is dominant in food product exports and in textiles, clothing and leather and wood products, fabricated metal, other transport equipment and furniture. Agricultural production has maintained a strong position and many strong industries in Etelä-Pohjanmaa are based on active SMEs, whereas in Pohjanmaa, exports are dominated more heavily by big industries. Employment was at 79,000 at 2013, almost the same as in 2003.

Table 3 shows that the export shares in Finland's private sector have been relatively consistent in the three periods considered.

**Table 3.** Regression on the persistence of RSCA export shares

| | 2010-2013 | 2005-2009 | 2000-2004 |
|---|---|---|---|
| Constant | -0.104*** | -0.121*** | -0.158*** |
| | (10.63) | (12.66) | (14.01) |
| RSCA lagged | 0.737*** | 0.679*** | 0.589*** |
| | (54.66) | (51.51) | (36.24) |
| R Squared | 0.348 | 0.458 | 0.542 |
| RSCA lagged/R | 2.118 | 1.483 | 1.087 |
| Observations | 2529 | 3141 | 2467 |

The persistence in export shares in different Nuts-III regions has increased over time from 0.589 in 2000-2004 to 0.737 in 2010-2013. The coefficient divided by R Squared has simultaneously increased so that regional specialization has increased at rapid rate. It is thus seen that regions have been increasing their exports with a less dispersed set of industries. Similar trends can be observed from import shares. These findings differ from those of Feenstra et al. (1999), Feenstra and Rose (2000), and Feenstra and Kee (2007), suggesting that trade openness has led to lower export variety. One explanation is that small open economies tend to be specialized in certain exports such that production in regions is also specialized, as well.

# 6 GROWTH ACCOUNTING AND REGRESSION RESULTS

This section analyses first the components of GDP growth in growth accounting framework. The idea is to examine how creative destruction affects labor productivity before analyzing subsequently how labor productivity components affect exports and imports. As described in equations (5) and (6) the determining factors are growth in labor supply and labor productivity, where the latter is divided into growth in tangible capital and intangible capital intensities (divided into R&D and organizational OC and ICT intensities). Table 4 shows the growth accounting results separately for Finland, Ostrobothnia, Etelä-Pohjanmaa and Uusimaa regions. Growth accounting is examined as average growth in 2000-2013, divided into the same three periods as before. The analysis uses value added that includes intangible investment in R&D, OC and ICT, which are not unaccounted for in the value added in balance sheet statistics because these items are evaluated here. It should be noted that manufacturing and market services are overrepresented in the analysis concentrating on the private sector.

The results imply that in Finland, GDP in the manufacturing and market services sectors has decreased annually by -1%, largely due to the negative annual growth of -2.9% in period 2005-2009, which includes the 2008 financial crisis. In Pohjanmaa, annual GDP growth has instead been positive at 2.6% per year in all periods, with 1.6% annual growth in the final period from 2010-2013, too.

Manufacturing and market services employment has decreased by -1.2% per year since the financial crisis in period 2010-2013. Employment decreased in Uusimaa by -2.6% per year and in Etelä-Pohjanmaa by -4.3% per year, while employment increased by 2.6% per year in Pohjanmaa. Hence, in Uusimaa, the increase in overall employment of all industries by 0.9% is concentrated in sectors other than market services, especially in the public sector.

Labor productivity growth in production and market services has been on average negative at -1.2%, including Ostrobothnia at -0.3% per year. The low or negative growth is explained by the deepest financial crisis period from 2005-2009, with -3-4.3% annual decreases in Finland as a whole, as well as in all regions studied. The following columns show the main interest of decomposing labor productivity growth of tangible and intangible capital into the common growth to all firms and to the creative destruction (CD) of each factor input. Tangible capital intensive firms have continued to investment in tangible at high rate, which has contributed positively to labor productivity growth of 2.5% annually. The tangible capital intensive energy sector has performed well, especially in Pohjanmaa, which has increased its exports, as shown in Table 2a. Some fixed-capital-intensive firms, such as paper and pulp, basic metal industries and large retailers, have on the other hand lost their markets, from half of manufacturing and market services sector in 1998 to one third share by 2012.

**Table 4.** Growth accounting of GDP growth in production and market services

| Finland by regions | GDP | Labor | Labor productivity | Tangible capital per labor | | R&D per labor | | OC and ICT per labor | | Entry firms | Exit firms | TFP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | CD | | CD | | CD | | | |
| Finland all years | -1.0 | 0.2 | -1.2 | 0.5 | 2.5 | 0.1 | -0.4 | 0.0 | -0.3 | 0.8 | -0.6 | -3.9 |
| Finland 2000-2004 | 1.2 | 0.7 | 0.4 | 0.5 | 2.5 | 0.1 | -0.7 | 0.1 | -0.6 | 1.0 | -1.0 | -1.5 |
| Finland 2005-2009 | -2.9 | 0.8 | -3.7 | 0.9 | 2.5 | 0.1 | -0.2 | 0.0 | -0.1 | 0.9 | -0.4 | -7.3 |
| Finland 2010-2013 | -1.3 | -1.2 | -0.1 | 0.2 | 2.3 | 0.2 | -0.1 | 0.0 | -0.1 | 0.4 | -0.4 | -2.7 |
| Ostrobothnia all years | 2.6 | 2.8 | -0.3 | -0.1 | 4.0 | -0.2 | -0.1 | -0.2 | -0.1 | 0.2 | 0.0 | -3.9 |
| Ostrobothnia 2000-2004 | 1.7 | -0.7 | 1.9 | -0.5 | 4.0 | -0.1 | -0.2 | -0.4 | -0.3 | 0.2 | 0.1 | -0.8 |
| Ostrobothnia 2005-2009 | 4.2 | 6.4 | -3.0 | 1.1 | 4.0 | 0.1 | -0.2 | 0.0 | 0.2 | 0.1 | 0.0 | -8.3 |
| Ostrobothnia 2010-2013 | 1.6 | 2.6 | 0.5 | -0.9 | 3.9 | -0.6 | 0.2 | -0.1 | -0.1 | 0.2 | 0.0 | -2.2 |
| Etelä-Pohjanmaa all years | -1.1 | -0.1 | -1.0 | 0.3 | 3.0 | 0.2 | 0.2 | -0.1 | 0.1 | 0.8 | -0.3 | -5.2 |
| Etelä-Pohjanmaa 2000-2004 | 1.2 | 0.9 | 0.3 | 0.3 | 3.1 | 0.1 | 0.2 | -0.1 | 0.0 | 0.9 | -0.5 | -3.6 |
| Etelä-Pohjanmaa 2005-2009 | -1.2 | 2.3 | -3.5 | 1.2 | 3.0 | 0.3 | 0.0 | -0.1 | 0.1 | 0.9 | -0.4 | -8.6 |
| Etelä-Pohjanmaa 2010-2013 | -3.9 | -4.3 | 0.4 | -0.7 | 2.9 | 0.4 | 0.3 | -0.1 | 0.1 | 0.5 | 0.0 | -3.0 |
| Uusimaa all years | -3.6 | -1.6 | -2.1 | 0.8 | 4.7 | 0.3 | 0.7 | 0.1 | 2.8 | 0.9 | -0.5 | -11.9 |
| Uusimaa 2000-2004 | 0.1 | -0.6 | 0.6 | 1.0 | 4.7 | 0.4 | 0.6 | 0.3 | 3.3 | 1.2 | -0.9 | -10.1 |
| Uusimaa 2005-2009 | -6.0 | -1.7 | -4.3 | 0.9 | 4.7 | 0.1 | 0.6 | 0.0 | 2.8 | 0.7 | -0.1 | -14.0 |
| Uusimaa 2010-2013 | -5.2 | -2.6 | -2.6 | 0.5 | 4.7 | 0.3 | 1.0 | 0.1 | 2.3 | 0.5 | -0.4 | -11.6 |

CD=Creative destruction. Growth rates for GDP and labor (employee), and labor productivity. Labor productivity growth is decomposed into that explained by tangible capital, R&D, OC and ICT intensities.

Piekkola and Åkerholm (2013) found intangible CD to have increased output since 2005 in manufacturing and other private sectors, although common intangible capital growth has been slow since 2000. Here, CD of OC AND ICT intensity has been negative for all of Finland with a -0.3% annual contribution to productivity. The creative destruction element of R&D has also been negative at -0.4%. Because these firms are skill-intensive with higher labor productivity, the negative labor productivity growth contribution inclines to losses in market share; however, ICs contributed one percentage point to productivity growth in Uusimaa.

It is also of interest to consider how restructuring in the form of firm entry and exit affects export orientation. Entry and exit includes changes in ownership so that the firm that exits enters the market the following year with no substantial changes in production. It is hence better to analyze the sum of entry and exit effects, as false exits do not disturb these figures. The sum of firm entries and exits improves labor productivity by 0.2% per year or in Etelä-Pohjanmaa, with a relatively higher share of SMEs, by 0.5%-point per year. In Ostrobothnia, large firms dominate and entries and entries have relatively small effects.

The final column shows strong negative total factor productivity growth of -3.9%, up to -7.3% in 2005-2009. Piekkola (2017) shows that total factor productivity growth was actually positive throughout Europe from 2008-2013 after controlling for the negative growth contribution of intangibles. In that analysis, ICs are more broadly defined to cover more extensively purchased ICs from IC producing services that decreased substantially more than own ICs in the financial crisis period. Hence, the true decrease in ICs is likely to be more negative, thus leading to a relatively less negative decrease in total factor productivity growth.

Smart specialization requires the identification of GDP growth factors that also lead to an increased share of exports measured by adjusted Balassa-index RSCA from (6). Analysis is also performed for RSCA constructed for both exports and imports and their difference. The regression analysis from (7) evaluates how different components of GDP or labor productivity have transformed into growth in RSCA. The Breusch and Pagan Lagrangian multiplier test for random effects shows that random effects should be preferred over ordinary least squares when explaining RSCA for imports. The Hausman test shows that fixed effects should be preferred over random effects. A high R Squared within also shows that within variation in regions explains most of the variation in RSCA growth for exports and imports (high R Squared within relative to R Squared between and relatively high intraclass correlation Rho). Table 5 shows that growth in RCSA export and RCSA import are interrelated. Regions that export goods also import a similar variety of capital goods. This follows Frensch and Wittich (2009), who find that the effect of the trade-based measure of product variety on productivity reflects the variety of capital goods, many of

which are imported intermediary goods. The final column measures the net effect, showing how the external balance is affected.

The strong tangible capital intensity structural change (CD) from Table 4 has not improved export shares, although lower common growth in tangible capital intensity as such is related to higher exports and imports. Table 5 shows that the relative slow common growth in R&D per labor from Table 4 has led to higher export and import shares in a way that improves trade balance. The CDs of R&D intensity and OC and ICT intensities have been negative with the one by R&D having stronger negative effect on RSCA for exports and trade balance. Overall common growth in OC and ICT per labor is zero and would have had positive on trade balance. The common labor productivity growth contribution of R&D is positive 0.1% per year with positive effect on RSCE on exports and trade balance.

**Table 5.** Determinants of the regional growth of RSCA export and import shares, fixed effect estimates

| Variables | RSCA exports | RSCA imports | RSCA exports - RSCA imports |
|---|---|---|---|
| Tangible capital per labor | 0.0312* | 0.0270* | 0.0042 |
| | (2.55) | (2.5) | (0.34) |
| Tangible capital per labor CD | -0.0158 | -0.0369* | 0.0212 |
| | (0.92) | (2.49) | (1.32) |
| R&D capital | 0.0745*** | 0.0275*** | 0.0469*** |
| | (5.79) | (2.49) | (3.78) |
| R&D per labor CD | -0.0010** | -0.0** | 0.0469** |
| | (0.46) | (2.49) | (3.78) |
| OC and ICT capital per labor | 0.0121 | 0.06320*** | 0.0469*** |
| | (0.81) | (3.98) | (1.32) |
| OC and ICT per labor CD | 0.00338 | 0.00461* | -0.001* |
| | (1.54) | (2.81) | (0.64) |
| Entry | 0.004 | 0.0022 | 0.003 |
| | (1.93) | (1.16) | (1.13) |
| Total factor productivity growth | 0.0017*** | 0.0018*** | -0.0 |
| | (6.88) | (7.11) | (0.45) |
| Average firm size | 0.113*** | 0.126*** | 0.0558*** |
| | (4.84) | (5.39) | (2.69) |
| Foreign value added share | -0.00646 | -0.0105 | -0.0131* |
| | (1.15) | (2.13) | (0.62) |
| Constant | -2.195*** | -2.118*** | -0.077*** |
| | (9.38) | (2.13) | (0.37) |
| N | 7764 | 7764 | 7764 |
| R Squared within | 0.0794 | 0.105 | 0.0003 |
| R Squared between | 0.0 | 0.0 | 0.0 |
| R Squared total | 0.019 | 0.025 | 0.0 |
| Sigma e | 0.491 | 0.432 | 0.501 |
| Sigma u | 0.321 | 0.307 | 0.204 |
| Rho | 0.299 | 0.336 | 0.143 |

All except growth accounting variables in logs. P values: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In industries firms with particularly high R&D intensity have not continued to investment heavily in R&D. This shows that firms with large R&D innovation potential have not performed very well exports. The common growth of R&D per labor in Finland can also been said to be sluggish over the period.

Regions with a larger average firm size have higher export and import shares in way that improves the trade balance. The position of large firms in Ostrobothnia thus explains why exports are 83% of value added. But innovation potential has not improved any better than in Finland on average. Firm size effects differ from Fritsch and Slavtchev (2011) findings in Germany that regions dominated by large establishments tend to be less efficient than regions with a lower average establishment size.

As seen from growth accounting many of the R&D or OC and ICT industries that continues to investment in intangible capital are in Uusimaa (and there in the greater Helsinki region), so that common growth and CD in R&D or in OC and ICT per labor has been one import reason for good export growth improving trade balance. As such CD of OC and ICT intensity has been the highest which improves exports but also imports in a way that trade balance effect is negative. These mostly service-sector firms are more oriented towards domestic market in their sales. High OC and ICT intensity may still correlate positively with good management, as Bloom and Van Reenen (2010) find for U.S. firms.

In all estimates, growth in exports and imports is related to higher total factor productivity growth. However, total factor productivity growth have been strongly negative and hence a major factor for decreasing exports and imports, but with ambiguous effect on trade balance. Finally, an increase in foreign ownership measured by share of value added of foreign-owned companies from all tend to deteriorate the trade balance.

Bloom and Van Reenen (2010) and Helpman et al. (2004) suggest a pecking order whereby exporting firms are better managed than non-exporters. Our analysis shows that exports would have benefitted from a general trend of Finnish firms becoming more skill intensive with higher IC intensity. Multinationals have the best management practices, but here the share of multiplant firms would have had no effect on exports or imports and also increasing share of foreign firms has had negative effect on trade balance.

# 7 CONCLUSIONS

This analysis of shifts in industry decomposition shows some smart specialization such that Finnish regions have been increasing their exports in special industries in a persistent manner. At the same time, industry variety over the exporting industries has narrowed over time. Similar trends could be observed from import shares. There findings are in contrast to those from Feenstra et al. (1999), Freenstra and Rose (2000), and Feenstra and Kee (2004, 2007) that incline greater export variety with trade openness. One simple explanation is smart growth, where a small economy specialize in order to stay gain enough market share and to be competitive.

However, our findings confirm the earlier findings e.g. by Piekkola (2017) showing that recently IC intensity has not increased especially among the most IC intensive firms, both of which are likely to decrease exports with negative effect on trade balance. CD has also led to increase in tangible investment among the tangible capital intensive firms with relatively poor export performance. If the tangible capital investment growth had spread equally leading to common growth in tangible investments, also export industry would have benefitted from this trend. This shows that the level of tangible investment is not a good approximate of sufficient high level of investment activity if the reallocation effects are away from the export industry.

Regions that have promoted exports and improved their trade balance are those with larger companies relying (at least formerly) on R&D, such as Ostrobothnia, which has a high Balassa's index for exports in electricity, electrical equipment, rubber and plastic and certain agricultural products. These industries also have noticeably higher gross operating surpluses. The export share of valued added is double that in the Uusimaa region that includes the metropolitan Helsinki area. GDP growth has been positive during the whole period from 2000-2013, and export shares have also been relatively stable during the whole period.

Ostrobothnia is potentially good example of a region that can boost exports in the future and employment in manufacturing and market services have continued to growth also after the financial crises. Such a policy requires large companies that can survive in international competition and are IC intensive both in terms of R&D and OC, ICT. However, innovation investments have been equally sluggish as in the whole Finland on average since 2000. It is noteworthy that large firms use subcontractors extensively so that large share, up to 30% here, of the valued added from exports is created by these SMEs. Many of these companies tend to be foreign-owned, which as such do not push the firms to be more export oriented, whereas the trade balance may deteriorate. The large number of foreign multinationals located in Sweden appears can be one factor in the good

economic performance that distinguishes Sweden from other Nordic countries. Finland has lower foreign ownership in exporting firms with relatively bad export performance.

Uusimaa and the greater Helsinki area are a focus of economic activity and innovation potential has continued to growth after the end of 2008 financial crises. Employment in manufacturing and market services, however, has decreased by -2.1% per year since 2003. Hence, all employment growth in Uusimaa has taken place in the public sector or in non-market services. The general shift to skill intensive companies in the service sector in greater Helsinki area has improved export performance and trade balance effects although not so for firms with highest OC and ICT per labor intensities. Such firms appear to orientate still to domestic market in their sales.

All these trends call for new industrial policy to maintain competiveness and export growth in a small open economy like Finland. Increased specialization in special industries such as domestic IC producing services without simultaneous support of the innovation activity of the most innovative R&D intensive firms will not improve the competitive position in international markets that boost exports.

## References

Balassa, Bela (1965), 'Tariff protection in industrial countries: an evaluation', *Journal of Political Economy,* 73 (6), 573-94.

Bloom, Nicholas and Van Reenen, John (2010), 'Why do management practices differ across firms and countries?', *The Journal of Economic Perspectives,* 24 (1), 203-24.

Caldera, Aida (2010), 'Innovation and exporting: evidence from Spanish manufacturing firms', *Review of world Economics,* 146 (4), 657-89.

Cantwell, John (1989), *Technological innovation and multinational corporations* (B. Blackwell Cambridge, MA).

Corrado, Carol, Hulten, Charles, and Sichel, Daniel (2005), 'Measuring capital and technology: an expanded framework', in Carol Corrado, John Haltiwanger, and Dan Sichel (eds.), *Measuring capital in the new economy* (University of Chicago Press), 11-46.

Corrado, Carol, et al. (2014), 'Intangibles and industry productivity growth: Evidence from the EU', *Manuscript available at www. intan-invest. net*.

D'Agostino, Lorena M, Laursen, Keld, and Santangelo, Grazia D (2013), 'The impact of R&D offshoring on the home knowledge production of OECD investing regions', *Journal of Economic Geography,* 13 (1), 145-75.

Dalum, Bent, Laursen, Keld, and Verspagen, Bart (1999), 'Does specialization matter for growth?', *Industrial and corporate change,* 8 (2), 267-88.

De Loecker, Jan (2011), 'Product differentiation, multiproduct firms, and estimating the impact of trade liberalization on productivity', *Econometrica,* 79 (5), 1407-51.

Diewert, W.E. and Fox, K.E (eds.) (2010), *On Measuring the Contribution of Entering and Exiting Firms to Aggregate Productivity Growth*, eds. W Erwin Diewert, B. M. Balk, and D. Fixler (Price and Productivity Measurements, 6; Victoria: Trafford Publishing) 41-66.

Drenkovska, Marija and Redek, Tjasa (2015), 'Intangible capital, innovation and export-led growth: empirical comparative study of Slovenia and the Western Balkans', *Economic and Business Review for Central and South-Eastern Europe,* 17 (1), 25.

Feenstra, Robert C and Rose, Andrew K (2000), 'Putting things in order: Trade dynamics and product cycles', *The Review of Economics and Statistics,* 82 (3), 369-82.

Feenstra, Robert C and Kee, Hiau Looi (2007), 'Trade liberalisation and export variety: a comparison of Mexico and China', *The World Economy,* 30 (1), 5-21.

Feenstra, Robert C, et al. (1999), 'Testing endogenous growth in South Korea and Taiwan', *Journal of development Economics,* 60 (2), 317-41.

Feldman, Maryann P and Florida, Richard (1994), 'The geographic sources of innovation: technological infrastructure and product innovation in the United States', *Annals of the association of American Geographers,* 84 (2), 210-29.

Frensch, Richard and Wittich, Vitalija Gaucaite (2009), 'Product variety and technical change', *Journal of Development Economics,* 88 (2), 242-57.

Fritsch, Michael (2000), 'Interregional differences in R&D activities—an empirical investigation', *European Planning Studies,* 8 (4), 409-27.

Fritsch, Michael and Slavtchev, Viktor (2005), *The role of regional knowledge sources for innovation: An empirical assessment* (15: Technical University Bergakademie Freiberg-Faculty of Economics and Business Administration).

Fritsch, Michael and Slavtchev, Viktor (2011), 'Determinants of the efficiency of regional innovation systems', *Regional Studies,* 45 (7), 905-18. http://dx.doi.org/10.1080/00343400802251494.

Ganotakis, Panagiotis and Love, James H (2010), 'R&D, product innovation, and exporting: evidence from UK new technology based firms', *Oxford Economic Papers,* 63 (2), 279-306.

Gourlay, Adrian R and Seaton, Jonathan S (2004), 'UK export behaviour at the firm level', *Economic Issues,* 9 (2), 3-20.

Handbook, UN (1999), 'Handbook of input–output table compilation and analysis', *Studies in methods series F* (New York: United Nations).

Harris, Richard and Li, Qian Cher (2008), 'Exporting, R&D, and absorptive capacity in UK establishments', *Oxford economic papers,* 61 (1), 74-103.

Helpman, Elhanan, Melitz, Marc J, and Stephen, R Yeaple (2004), 'Exports Versus FDI with Heterogenous Firms, American Economic Review 94'.

Hyytinen, A. and Maliranta, M. (2013), 'Firm lifecycles and evolution of industry productivity', *Research Policy,* 42 (5), 1080-98.

Lachenmaier, Stefan and Wößmann, Ludger (2006), 'Does innovation cause exports? Evidence from exogenous innovation impulses and obstacles using German micro data', *Oxford Economic Papers,* 58 (2), 317-50.

Laursen, Keld (2015), 'Revealed comparative advantage and the alternatives as measures of international specialization', *Eurasian Business Review,* 5 (1), 99-115.

Lee, Jim (2011), 'Export specialization and economic growth around the world', *Economic Systems,* 35 (1), 45-63.

Lodefalk, Magnus (2014), 'The role of services for manufacturing firm exports', *Review of World Economics,* 150 (1), 59-82.

Musolesi, Antonio and Huiban, Jean-Pierre (2010), 'Innovation and productivity in knowledge intensive business services', *Journal of Productivity Analysis,* 34 (1), 63-81.

Nadim, Ahmad (2017), 'Trade in value added and beyond: developing integrated international economic accounts', *The joint Eurostat – DG RTD satellite event on "Challenges in measuring productivity, growth and intangibles" of the Eurostat biannual*

*conference "New Techniques and Technologies for Official Statistics – Increasing Data Relevance for All" (13 – 17 March 2017)* (OECD).

OECD (2013), 'Measuring knowledge-based capital', *Supporting Investment in Knowledge Capital, Growth and Innovation* (OECD Publishing).

Piekkola, Hannu (2016), 'Intangible Investment and Market Valuation', *Review of Income and Wealth,* 62 (1), 28-51.

Piekkola, Hannu (2017), 'Broad-based intangibles as generators of growth in Europe', *Forthcoming in Economics of Innovation and New Technology*. http://dx.doi.org/10.1080/10438599.2017.1376170.

Piekkola, Hannu and Åkerholm, Johnny (2013), 'Talouden kasvun veturit – osaamiseen ja aineettomiin investointeihin vaikuttavat tekijät ', *Kansantaloudellinen aikakauskirja,* 109 (4), 429-42.

Piekkola, Hannu, et al. (2011), 'Firm-level intangible capital in six countries: Finland, Norway, the UK, Germany, the Czech Republic, Slovenia', in Hannu Piekkola (ed.), *Intangible Capital - Driver of Growth in Europe* (Proceedings of the University of Vaasa. Reports 16; Vaasa), 63-95.

Radzi, Mohd Shahril Nizam Md, et al. (2015), 'The effect of information, communication and technology (ICT) and quality management to export performance of Malaysian's SME in manufacturing sector'.

Rodríguez, José López and Rodríguez, Rafael M García (2005), 'Technology and export behaviour: A resource-based view approach', *International Business Review,* 14 (5), 539-57.

Squicciarini, Mariagrazia and Le Mouel, Marie (2012), 'Defining and Measuring Investment in Organisational Capital Using US Microdata to Develop a Task-based Approach', *OECD Science, Technology and Industry Working Papers* (Paris).

Wagner, Joachim (2006), 'Export intensity and plant characteristics: what can we learn from quantile regression?', *Review of World Economics,* 142 (1), 195-203.

Wagner, Joachim (2012), 'International trade and firm performance: a survey of empirical studies since 2006', *Review of World Economics,* 148 (2), 235-67. https://doi.org/10.1007/s10290-011-0116-8

Van Ark, Bart, et al. (2009), 'Measuring intangible capital and its contribution to economic growth in Europe', *EIB papers,* 14 (1), 62-93.

Van Beveren, Ilke and Vandenbussche, Hylke (2010), 'Product and process innovation and firms' decision to export', *Journal of Economic Policy Reform,* 13 (1), 3-24.

# Appendix

Figure A.1 Domestic value added in exports by domestic firms, foreign MNEs and foreign value added 2009 in 22 countries

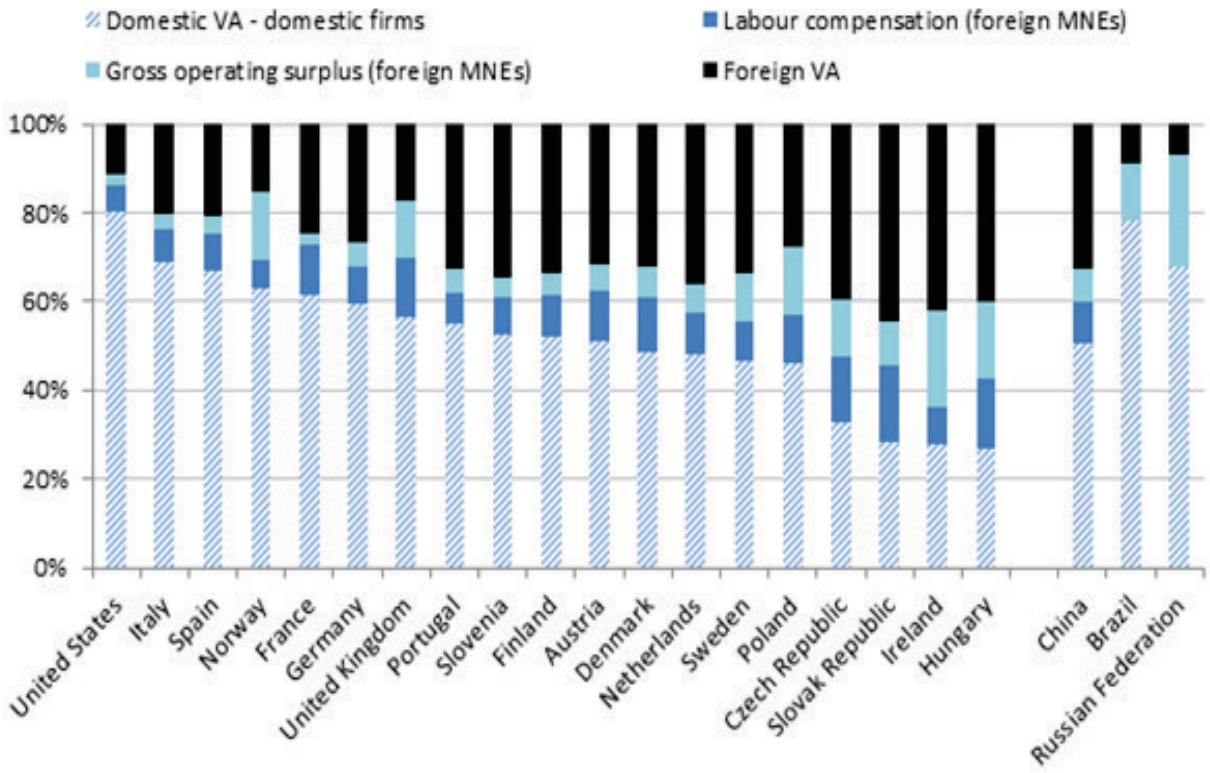
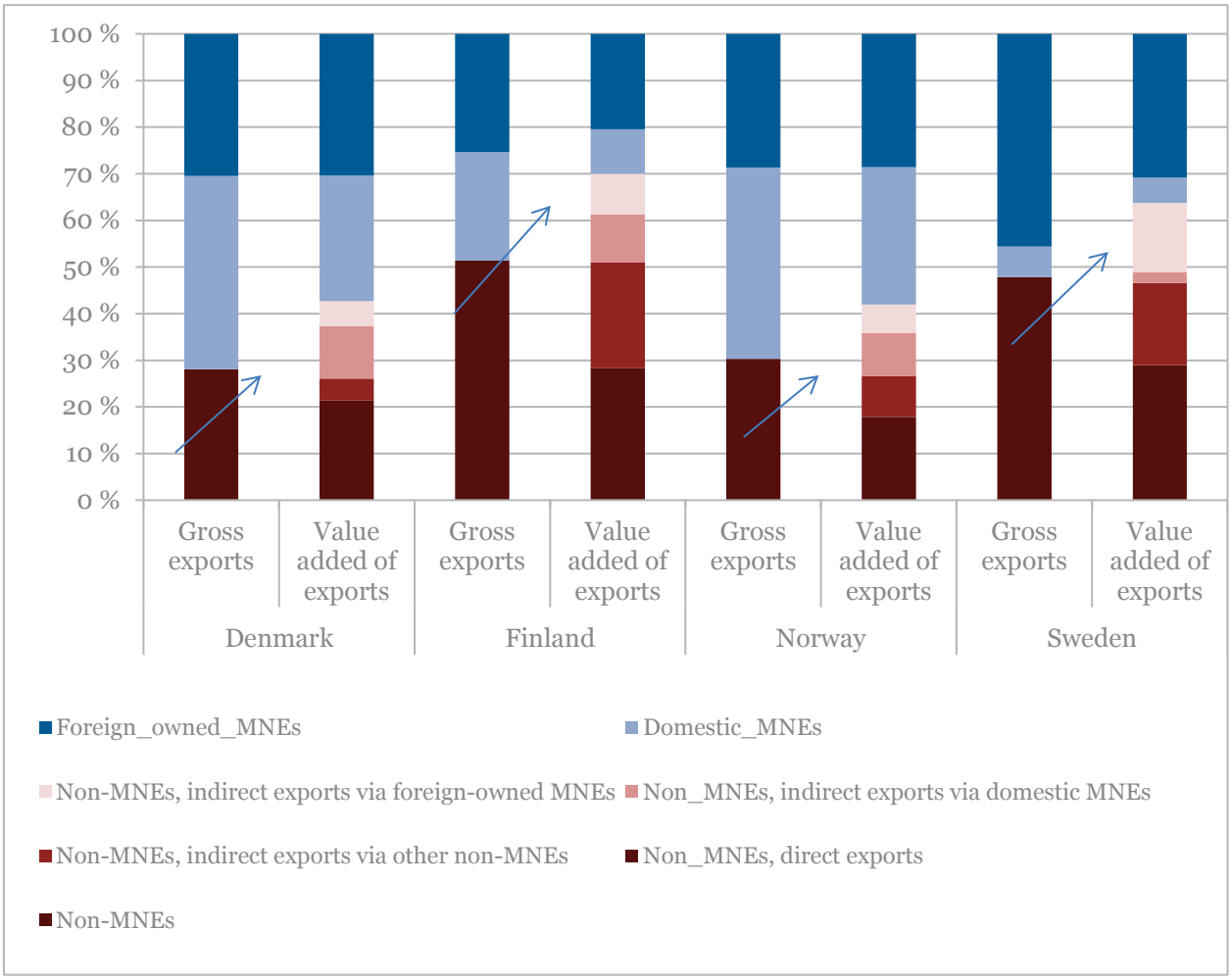


Figure A.2. Firm types in gross exports and value added of exports in Nordic countries, 2013




Source: Nadim (2017)

Table A.1 Summary tables over Finland and Pohjanmaa, Etelä-Pohjanmaa and Uusimaa

| | Finland | | | | |
|---|---|---|---|---|---|
| Variable | Mean | Q1 | Median | Q3 | Std |
| Value added per empl. | 259186 | 236639 | 252719 | 275538 | 26994 |
| Return on asset | 15.9 | 14.3 | 16.3 | 17 | 1.76 |
| Operating profit per empl. | .108 | .0779 | .122 | .138 | .0543 |
| Export share | .583 | .553 | .575 | .631 | .0424 |
| Tangible capital per empl. | 453673 | 429254 | 455063 | 469591 | 35063 |
| Tangible capital per empl. Common growth | .165 | -.258 | .232 | .572 | .435 |
| Creative destruction | 9.99 | 9.6 | 10.1 | 10.5 | .984 |
| R&D per empl. | 79707 | 70347 | 84244 | 86106 | 9191 |
| R&D investment per empl. | 14183 | 12814 | 13774 | 15712 | 1566 |
| R&D per empl. Common growth | .157 | .031 | .161 | .359 | .3 |
| Creative destruction | -.156 | -.437 | -.255 | .0194 | .378 |
| OC, ICT per empl. | 48881 | 42343 | 50548 | 53541 | 6328 |
| OC, ICT investment per empl. | 18713 | 17175 | 18264 | 20408 | 1724 |
| OC, ICT per empl. Common growth | .11 | -.0316 | .116 | .188 | .191 |
| Creative destruction | -.00919 | -.184 | -.034 | .177 | .253 |
| Entry of new firms | .496 | -.00902 | .462 | .711 | .474 |
| Exit of firms | -.317 | -.213 | -.158 | -.0511 | .508 |
| Residual growth | -10.8 | -13.4 | -9.3 | -8.18 | 5.97 |
| Foreign share of value added | .829 | .784 | .823 | .86 | .0609 |
| | Ostrobothnia | | | | |
| Variable | Mean | Q1 | Median | Q3 | Std |
| Value added per empl. | 81829 | 77263 | 84150 | 87868 | 9246 |
| Return on asset | 15.4 | 13.2 | 16.1 | 16.8 | 1.79 |
| Operating profit per empl. | .13 | .0884 | .137 | .156 | .066 |
| Export share | .843 | .672 | .806 | 1.04 | .242 |
| Tangible capital per empl. | 142930 | 102554 | 117321 | 176359 | 58934 |
| Tangible capital per empl. Common growth | -1.5 | -1.53 | -.198 | .831 | 8.03 |
| Creative destruction | 16.0 | 12.3 | 15.8 | 17.5 | 4.49 |
| R&D per empl. | 26493 | 21664 | 26698 | 29642 | 4401 |
| R&D investment per empl. | 4672 | 3684 | 4740 | 5397 | 881 |
| R&D per empl. Common growth | -1.91 | -.159 | .122 | .253 | 7.25 |
| Creative destruction | -.124 | -.477 | -.0943 | .172 | .775 |
| OC, ICT per empl. | 10791 | 9402 | 10054 | 12605 | 1769 |
| OC, ICT investment per empl. | 4330 | 3870 | 4130 | 4783 | 694 |
| OC, ICT per empl. Common growth | -.191 | -.132 | .0708 | .153 | 1.17 |
| Creative destruction | -.3 | -.932 | -.317 | .233 | .682 |
| Entry of new firms | .123 | -.0709 | .0579 | .433 | .309 |
| Exit of firms | -.00199 | -.154 | -.0111 | .11 | .318 |
| Residual growth | -8.39 | -23.8 | -19.7 | 5.92 | 23.6 |
| Foreign share of value added | .831 | .742 | .832 | .916 | .112 |

| Etelä-Pohjanmaa | | | | | |
|---|---|---|---|---|---|
| Variable | Mean | Q1 | Median | Q3 | Std |
| Value added per labor | 67222 | 61974 | 69650 | 72218 | 8233 |
| Return on asset | 15.5 | 13.4 | 16.2 | 17.5 | 2.39 |
| Operating profit per labor | .0841 | .0781 | .0913 | .126 | .0634 |
| Export share | .302 | .224 | .245 | .382 | .133 |
| Tangible capital per labor | 111154 | 94390 | 105271 | 112016 | 25504 |
| Tangible capital per labor Common growth | -.214 | -1.12 | -.0809 | .423 | 1.05 |
| Creative destruction | 12.9 | 11.7 | 12.8 | 14.9 | 1.98 |
| R&D per labor | 15977 | 13300 | 15054 | 18196 | 3278 |
| R&D investment per labor | 2835 | 2374 | 2597 | 3084 | 695 |
| R&D per labor Common growth | .499 | -.0758 | .0347 | .208 | 1.67 |
| Creative destruction | .181 | -.327 | -.0885 | .682 | .726 |
| OC, ICT per labor | 7585 | 6989 | 7620 | 8098 | 573 |
| OC, ICT investment per labor | 2912 | 2631 | 2892 | 3115 | 278 |
| OC, ICT per labor Common growth | -.0339 | -.127 | -.0767 | .0438 | .129 |
| Creative destruction | -.117 | -.256 | .031 | .0764 | .294 |
| Entry of new firms | .789 | -.00729 | .528 | .921 | 1.17 |
| Exit of firms | -.35 | -.454 | -.311 | .0216 | .44 |
| Residual growth | -11.6 | -17.7 | -10.0 | -5.34 | 7.9 |
| Foreign share of value added | .935 | .909 | .946 | .969 | .0447 |
| Uusimaa | | | | | |
| Variable | Mean | Q1 | Median | Q3 | Std |
| Value added per labor | 93360 | 84387 | 96001 | 101003 | 8290 |
| Return on asset | 16.2 | 14.9 | 16.6 | 17.4 | 1.94 |
| Operating profit per labor | .116 | .0699 | .0951 | .176 | .0501 |
| Export share | .43 | .355 | .4 | .516 | .109 |
| Tangible capital per labor | 161783 | 153756 | 160643 | 168358 | 11038 |
| Tangible capital per labor Common growth | .194 | -.839 | .318 | .925 | 1.28 |
| Creative destruction | 39.6 | 37.5 | 40.3 | 40.7 | 1.75 |
| R&D per labor | 27123 | 25857 | 26922 | 28290 | 1603 |
| R&D investment per labor | 4944 | 4686 | 4814 | 5192 | 426 |
| R&D per labor Common growth | .24 | .00632 | .278 | .712 | .589 |
| Creative destruction | 2.26 | 1.16 | 1.79 | 3.19 | 1.65 |
| OC, ICT per labor | 21495 | 20489 | 20922 | 22089 | 1782 |
| OC, ICT investment per labor | 8253 | 7462 | 7798 | 9252 | 1014 |
| OC, ICT per labor Common growth | .343 | -.155 | .178 | .74 | .594 |
| Creative destruction | 4.87 | 2.47 | 4.7 | 6.63 | 2.46 |
| Entry of new firms | .516 | .0349 | .593 | .707 | .555 |
| Exit of firms | -.308 | -.475 | -.311 | -.124 | .339 |
| Residual growth | -59.6 | -68.0 | -56.5 | -49.2 | 11.6 |
| Foreign share of value added | .805 | .764 | .784 | .841 | .0681 |

Figures in thousand 2010€.