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Tiivistelmä
The rapid rise of Chinese exports over the past few decades has raised concerns about manufacturing jobs and internal labor market outcomes in high-income countries. I analyze the effect of rising Chinese import competition on Finnish regional manufacturing employment between 1995–2007. The analysis exploits the cross-regional variation in initial industry structures and uses Chinese imports to other high-income countries as an instrument for Chinese imports to Finland. I find that rising Chinese import competition has a negative effect on the share of manufacturing employment in Finnish sub-regions.

Asiasanat Globalization, import competition, labor market, manufacturing employment

JEL: E24, F16, J23, L60, R23

1 Introduction

Increasing globalization and the rise of the Chinese power in the world trade has caused concerns during the last decades. World trade organization (WTO) was established in 1995 to boost trade openness. China got its WTO membership in 2001 which led the Chinese economy in fast opening to the world markets. At the same time there was a rapid productivity increase in China which led Chinese economy in huge growth. After the international trade barriers was eased China has become one of the most important exporter and importer in the world trade. In times with wide global value chains, the effect of Chinese trade is very crucial for many countries directly and indirectly. The opening of the Chinese economy and the membership of WTO has been a good opportunity for many Western companies to organize their production in a new way. To define the size and importance of this change for local labor markets has induced a large body of research.

Chinese trade has also increased significantly in Finland. Chinese imports to Finland increased by almost 1200 percent between 1995 and 2007 with accelerating pace after 2001. In 1995, imports were only 0.4 billion euros but by the year 2007 annual import volumes had increased to 5.1 billion euros. Finnish exports to China have not increased as much, only slightly over 300 percent during the same time period. At the same time Finnish total imports increased only by 130 percent, stating the increased importance of China as a trading partner.

Figure 1 shows how the importance of Chinese exports, measured as import penetration ratio, have evolved over time in Finland. Between years 1995 and 2007 the Chinese import penetration ratio increased from 0.2 percent to 1.3 per cent. During the same time, the share of employment in manufacturing in Finland decreased from 20.3 percent to 17.7 percent. At the beginning of this period, Finland started to recover from a severe recession which also increased the amount of people working in manufacturing until the year 2000. Although the whole economy was recovering there were differences in local manufacturing industries and employment trends. Some industries were able to catch up with the recovery and increase employment, but employment in other industries continued to decrease. Overall, the employment potential of manufacturing decreased during the whole period because the employment was increasing more in other sectors.

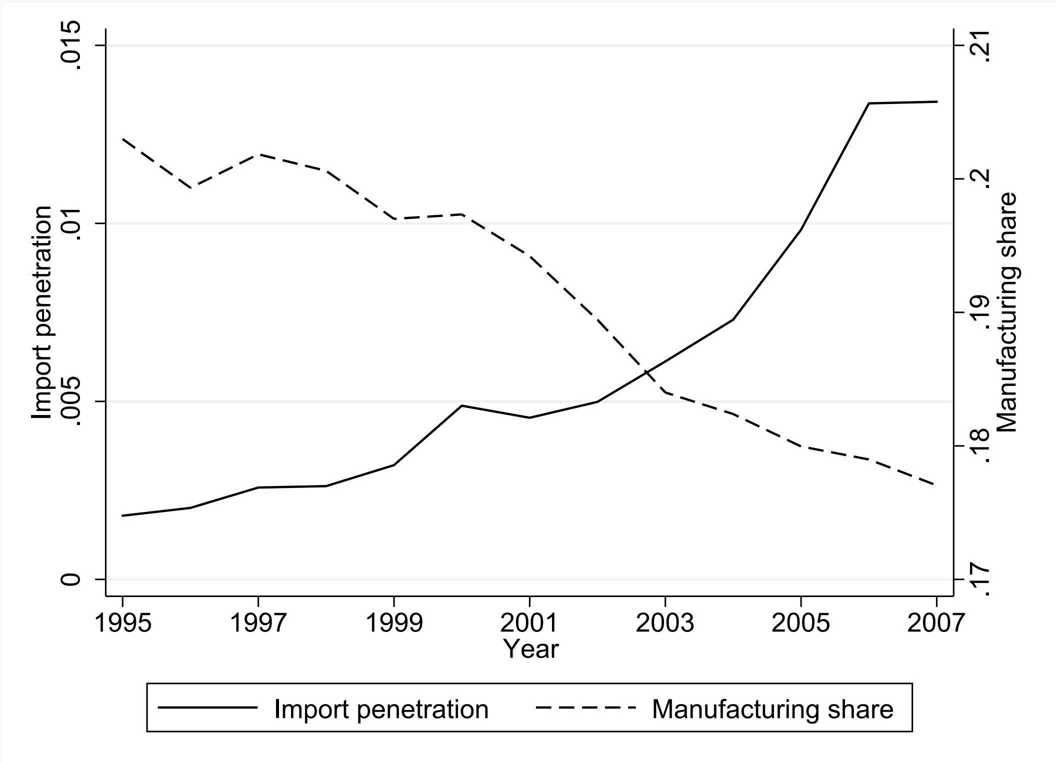

Figure 1. Import penetration ratio[1] *for Finnish imports from China (left scale) and the Finnish manufacturing employment share (right scale).*

International trade may be beneficial as it lowers the prices of consumer goods and enables wider variety of products in a country. International trade allows countries to specialize in the goods in which they are most productive. Thus, free trade among consenting nations raises GDP in all of them (Krugman, 1981). However, the consequences of international trade within a country can be very heterogenous. This leads to that trade creates winners and losers as the benefits are diffused around the country, but costs are concentrated. International trade and specialization eventually affect the sectoral structure of the economy and thereby the structure of the labor force, requiring reallocation of workers and jobs. Adaptation to the structural change may necessitate workers to change location or occupation or even both. If markets reacted quickly and frictionlessly, there would not be disadvantages in readjustment in labor markets. However, changes typically happen so quickly that markets cannot react fast enough. Workers are not geographically mobile enough, acquiring new

[1] Import penetration is defined as Finnish imports from China divided by total Finnish expenditure on goods, measured as Finnish gross output plus Finnish imports minus Finnish exports.

skills takes time and firms do not enter declining locales. Consequently, small group of people bear most of the economic costs of international trade.

In addition to opportunities to buy products and intermediates cheaper abroad, the opening of international trade has enabled Western companies to offshore parts of their production to low-cost countries. The job tasks that have been easily offshored are typically routine intensive manual tasks. Most of these tasks are situated in the middle of the wage and employment share distributions. Therefore, the rise of import competition may lead to the deepening of labor market polarization (Keller and Utar (2016) and Nilson Hakkala and Huttunen (2016)).

In this paper, I study how Chinese import competition has changed the Finnish regional labor markets during the years1995–2007. The main outcome of interest is how the regional manufacturing employment share has changed in Finnish sub-regions. Sub-regions may be differently exposed to Chinese import competition due to the variation in sectoral employment patterns at the regional level, and within the manufacturing sector where commodity trade occurs. Sub-regions strongly specialized in export-oriented industries may benefit from new trading opportunities, while sub-regions specialized in import industries may experience significant changes in their employment structure when the exposure to foreign competition rises. This study is limited only to direct trade flows. Domestic producers and local labor markets may also be affected by Chinese trade competition in their export markets. This means that in trade partner countries China wins market shares from Finland in exported goods.

Finland suffered a severe recession in the beginning of the 1990's and started to recover in the middle of the decade. Technology sector, especially Nokia, was leading the economic growth. Although employment in manufacturing was increasing in number, its share of total employment was decreasing, meaning that manufacturing sector was losing its relative ability to employ people. In Finland as in Norway, labor market unionization is high and collective bargain is universally binding so it is also interesting to see if the employment and wage effects in Finnish local labor markets are in line with other Nordic welfare countries.

I find a strong negative effect of direct Chinese import competition on local manufacturing employment shares in Finland. On average Chinese import penetration increased 1512 euros per worker between 1995 and 2007 in Finland. Estimates show that this increase in import exposure results in a decline in the manufacturing employment share of 0.786 percentage points. During the second period from 2000 to 2007, the manufacturing employment share of a sub-region at the 75th percentile of import exposure declined by -0.3 percentage points more than in a subregion at the 25th percentile. I do not find evidence that increased export opportunities to China have compensated for the negative impact of import competition in Finland. Further, I find small effects on relative wages of highly skilled manufacturing workers. Relative wages for high skilled manufacturing workers increased 0.3 percentage points during the whole research period. Wage effects are predictably mild and mostly insignificant in a welfare state like Finland due to high unionization and wages being rigid downwards.

This analysis of Finnish local labor markets is based on the empirical approach developed by Autor et al. (2013a). They studied the impact of increased Chinese imports on various labor market outcomes in US commuting zones. Autor et al. (2013a) find that local labor markets that are exposed to Chinese import competition experienced larger decreases in manufacturing employment share. Chinese import competition explains around 44 percent of the contemporaneous aggregate decline in US manufacturing employment during the years 1995–2007. Their results also showed that larger increases in Chinese import competition is connected to higher unemployment, decreased labor-force participation, and increased use of disability and other transfer benefits, as well as lower wages.

Dauth, Findeisen and Suedekum (2014) have report opposite effects in Germany. Growing export opportunities in Eastern Europe increased the labor demand while the Chinese import competition had only modest negative labor market effects. Their empirical findings suggest that the rise of Eastern Europe affected local labor markets in Germany more strongly than the rise of China, thus leading in increase in manufacturing employment demand. These opposite labor demand effects in Germany seem to be mainly driven by the structure of imports from Eastern Europe and from China.

Balsvik, Jensen and Savanes (2015) found negative impact of exposure to competition from China on the manufacturing employment share in Norwegian local labor markets. Increasing Chinese import competition can explain 10.5 percent of the decrease in manufacturing employment share, which is substantially smaller effect than for the United States. They also found that that the unskilled workers bear the brunt of the reduction in manufacturing employment caused by the Chinese import shock. According to Balsvik et al. (2015) there was a negative wage effect, which is quite expected in Nordic welfare state with central wage bargaining and flexible rules for employment adjustment. Malgouyres (2017) has found a strong effect of increased Chinese imports on local manufacturing employment in France. His study also shows that wages are rather uniformly negatively affected in the manufacturing sector. On the contrary, increased Chinese imports enlarges the wage polarization within the nontraded sector, which can be explained by the strongly binding minimum wage legislation.

The total effect of Chinese import competition in Finland is smaller than for the United States but the structure of the effect is similar. Compared to Norwegian results the effect in Finland has been larger. Chinese import competition can explain 44 percent of the decrease in manufacturing employment share in the United States during 1990–2007 and only 10.5 percent in Norway during 1995–2007. The 30 percent effect in Finland during 1995–2007 settles between the results of these two countries.

The literature of Chinese import competition is associated to literature of technological change and offshoring. Practically, these three phenomena are to some extent intertwined and it may be difficult to separate the effects and mechanisms of these three. Acemoglu (2003) has shown that international trade has strengthened the skill biased technological change and has therefore affected the relative demand of skilled labor. Autor et al. (2013b) have shown that regional exposure to technological change is largely uncorrelated with regional exposure to trade competition from China. While the impacts of technology are present throughout the United States, the impacts of trade tend to be more geographically concentrated, owing in part to the spatial agglomeration of labor-intensive manufacturing.

In recent years globalization and Chinese import competition and its labor market consequences have also a topic of political debate. For example, Autor, Dorn, Hanson and Majlesi (2020) have found that increased Chinese imports have sifted votes to nativist and extreme politicians. Colantone and Stanig (2018) have also shown similar impact of globalization on electoral outcomes in 15 Western European countries. These kinds of extreme opinions have increased in Finland too during latest decades. This research does not include Finnish voting habits though.

The rest of this paper is organized as follows. Section 2 describes the empirical approach and the data. Section 3 provides estimation results of the impact of Chinese import competition on regional employment in manufacturing. Section 4 goes through the results of other outcome variables such as wages and local population and employment counts and net exports. Section 5 concludes.

2 Empirical Approach

2.1 Import Exposure Across Local Labor Markets

Autor et al. (2013a) have created theoretical model for international trade effects on local labor markets. This approach is based on monopolistic competition model of international trade with cross-country productivity differences. The model explains how growth in US imports from China affects the demand for goods produced by US regional economies. These product demand shocks motivate their empirical measure of exposure to import competition. In this study the effects of Chinese import competition on Finnish local labor markets are modelled with same approach.

The measure for local labor market exposure to import competition is the change in Chinese import exposure per worker in a sub-region. Imports are apportioned to a sub-region according to its share of national industry employment:

$$(1) \qquad \Delta IPW_{fit} = \sum_j \frac{L_{ijt}}{L_{fjt}} \frac{\Delta M_{fcjt}}{L_{it}}.$$

In this equation (1) ΔM_{fcjt} is the observed change in Finnish imports from China in industry *j* between the start and end of the period. L_{it} is the start of period total employment (year *t*) in sub-region i, L_{ijt} is employment in sector *j* in sub-region *i* and L_{fjt} is overall employment in sector *j* in Finland. The subscript *f* refers to Finland and *c* refers to China. The equation (1) shows that the increase in Finnish imports from China in industry *j* affects labor demand only in those sub-regions where industry *j* is located. The increase in imports of industry *j* over a period *t* is allocated to sub-region *i* according to the region's share of total national employment in industry *j* at the beginning of the period. This measure is then scaled by the total employment in sub-region *i* at the beginning of the period. Lastly, I take the sum of import changes over all industries and get the measure of import exposure per worker ΔIPW_{fit} for all sub-regions. Thus, this measure in equation (1) captures the potential increase in import exposure of a Finnish sub-region *i* given its initial sectoral employment structure.

Consequently, differences in regional import exposure may be due to two reasons: firstly, different distribution of labor between manufacturing and non-manufacturing employment, and secondly, different specialization in import-intensive industries within local manufacturing. If the relative amount of manufacturing employment is low in a sub-region, the Chinese import exposure is small because there is no direct channel for import competition. Also, if the share of import-intensive manufacturing employment is low the Chinese import exposure is small. Although, there is plenty of manufacturing employment in a sub-region, but the production is centralized on industries whose products are not imported from China, the import competition per worker is small.

The aim of the empirical analysis is to identify the extent to which the change in exposure to competition from China affected manufacturing employment in Finnish local labor markets. The model regresses the change of a regional overall manufacturing employment share between *t* and *t+1* on the change of regional import exposure over the same time period, while controlling for start of period regional characteristics:

(2) $$\Delta L_{it}^{m} = \beta_0 + \beta_1 \Delta IPW_{fit} + X_{it}' \beta_2 + \varepsilon_{it}.$$

Manufacturing employment share in a sub-region, denoted as ΔL_{it}^{m}, is calculated as a share of total employment and measured as the percentage point change from the start to the end of period. The change of import penetration per worker ΔIPW_{fit} is constructed as shown in equation (1).

The data covers the period 1995–2007, which is split into two sub periods: 1995–2000 and 2000–2007. Thus, the vector X_{it}' in equation (2) includes a period dummy and it is estimated in first differences. This period dummy controls for general trend in manufacturing labor demand changes in all sub-regions over these two periods. The vector also includes three dummies for different Finnish grand areas (NUTS 2 regions). These dummies correspond to controlling for region-specific trends in the development of manufacturing employment. Also, other controls were added that may reflect other changes at the regional level that may be correlated with both changes in imports and manufacturing employment share. First of these control variables is the start-of-period share of the population employed in manufacturing, which reflects the role of manufacturing in the region. It controls that the coefficient of the variable for import exposure to China does not include the general trend of a decline in the manufacturing share. The included variable for the start-of-period share of routine occupations separates the effect of general technological change from the effect of Chinese import competition. Rest of the control variables, employment share of high skilled workers, share of foreigners and share of working women, control for the start-of-period demographic structure of sub-regions.

Unobserved demand and supply shocks at the regional level both affect the amount of goods imported to Finland from abroad. If these shocks affect simultaneously both the sectoral imports from China and regional economic performance, the variable for Chinese import competition in equation (2) is endogenous. In this case OLS estimates will be biased.

2.2 Identification Strategy

To identify the causal effect of rising Chinese import exposure on Finnish manufacturing employment, I use an instrumental variables strategy that accounts for the potential endogeneity of Finnish trade exposure. The instrument variable strategy has been previously used by Autor et al. (2013a). The strategy is based on idea that during the sample period much of the growth in Chinese imports stems from the rising competitiveness of Chinese manufacturers and lower trade barriers. The Chinese supply shock has also increased Chinese exports to other developed countries but the increase in imports from China in these countries is uncorrelated with unobserved demand and supply shocks in Finnish regional economies and labor markets. Therefore, the measured import exposure variable ΔIPW_{fit} will be instrumented with Bartik-style[2] non-Finnish exposure variable ΔIPW_{oit} that is constructed using data on contemporaneous industry-level growth of Chinese exports to eight other high-income countries. It is important to pay attention to instrument country selection. I have focused on other developed countries, but I have excluded all direct neighbors as well as all members of the European Monetary Union. Taking these restrictions into account the instrument group is Australia, Canada, Chile, Denmark, Japan, New Zealand, Singapore, and Switzerland.

$$\Delta IPW_{oit} = \sum_j \frac{L_{ijt-1}}{L_{fjt-1}} \frac{\Delta M_{ocjt}}{L_{it-1}} \tag{3}$$

In equation (3) ΔM_{ocjt} is realized imports from China to other high-income markets. The subscript *o* refers to others. Using the import flows of other countries as an instrument for the local import exposure in Finland identifies the exogenous component of rising competitiveness in Chinese trade and takes away

[2] The typical use of a Bartik instrument assumes a pooled exposure research design, where the shares measure differential exposure to common shocks, and identification is based on exogeneity of the shares. (Goldsmith, Sorkin and Swift, 2019.)

the effect of possible shocks that simultaneously affect Finnish imports and regional employment.

If regional employment reacts to expected future increases in Chinese imports, there is a problem with simultaneity bias. To address this concern, the instrumental variables use employment levels by industry and region from a prior year instead of start-of-period employment levels. Because of data availability and Finnish economic situation this instrumental variable uses four years lagged levels of employment variables, for the first period year 1991 and for the second period year 1996.

2.3 Data

This study combines commodity-specific foreign trade data with national employment and employer data. The research period is from 1995 to 2007 divided into two subperiods 1995–2000 and 2000–2007. The Finnish labor market data at the regional and local industry level is based on the Finnish Longitudinal Employer-Employee Data (FLEED) provided by Statistics Finland. These data contain large number of variables about the employment status, occupation, and employer information for all the 15 to 70 years old people living in Finland. Regressions are calculated for the working aged population aged 15–64 years. The information of wages is from structure of earnings data from Statistics Finland.

Data on international trade by commodities is taken from the United Nations Commodity Trade Statistics Database (Comtrade). This data contains annual international trade statistics of over 170 reporter countries detailed by commodities and partner countries. I use data on Finnish imports at the six-digit Harmonised System (HS) level. Trade flows are converted into euros of 2016 using the currency conversion factor from Comtrade and a deflator from Statistics Finland. Data on regional employment and international trade are merged by harmonizing industry and product classifications. First the HS classified trade data is converted into CPA2008 classification. Then this classification is converted into NACE rev. 2 four-digit industry codes. Four-digit NACE classification corresponds to Finnish national industry classification TOL2008[3].

Chinese imports have been divided to regions in the same proportion as the regions share of industrial labor force. First import changes are calculated at the four-digit industry level for each 67 sub-regions (LAU 1 areas). Then these changes are weighted by using the regional employment shares in each four-digit industry. For each four-digit industry, I calculate the total national employment as the number of people employed by firms in this industry. The industry employment share of each region is calculated according to employee's residence. FLEED is also used to calculate the dependent variable, change in manufacturing employment share, and the start-of-period control variables.

The regional economies are defined as sub-regions. There are 70 sub-regions in Finland but due to small size I exclude three sub-regions situated in Åland, thus my research data consists of 67 sub-regions. Sub-regions are a set of territories formed by a few municipalities. The basis of establishment of sub-regions is cooperation between municipalities and commuting. Each municipality in Finland belongs to one of the sub-regions and the member municipalities of the same region must be from the same province. The sub-regions constitute the statistical territory of the European Union LAU 1 (formerly NUTS 4).

2.4 Descriptive overview

In Finland, the changes in manufacturing employment share have been comparatively small. Finland was still recovering from the early 1990's severe recession during the start of research period. Manufacturing sector was leading the recovery so in the first sub-period manufacturing employment share increased in many sub-regions, but the trend reversed in early 21st century. During 1995–2000 the manufacturing employment share decreased 0.07 percentage points a year and during 2000–2007 the decrease was more than three-

[3] I have dropped *Manufacture of office machinery and* equipment *(except computers and peripheral equipment)* (TOL 2008, industry 2823) out of the data because it has strongly positively deviant values. Although the changes in imported values are large, this industry is relatively small employing only few people in few sub-regions. Thus, the outlier values have strong effect on some sub-regions' import penetration per worker.

fold being 0.25 a year. During the second period the largest manufacturing employment share decreases were in sub-regions of Eastern-Lapland, Salo and Oulu.

During the research period Chinese import structure differs in Finland somewhat from the import structures of the other developed countries. Increases in machinery and electronics imports were much more pronounced in Finland than in many other countries. For Finland the three biggest Chinese import product categories are electronics, machinery, and textiles. Imports in all these categories increased between 1995 and 2007, but the speed of growth varied greatly, changing the structure of Chinese imports significantly. In 1995 textiles were the biggest product category Finland imported from China, approximately 35 percent of total Chinese imports. Machines and electronics were second largest categories with approximately 18 percent share each. In year 2000 the import shares had changed drastically. The share of textile and machinery imports were only slightly over 13 percent each. The electronics import share had increased to staggering 60 percent. In year 2007 the share of textile imports had decreased to less than 10 percent. Machinery import share had increased to 27 percent and electronics decreased to 49 percent. This large share of machinery and electronics imports may make Finnish regional manufacturing employment vulnerable to increased Chinese imports.

The regional changes in Chinese import exposure stems from two different sources as equation (1) shows. First the industry structures in sub-region are different so that there are regional differences in the shares of employment in manufacturing. Secondly the specialization of manufacturing employment in import-intensive industries varies in sub-regions. Figure 2 indeed shows that there has been large variation in import penetration in sub-regions in Finland. Panel (a) of Figure 2 shows the regional division of growth in import penetration per worker per year and panel (b) shows the change in manufacturing employment share per year during the period from 2000 to 2007. Panel (a) shows that the most of Chinese import growth is accumulated to southern and southwestern Finland. Another Chinese import growth accumulation is in sub-region of Oulu and its surrounding sub-regions. Many of these sub-regions that have experienced the largest increases in Chinese import growth per work have also experienced the largest decreases of the change in manufacturing employment share, as panel (b) in figure 2 shows. Colors in panel (b) are reversed, the darker the area the more manufacturing employment share has decreased from 2000 to 2007.

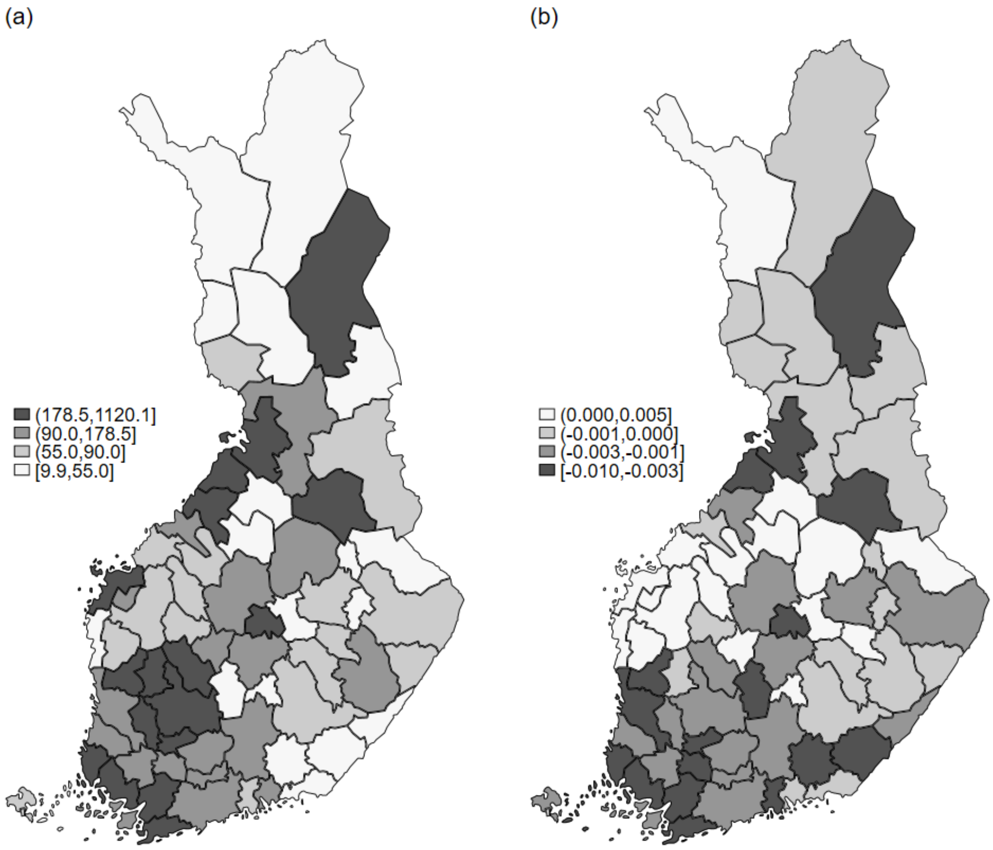

Figure 2. Exposure to Chinese Import Competition and Manufacturing Employment Growth during 2000–2007. (Colors for panel (b) are reversed.)

Appendix Table 1 lists more specifically the changes in import penetration per worker in Finnish sub-regions. Panel A shows that on average the import penetration more than doubled from period to period. Between 1995–2000 the average import penetration per worker was 98 euros per year and between 2000–2007 it was 211 euros per year. In the first period the sub-regions at the 75th percentile of import exposure experienced an increase in import exposure per worker that was almost three times as large as that faced by sub-regions at the 25th percentile. In the second period the difference between these two percentiles was only twofold.

Import penetration grew in all the sub-regions during the two periods but there are sizeable differences between the amount of growth in import penetration in sub-regions as the panel B shows. During the second period sub-regions that experienced the sharpest increases in import penetration were Raahe, Salo and Oulu. The rankings show that there has been changes in the top 10 sub-regions. Only four of the sub-regions that were in the top 10 of import exposure growth rank in the first period were there in the second period. Eight of the sub-regions in the bottom 10 in the first period where there also in the second period, only the order had changed a little.

3 Import Exposure and Manufacturing Employment

The aim of this study is to analyze if the change in the Chinese import exposure has had an effect on the Finnish regional manufacturing employment growth. To answer the question, I estimate the equation (2) and use the variable (3) to instrument the main import exposure variable (1). The benchmark dependent variable is the annual change in manufacturing employment as a share of total employment in region *i*, denoted as ΔL_{it}^{m}. Models are weighted by start of period sub-region share of national population. To account for spatial and serial correlation, the robust standard errors are clustered at the level of 18 Finnish provinces. Models are also estimated using time dummy for the two periods: 1995–2000 and 2000–2007. The latter getting the value 1.

The instrumental variable strategy identifies the component of Finnish import growth that is due to increases in Chinese productivity and trade opening. The identifying assumption in this strategy is that the common within-industry component of rising Chinese imports to Finland and other high-income countries is due to China's rising comparative advantage and falling trade costs. The results of first-stage regressions are in panel (b) of Table 1. For the simplest specification in column (1) the Kleibergen-Paap F-statistics is 28.90. This and all the other F-statistics are well above the critical value of 16 suggested by Stock and Yogo (2015) for 2SLS estimates. Instrumental variable as an explanatory variable stays highly significant although other exogenous variables are added to the model. These results show that the chosen instrument is a strong predictor of the endogenous variable.

3.1 Manufacturing Employment Growth

Results from the instrumental variables regressions are listed in Table 1 panel (a). The coefficient for import exposure shows the effect of a one euro change in import penetration per worker per year. The first column shows the simplest model, where there are no control variables. Five other specifications add different sets of control variables. In all of these six models change in import exposure has a negative and statistically significant impact on manufacturing employment growth. The coefficient in column (1) suggests that one additional euro in import penetration per worker decreases manufacturing employment by 0.001 percentage points a year. A one thousand euros increase in import penetration would decrease manufacturing employment by one percentage point. This effect may not seem large, but it has also an economic significance as I show later.

Table 1. Imports from China and Change of Manufacturing Employment in sub-regions, 1995–2007: 2SLS Estimates.

a: Dependent variable: annual change in manufacturing employment/employed people (in % pts)						
	(1)	(2)	(3)	(4)	(5)	(6)
Δ import exposure	-0.00096***	-0.00071***	-0.00039**	-0.00042**	-0.00061***	-0.00052***
	(0.00017)	(0.00022)	(0.00020)	(0.00020)	(0.00019)	(0.00020)
% employment in manu-facturing		-1.47265*	-1.91015***	-3.17034**	0.33712	-1.43886
		(0.75567)	(0.69967)	(1.28538)	(1.42337)	(1.53724)
% high skilled				-0.04960***		-0.04779***
				(0.00726)		(0.00759)
% foreign born				-0.01621		-0.00807
				(0.03558)		(0.03934)
% employment among women				0.04964***		0.04031***
				(0.00943)		(0.00875)
% employment in rou-tine occupations					-0.02399**	-0.02168**
					(0.01057)	(0.00909)
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies	No	No	Yes	Yes	Yes	Yes
b: 2SLS first stage estimates						
Δ import exposure, ot-hers	0.04876***	0.04727***	0.04744***	0.04229***	0.04306***	0.04159***
	(0.00907)	(0.00972)	(0.00902)	(0.00687)	(0.00776)	(0.00669)
R-squared	0.60	0.60	0.63	0.69	0.65	0.69
F-test of excluded inst.	28.90	23.66	27.66	37.87	30.83	38.70

Note: N=134 (67 subregions and two time periods). All regressions include a constant and a dummy for the 2000-2007 period. First stage estimates in panel (b) also include the control variables that are indicated in the corresponding columns of panel (a). Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In the second column I add a control for start-of-period manufacturing share of working age population. This control sets the focus on variation in import exposure stemming from differences in industry mix within local manufacturing sectors. The result implies that a sub-region with a one percentage point higher initial manufacturing share experiences a differential manufacturing employment share decrease of 1.5 percentage points in a year. The more there is manufacturing employment at the start-of-period in a sub-region the more the manufacturing employment share decreases. In this specification the coefficient for import penetration per worker is smaller than in column 1 so this specification indicates that the coefficient in column (1) is catching some of the variation caused by other reasons than increased Chinese trade. Column (3) augments the regression model with geographic dummies for the three grand areas[4] that absorb region-specific trends in the manufacturing employment share. Although the start-of-period manufacturing share of working-age population is controlled, these regions may have different trends in changes of manufacturing employment shares due to different composition of manufacturing industries in the areas. These regional dummies decrease the estimated effect of import exposure on manufacturing employment and the significance also decreases a little yet staying significant at the five-percentage level.

In column (4) I add controls for other start-of-period local labor market structures. Including these controls allows each sub-region to have a specific trend proportional to each of these initial shares. A higher initial share of high-skilled[5] labor force is negatively related to change in manufacturing employment. The share of high skilled labor force takes into account the possibility that high skilled and low skilled workers have different employment and unemployment trends. Also, the share of foreign-born population in sub-region decreases with the change in manufacturing employment. Instead, the share of female workers is positively correlated with manufacturing employment changes. The smaller the share of employed working-age women is at the start-of-period the smaller the manufacturing employment growth is. These controls decrease the main result only a little and the coefficient for import penetration per worker remains significant.

Column (5) introduces a variable that captures the routine intensiveness of sub-region's occupation structure. Routine intensiveness reveals the potential of technological substitution. Routine occupations are defined by using the method of Acemoglu and Autor (2010) which is converted into Finnish occupation titles by Böckerman, Laaksonen and Vainiomäki (2013). Routine intensive occupations are a set of jobs whose primary activities follow a set of precisely prescribed rules and procedures that make them readily subject to computerization. This category includes white collar positions whose primary job tasks involve routine information processing (e.g., accountants and secretaries) and blue-collar production occupations that primarily involve repetitive motion and monitoring tasks. This variable of routine intensiveness takes into account the potential exposure of sub-regions to technological change and automatization that could possibly lead to a decline in labor demand by the manufacturing

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[4] The division is based on NUTS 2 (2012). The areas are Helsinki-Uusimaa and Southern Finland, Western Finland, and Northern and Eastern Finland.
[5] High-skilled labor force is defined as the people with short-cycle tertiary education or more.

sector independently from globalization. If a sub-region that has a large start-of-period employment share in routine occupations experiences strong displacement of manufacturing jobs due to automation, one would expect a negative relationship between the routine share variable and the change in manufacturing share. The estimates in column (5) suggest that the employment share in manufacturing falls by about 0.02 percentage points a year for each additional percentage point of initial employment in routine occupations. This coefficient for routine intensiveness is significant and adding it into the model increases the coefficient for import penetration per worker but the coefficient for start-of-period manufacturing share loses its significance.

The fully augmented model in column 6 indicates sizeable negative impact of increasing import exposure on changes in manufacturing employment. The decline in manufacturing employment share is larger in sub-regions with larger initial share of high skilled employment, and employment in routine occupations. Instead, higher initial share of working women makes the decline smaller.

3.2 Economic significance and the results compared

To assess the economic significance of the results I explore the effect of increase in import penetration per worker in different regions. The point estimate for import exposure in column (6) implies that the manufacturing employment share in a sub-region at the 75th percentile of import exposure declined by 0.3 percentage points more than in a subregion at the 25th percentile during the whole second period from 2000 to 2007.

Another way to interpret the magnitude of the results is to compare the estimated trade-induced reduction in manufacturing employment shares with the actual decrease over the period 1995–2007. The preferred specification in column (6) of Table 1 implies that a 1,000 euro increase in Chinese import penetration per worker reduces the manufacturing employment share by 0.52 percentage points a year. As the Appendix Table 1 shows during the first period from 1995 to 2000 Chinese import exposure rose by 480 euros per worker and during the second period from 2000 to 2007 additional 1085 euros per worker. Thus, using this estimated coefficient, the increased exposure to Chinese imports reduced manufacturing employment as a portion of employed people by

0.22 percentage points in the first five-year period and by additional 0.49 percentage points during the following seven-year period.

At the same time, the Finnish manufacturing employment share fell by 0.57 percentage points between 1995 and 2000 and by 2.03 percentage points between 2000 and 2007. Hence, according to these calculations, the increased exposure to Chinese import competition explains 44 percent of the manufacturing employment decline in the first period and 28 percent in the second period and 30 percent of the decline for the full period from 1995 to 2007.

In Finland the effects of Chinese import competition have been smaller than in the United States (Autor et al., 2013a) but larger than in Norway (Balsvik et al., 2015). Changes in import penetration per worker per year have varied a little between these three countries. In Finland import penetration per worker per year increased 97 euros during the first period and 155 euros during the second period. Corresponding values are 95 and 220 euros for the United States and 44 and 166 euros for Norway. In Finland and in the United States the magnitude of the coefficient is quite close to each other. In Finland 1000 euros increase in import penetration decreases manufacturing employment share by 0.52 percentage points. In the United States 1000 dollars (approximately 830 euros) increase in import penetration per worker decreases manufacturing employment by 0.60 percentage points. In Norway the effect is smaller, and 10 000 NOK (approximately 980 euros) increase in import penetration per worker decreases manufacturing employment by 0.13 percentage points. Chinese import competition can explain 44 percent of the decrease in manufacturing employment share in the United States during 1990–2007 and only 10.5 percent in Norway during 1995–2007. The 30 percent effect in Finland settles between these two results.

4 Other outcome variables

4.1 Wage Effects

In Table 2 I analyze effects of import exposure shocks on sub-region's wage levels. The estimation approach follows the model previously presented except that now the dependent variable is the change in log monthly earnings. The results show that Chinese import competition has increased monthly earnings of high skilled workers. One euro increase in import penetration increases monthly earning of high skilled workers by 0.0017 log points. For example, during the second period Chinese import competition has increased wages of high skilled workers by 0.26 log points. However, the effect on incomes of low educated workers is negative and unsignificant. In column (4) the dependent variable is change in high skilled relative wage and it shows that the wages of low-skilled workers have lagged high-skilled wages during the research period. This suggest that the production surviving the Chinese competition uses relatively more high-skilled workers in Finland. Column (5) Chinese import competition has not affected total private sector wages.

Table 2. Wage response: change in log earnings and imports from China, 2SLS estimates.

	Manufacturing				Private Sector
	All	Low skilled	High skilled	High skilled/Low skilled	All
	(1)	(2)	(3)	(4)	(5)
Δ import exposure	0.00124*	-0.00002	0.00167**	0.00021*	-0.00046
	(0.00064)	(0.00079)	(0.00073)	(0.00012)	(0.00100)
Controls	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
Period dummy	Yes	Yes	Yes	Yes	Yes
Observations	134	134	134	134	134
R^2	0.40539	0.09517	0.45083	0.20496	0.27346

In columns (1)-(3) and (5) dependent variable is change in log monthly earnings of group indicated in column heading. In column (4) dependent variable is change in high skilled relative wage. Each regression contains the same control variables as column (6) of table 1. Robust standard errors in parenthesis are clustered at the level of 18 Finnish provinces. *** p<0.01, ** p<0.05, * p<0.1

These wage estimates should be interpreted with caution because monthly earnings are only available for the employed. As the earlier result show Chinese import competition reduces manufacturing employment. This reduction concerns with high probability the workers with lower ability and earnings. Thus, the observed changes in earnings may understate the composition-constant changes in wages.

Labor market unions may have substantial impact on the wage effects. For the US where the unionization is low, Autor et al. (2013a) got rather high negative wage effects. In turn for Norway which is similar kind of Nordic welfare state to Finland, Balsvik et. (2015) did not get any wage effects. Finnish wage effects are quite close to those of Norway. Nordic welfare states with high unionization tend to flatten wage changes and especially prevent decreases of wages. In Finland wages are particularly downward rigid due to union power and centralized wage bargaining. In contrast, employment termination clauses are relatively loose.

4.2 Population and Employment Effects in Sub-Regions

This section studies the degree to which import shocks to local manufacturing industries cause reallocation of workers across sub-regions. If mobility responses are large, indirect effects of trade on local labor markets will be small, because initial local impacts will rapidly diffuse across regions. Table 4 shows the results for changes in the structure of working age population in sub-regions. The only significant effect has been that increased Chinese import has increased the number of older working-age people. Import competition has not changes the educational structure of working-age population in sub-regions as columns (4) and (5) in Table 4 shows.

Table 4. Imports from China and Change of Working-Age Population within Sub-Regions, 1995–2007: 2sls Estimates.

	Working-age population (1)	Age 15–40 (2)	Age 41–64 (3)	High educa-ted (4)	Low educa-ted (5)
Δ import exposure	0.00052	0.00036	0.00072**	0.00039	0.00067
	(0.00048)	(0.00080)	(0.00034)	(0.00057)	(0.00060)
Controls	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes
Period dummy	Yes	Yes	Yes	Yes	Yes
Observations	134	134	134	134	134
R-squared	0.83182	0.81038	0.81979	0.69002	0.68167

Dependent variable is change in log population counts. Each regression contains the same control variables as column (6) of table 1. Robust standard errors in parenthesis are clustered at the level of 18 Finnish provinces. *** p<0.01, ** p<0.05, * p<0.1

As the earlier results show, population in sub-regions react sluggishly to this kind of negative trade shocks. Most likely the biggest reason for sluggish migration between sub-regions is mobility costs and housing prices tend to make up the majority of mobility costs. In Finland labor mobility is relatively limited compared to US and to other European countries (IMF, 2018). Finland experiences also a grate share of owner-occupied housing. For example, Wolf and Caruana-Galizia (2015) have shown with German data that homeownership reduces labor mobility and increases unemployment in Germany. Laamanen (2017) has shown similar results for Finland. Because of this sluggish migration, the trade-induced decline in manufacturing employment should yield a corresponding rise in non-manufacturing employment, unemployment, labor force exit, or some combination of these three. Table 3 shows the results for employment structure in sub-regions. The regression in Table 3 is analogous to the earlier models for the manufacturing employment share except now the dependent variable is the change in log population counts in sub-regions.

Table 3. Imports from China and Employment Status of Working-Age Population within Sub-Regions, 1995–2007: 2sls Estimates.

	Employment others	Employment Manufacturing	Unemployed	Outside labor force
	(1)	(2)	(3)	(4)
Δ import exposure	0.00066	-0.00103	0.00123	0.00081
	(0.00120)	(0.00176)	(0.00336)	(0.00075)
Controls	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes
Period dummy	Yes	Yes	Yes	Yes
Observations	134	134	134	134
R-squared	0.73481	0.57579	0.36726	0.83447

Dependent variable is change in log population counts. Each regression contains the same control variables as column (6) of table 1. Robust standard errors in parenthesis are clustered at the level of 18 Finnish provinces. *** p<0.01, ** p<0.05, * p<0.1

In this case Table 3 shows the shocks to local manufacturing has not led to significant changes in employment status of working-age people in sub-regions. Although, the signs of the coefficient are as expected. Chinese import competition decreases employment count in manufacturing and increases employment in other industries, unemployment, and labor force exit. The reason for insignificance of the coefficients may be that the effects of decrease in manufacturing employment has divided between all these three categories.

4.3 Net export

The main result in Table 1 consists only of Chinese import shock. At the same time also Finnish exports to China increased a lot, though less than imports. Biggest export product categories have been electrical and industrial machinery, especially exports of machinery for making paper increased substantially between 1995 and 2007. Also exports of metals started to increase in the second period. It seems that at least a part of the increased exports is from different manufacturing sector than the increases in Chinese imports. This may allocate the effects of total Chinese trade differently across sub-regions.

Following the example of Autor et al. (2013a), I construct a measure for net imports from China by subtracting Finnish exports from Finnish imports by industry:

$$(4) \qquad \Delta NPW_{fit} = \sum_j \frac{L_{ijt}}{L_{fjt}} \frac{\Delta M_{fcjt}}{L_{it}} - \sum_j \frac{L_{ijt}}{L_{fjt}} \frac{\Delta X_{cfjt}}{L_{it}}.$$

This measure for net import penetration per worker is instrumented with two variables: first one is the earlier used instrument for import penetration per worker (equation 3) and the second is analogously constructed potential export exposure measure, built using observed exports to China by industry from eight comparison countries previously used for the potential import exposure measure.

Table 5 presents the estimates for the effect of net import exposure on local manufacturing employment share. The results show that increases in Chinese net imports have negative effects on manufacturing employment share in Finnish sub-regions. Though, the main explanatory variable is not significant, or the significance is weak in columns (3)-(6).

Table 5. Net Imports from China and Change in Manufacturing employment in Sub-Regions, 1995–2007: 2SLS Estimates.

Dependent variable: annual change in manufacturing employment/employed people (in % pts)

	(1)	(2)	(3)	(4)	(5)	(6)
Δ net exposure	-0.01183***	-0.00609**	-0.00333	-0.00565	-0.00669*	-0.00747*
	(0.00427)	(0.00268)	(0.00221)	(0.00368)	(0.00381)	(0.00402)
% employment in manufacturing		-2.32989***	-2.39055***	-3.91475***	0.32591	-2.34862
		(0.69245)	(0.74252)	(0.88585)	(1.98586)	(1.43539)
% high skilled				-0.05442***		-0.05395***
				(0.00884)		(0.01026)
% foreign born				-0.07810		-0.09003
				(0.05834)		(0.06826)
% employment among women				0.07010***		0.06766***
				(0.02227)		(0.02324)
% employment in routine occupations					-0.03283	-0.02172
					(0.02019)	(0.01333)
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies	No	No	Yes	Yes	Yes	Yes

Note: N=134 (67 subregions and two time periods). All regressions include a constant and a dummy for the 2000-2007 period. First stage estimates in panel II also include the control variables that are indicated in the corresponding columns of panel I. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Column (6) shows that a 1 euro increase in Chinese net import exposure per worker reduces the manufacturing employment share by 0.0075 percentage points. Average net imports increased 40.8 euros during 1995–2007, so this estimate gives 0.3 percentage point decrease for local manufacturing employment share. Thus, the increases in Chinese net import explain about 12 percent of the total decrease of manufacturing employment share in Finnish subregions.

5 Conclusions

Chinese imports to Finland started to increase rapidly in the mid 1990's. Finnish exports to China increased also but not as much, so the dependence on Chinese trade has increased vastly in Finland as in other developed countries. In this paper I analyze the effects of increase in Chinese imports on Finnish local labor markets during 1995 to 2007. Differences in regional effects may be due to either differences in industry structure or differences in specialization.

I analyze regional exposure to Chinese import competition and its effects on manufacturing employment. The main outcome is how much the increased exposure to import competition can explain the decrease in manufacturing employment share in Finland. I use an instrumental variable approach which was first presented by Autor et al. (2013a). This approach accounts for the possible simultaneity of import demand and labor demand shocks by instrumenting Finnish import growth from China with Chinese import growth in other developed countries. I found a negative impact of regional exposure to Chinese import competition on the manufacturing employment share in Finnish local labor markets. My estimates suggest that 30 percent of the reduction in the manufacturing employment share from 1995 to 2007 can be explained by increased import competition from China.

Chinese import competition has not had a statistically significant effect on wages of low skilled manufacturing workers, but it has had a positive statistically significant effect on relative wages of high-skilled manufacturing workers. During period 1995–2007 relative wages of high skilled manufacturing workers increased 0.32 percent. There are frictions in labor markets due for example to limited mobility of people. Because of sluggish migration, the trade-induced decline in manufacturing employment should yield a corresponding rise in non-manufacturing employment, unemployment, labor force exit, or some combination of these three. The estimates shows that the shocks to local manufacturing have not led to significant changes in employment status of working-age people in local labor markets, although the coefficients are of expected sign. The reason for insignificance of the coefficients may be that the change in Finnish manufacturing share was quite modest and the effects of decrease have divided between all these three categories.

APPENDIX

Appendix Table 1. Descriptive statistics for Growth of Imports Exposure per worker across sub-regions: one-year change in euros.

		1995–2000		2000–2007	
Panel A. Percentiles					
		90th percentile	126	90th percentile	219
		75th percentile	123	75th percentile	181
		50th percentile	75	50th percentile	129
		25th percentile	44	25th percentile	87
		10th percentile	23	10th percentile	55
		mean	97	mean	155
Panel B. Largest and smallest values among sub-regions.					
Rank	1	Salo	568	Raahe	1120
	2	Oulu	398	Salo	827
	3	Äänekoski	255	Oulu	440
	4	Haapavesi-Siikalatva	225	Äänekoski	389
	5	Lounais-Pirkanmaa	179	Ylä-Pirkanmaa	361
	6	Turku	126	Pohjois-Satakunta	267
	7	Oulunkaari	123	Raasepori	244
	8	Helsinki	123	Kajaani	232
	9	Tampere	115	Itä-Lappi	223
	10	Ylivieska	109	Tampere	220
	34	Ylä-Savo	49	Oulunkaari	95
	58	Kouvola	20	Kouvola	36
	59	Kuusiokunnat	20	Pielisen Karjala	36
	60	Kotka-Hamina	19	Kotka-Hamina	35
	61	Koillismaa	18	Koillismaa	35
	62	Imatra	15	Sisä-Savo	32
	63	Pielisen Karjala	15	Koillis-Savo	27
	64	Sisä-Savo	14	Torniolaakso	26
	65	Pohjois-Lappi	9	Pohjois-Lappi	20
	66	Tunturi-Lappi	9	Tunturi-Lappi	15
	67	Koillis-Savo	7	Haapavesi-Siikalatva	10

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