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Level, distribution and long-term development of market power in Finland

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Abstract

This study examines the level, distribution and development of market power in Finland between 1975 and 2016. The paper applies the methods proposed by Hall (2018a) and Hall (2018b). In contrast to some other international evidence, the aggregate level of market power has not risen in Finland during the last decades. The estimate of country level markup ratio in Finland is 1,25. The paper also analyses the distribution of markup ratios across industries. About 90 per cent of industry level markup ratios are between 1 and 1,5. The results suggest that markups are typically higher in exporter firms than in non-exporter firms.

JEL codes: D22, D24, D4, F14, L1

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1. Introduction

When a firm has market power it can charge a higher price for its products than its marginal costs are. The ratio by which the firm can exceed its marginal costs is called the markup ratio. In perfect competition the markup ratio would be equal to one and marginal costs would equal market price. The main goal of this paper is to apply new methods proposed by Hall (2018a) and Hall (2018b) to Finnish data and shed light on the average level of market power and its development over time in Finland.

In recent years, economists have observed that the market power of firms has increased globally. For example, De Loecker and Eeckhout (2017) find that average markup ratios have risen substantially in the USA beginning from 1980s. Diez, Leigh and Tambunlertchai (2018) find that the phenomenon is global and extremely strong in advanced economies. Despite the fact that markups have been seen rising worldwide, there is very little evidence why. De Loecker and Eeckhout (2017) speculate that the reason could be, for example, the rise of merger and acquisition activity or deregulation. Autor, Dorn, Katz, Patterson, and Van Reenen (2017) and Hall (2018a and 2018b) argue that the rise of so called “superstar firms” might be part of the explanation.

Knowledge about the level of markups and their evolution is important due to the adverse effects of market power. A monopoly produces less than would be optimal and causes a deadweight loss and a decline in total utility. Recently, Baqaee and Farhi (2017) have showed that market power may have a very strong impact on total factor productivity. On the other hand, profit maximizing firms do not have incentives to invest and innovate in perfect competition as there is no economic rent to be gained. Aghion et al. (2005) find that there is an inverted U-shape relationship between innovations and market power. Kilponen and Santavirta (2007) find relatively strong evidence in favour of this theory using Finnish firm level data. Eggertsson, Robbins and Wold (2018) argue that increasing markup ratios could also increase income and wealth differences.[1]

As one can see, the causes and the effects of increasing market power are theoretically far from clear. There are also many challenges in the empirical literature. The central challenge has been measuring the level of market power. As Diez et al. (2018) note, it is not possible to measure market power by simply using sales concentration of an industry. Even if sales would be very concentrated in some industry, the firms may sell undifferentiated products which are priced globally.

The major problem of analysing markups at the aggregate level is that marginal costs and prices are hard to measure for a large number of firms. According to Hall (2018a, p. 2), there has been basically two different approaches in measuring markups. He calls the first one demand-side[2] and the second one supply-side approach. The idea of the supply-side approach is to analyse data on prices and costs from firms. In this paper, I follow the supply-side approach proposed by Hall (2018a) and Hall (2018b) that utilise industry level productivity data.

There are a few papers that investigate the level of markup ratios and their development over time at the macro level in Finland. Forsman, Saarenheimo and Terviö (1996) estimate the level of markups in manufacturing industries using several methods. According to their results, the

[1] Whether the increase in income and wealth inequality is a good or bad thing, in itself, has been debated in the economics literature – however, increasing inequality may have a negative effect on economic growth (see, for example, the literature review and the empirical results by Cingano, 2014), which, is commonly seen as negative. The fact that income inequality may also have a positive impact on economic growth, makes analysing welfare effects of increasing market power even more complicated.

[2] The idea of the demand-side approach is to examine the residual elasticity from a differentiated-products oligopoly model (Hall 2018a, p. 2).

average markup ratio in manufacturing industries in Finland was, depending on method, between 0,99 and 1,32 during the years 1980-1994. Kilponen and Santavirta (2007) also analyse market power in Finnish manufacturing. They use Finnish firm level data from 1990 to 2001. According to their estimates, the average markup ratio for manufacturing firms is only about 1,08.[3]

Some more recent research is made by Christopoulou and Vermeulen (2012). They analyse the level and the evolution of markup ratios in several developed countries[4] including Finland. They use data from 44 industries from 1981 to 2004. Their weighted average markup estimate for Finland is 1,28, which is very similar to the other country level estimates.[5] They analyse the possible time variation in markup ratios and find no evidence for increasing markups in Finland. Another country comparison is made by Oliveira Martins, Scarpetta and Pilat (1996) who analyse markups in 14 OECD countries using data from 1970 to 1992. Their estimate for Finland (1,14) is relatively close to the other Nordic countries.[6]

The structure of the paper is following. First, I introduce the theoretical framework proposed by Hall (2018a) and Hall (2018b). Second, I introduce the Finnish data. Third, I analyse the level of markups and their distribution across industries. Fourth, I examine the development of markups over time. Finally, I analyse the relationship between market power and exports.

2. Measuring market power

In the empirical analysis, I apply the model proposed by Hall (2018a) and Hall (2018b), and briefly repeat the logic of the calculus here. The cost of production is the sum of the values of inputs:

$$c = \sum_i w_i x_i, \tag{1}$$

where w is the price and x is the quantity of input i. The total differential of the cost is:

$$dc = \sum_i x_i \, dw_i + \sum_i w_i \, dx_i, \tag{2}$$

which implies that the change in cost can be divided to the change caused by changes in prices of inputs, and to the change caused by the changes in quantities of inputs. The part that is not associated with changes in factor prices is therefore:

$$\tilde{d}c = \sum_i w_i \, dx_i = dc - \sum_i x_i \, dw_i. \tag{3}$$

Output is given by:

$$y = Af(x), \tag{4}$$

where A is technology parameter and x is a vector of inputs. Output growth can be expressed as the total differential of output:

$$dy = Adf(x) + f(x)dA = Adf(x) + y\frac{dA}{A}. \tag{5}$$

The part of output growth that is not associated with productivity growth is therefore:

[3] Kilponen & Santavirta (2007, p. 19-20) estimate that the average value of Lerner index is 0,076. Thus, the average markup ratio is about 1,08 (see equation (16)).
[4] Germany, France, Italy, Spain, Netherlands, Belgium, Austria, Finland, USA
[5] Their estimates vary between 1,21 (France) and 1,66 (Italy) and the estimate for the Euro area is 1,37 (see Christopoulou and Vermeulen, 2012, Table 1).
[6] Their estimate for Finland is 1,14, for Denmark 1,14, for Norway 1,19 and for Sweden 1,19 (see Oliveira Martins et al., 1996, Table 7).

$$\tilde{d}y = Adf(x) = dy - y\frac{dA}{A}. \tag{6}$$

The markup coefficient is defined as the ratio of price to marginal costs:

$$\mu \equiv \frac{p}{\tilde{d}c/\tilde{d}y}, \tag{7}$$

where p is the price of output.

In perfect competition the marginal cost of a profit-maximizing firm is equal to the price level. That means the ratio of price to marginal cost equals one. If the firm has some market power it produces less and sets output price higher than in competitive market equilibrium. Thus, the ratio of the price to marginal cost will be greater than one. Equation (7) can be rearranged:

$$p\tilde{d}y = \mu\tilde{d}c. \tag{8}$$

Now, equation (6) can be plugged in equation (8):

$$p(dy - y\frac{dA}{A}) = \mu\tilde{d}c. \tag{9}$$

Again, this can be rearranged:

$$pdy = \mu\tilde{d}c + py\frac{dA}{A}. \tag{10}$$

The share of input i in total revenue is:

$$\alpha_i \equiv \frac{w_i x_i}{py}. \tag{11}$$

Multiplying the both sides of equation (10) by $\frac{1}{py}$ and the term $\mu \sum_i w_i \, dx_i$ by $\frac{x_i}{x_i}$ yields:

$$pdy\frac{1}{py} = \mu \sum_i w_i \, dx_i \frac{1}{py}\frac{x_i}{x_i} + py\frac{dA}{A}\frac{1}{py}, \tag{12}$$

which can be simplified as:

$$\frac{dy}{y} = \mu \sum_i \alpha_i \frac{dx_i}{x_i} + \frac{dA}{A}. \tag{13}$$

In discrete time, this equation is:

$$\Delta \ln(y) = \mu \sum_i \alpha_i \, \Delta \ln(x_i) + \Delta\ln(A). \tag{14}$$

That is, the change in output is explained by the change in total inputs and technical progress. Equation (14) also indicates that the productivity accounts based on Solow (1957), in which the change in total factor productivity equals to the change in output minus the change in total inputs, do not measure technical progress correctly if the markup ratio is greater than one (see Hall, 2018a, p. 4).

When it comes to estimation of equation (14), Hall (2018a) argues that it is more convenient to estimate the reciprocal of μ:

$$\sum_i \alpha_i \, \Delta \ln(x_i) = \frac{1}{\mu}\Delta \ln(y) + a_t. \tag{15}$$

An alternative measure of market power is the Lerner index, which is defined as:

$$L \equiv 1 - \frac{1}{\mu}. \tag{16}$$

Thus, the Lerner index is just the other side of the same coin. However, in some of the further analysis, it matters whether one uses the Lerner index or the markup ratio.

L may be solved after estimation of equation (15) or alternatively estimated directly. This equation to be estimated can be derived as follows. Equation (16) can be solved for μ and plugged in equation (15):

$$\Delta \ln(y) = \frac{1}{1-L} \sum_i \alpha_i \Delta \ln(x_i) + \Delta \ln(A). \tag{17}$$

This can be rearranged:

$$\Delta \ln(y) - L\Delta \ln(y) = \sum_i \alpha_i \Delta \ln(x_i) + (1-L)\Delta \ln(A), \tag{18}$$

and finally:

$$\Delta \ln(y) - \sum_i \alpha_i \Delta \ln(x_i) = L\Delta \ln(y) + e_t. \tag{19}$$

It does not matter whether one estimates equation (15) or (19). Instead, estimating equation (14) may yield different results if 2SLS with multiple instrumental variables is used (see Hall, 2018a, p. 8).

3. Data

The data is from Statistics Finland (Multi-factor productivity by industry 1976-2016, production).[7] The data contain contributions of capital (K), hours worked and labour composition (L), intermediate inputs (E, M, S) and multi-factor productivity to output growth. The dataset covers 63 distinct non-overlapping industries in Finland from 1976 to 2016. There are some pros and cons in Finnish data. On the one hand, the data are substantially long. This allows us to detect possible long run trends in the development of market power. On the other hand, the quality of the data from 1976 to 2000 is not as good as from 2001 to 2016.[8]

The variables used in the estimations are calculated from contributions. Input growth, $\sum_i \alpha_i \Delta \ln(x_i)$, is the part of output growth that is not explained by multi-factor productivity growth. Because growth rates of output and multi-factor productivity are known, it is straightforward to calculate the output and the input index of every industry.[9] I use the change in the natural logarithm of these indexes to estimate equation (15).

Estimating equation (15) or equation (19) using OLS would be very problematic, because the explanatory variable is very likely to be endogenous. Because output growth is correlated to productivity growth the OLS-estimate would be biased. Therefore, I use instrumental variables that are expected to be uncorrelated to productivity growth but correlated to output growth. Hall (1988, p. 932-933) proposes military spending, world oil price and the political party of the president. Those variables are unlikely to cause movements in productivity growth or to be affected by productivity growth, at least not in the short run.

As for military spending, the problem is the availability of data for the whole period of 1976-2016. When it comes to the world oil price, it appears to be a very weak instrument for most of the Finnish industries. Instead, the political party of the head of state appears to be a suitable

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[7] https://www.stat.fi/til/ttut/index_en.html

[8] In some industries, the growth rate of intermediate input usage follows the output growth rate from 1976 to 2000 (See Tuottavuustutkimukset [verkkojulkaisu]).

[9] Input index is calculated as follows: $Total\ inputs_{t+1} = Total\ inputs_t * (1 + output\ growth\ rate_{t+1} - productivity\ growth_{t+1}) = Total\ inputs_t * (1 + contribution\ of\ capital_{t+1} + contribution\ of\ hours\ worked_{t+1} + contribution\ of\ change\ in\ labour\ composition_{t+1} + contribution\ of\ intermediate\ inputs_{t+1})$.
Output index is calculated as follows: $Output_{t+1} = Output_t * (1 + output\ growth\ rate_{t+1})$.

instrument for output growth in Finland. In Finland, the political party of the prime minister seems to be a better instrument than the political party of the president.

Because Finland is a small open economy, foreign variables could be potential instruments. It is not very likely that the productivity growth of Finland would affect, or would be affected by, for example, a German interest rate significantly. On the other hand, the German interest rate affects German investments and consumption, which in turn affect Finnish exports, and hence, output. In addition to foreign interest rates, output growth of important export destination countries of Finland could be good and powerful instruments for Finnish output.

I decided to try the following set of instruments:

- SDP (A dummy variable that equals 1 when the political party of the prime minister is Social Democratic, otherwise it equals 0)
- Kokoomus (A dummy variable that equals 1 when the political party of the prime minister is National Coalition, otherwise it equals 0)
- Keskusta (A dummy variable that equals 1 when the political party of the prime minister is Centre, otherwise it equals 0)
- Germany's/FRG's 10-year real interest rate
- Change in natural logarithm of World's real GDP
- Change in natural logarithm of Germany's/FRG's real GDP
- Change in natural logarithm of Sweden's real GDP
- Change in natural logarithm of Russia's/USSR's real GDP

The real GDPs are from World Bank, except the GDP of Russia/USSR, which is from Maddison Historical Statistics. The real interest rate of Germany/FRG is from OECD. I have calculated it as a difference between the 10-year bond yield and the percentage change in the consumer price index.

4. Results

4.1 First-stage

First, I test the potential instruments that were introduced earlier. In the first-stage of the two-stage least squares (2SLS) estimation, the dependent variable is the output of an industry and the independent variables are the instrumental variables. Like Hall (2018a) and Hall (2018b), I estimate the first-stage regression for every industry, and then, examine in how many regressions each instrument was statistically significant. This reveals the power of different instruments. The percentage of the 63 t-values that exceed 2 in absolute value are given in Table 1 for every instrument. If the data were random, these numbers would be approximately 5 per cent.

When it comes to the political party of the prime minister, especially the Centre party being in power seems to be correlated to output growth in many industries. As for foreign variables, output growth of Sweden is a remarkably powerful instrument. None of the proposed instruments is totally powerless.

The results in Table 1 do not tell if there is a problem of weak instruments in some of the first-stage regressions. There might be substantial differences between industries in how powerful the chosen instruments are. For every first-stage regression, I restrict all the coefficients to be zero. Then I test these restrictions using F-test. The second row of Table 2 reports the percentage of p-values given by the F-tests that fall below 0,05. The result means that in 19 per cent of the regressions there might be a weak instruments problem. A closer look at the regression reveals that for most of the regressions, the null hypothesis could be rejected even using the risk level of 0,001. However, there are a couple of industries in which the instruments are extremely weak. The following industries have a p-value greater than 0,5: “01, crop and animal production, hunting and related service activities”, “03, fishing and aquaculture”, “30, manufacture of other transport equipment”, “65, insurance, reinsurance and pension funding, except compulsory social security”. However, weak instruments are not a central problem in this study because the most of the analyses focus on weighted averages rather than single industries and the problem occurs mainly in small industries. For example, the share of fishing and aquaculture in total value added has been on average only 0,1 percent (see Appendix A).

Instrument	**Percentage of first-stage t-values that are greater than 2**
SDP	11
Kokoomus	14
Keskusta	30
Real interest rate of Germany	19
Real GDP growth of the World	21
Real GDP growth of Germany	15
Real GDP growth of Sweden	52
Real GDP growth of Russia	13
Average	**22**

Table 1: Percentages of t-values that exceed 2 in absolute value for every instrumental variable

Instrument	**Percentage of first-stage regressions that have p-value smaller than 0,05**
Weak instruments	81
Wu-Hausman	22
Sargan	5

Table 2: Percentages of p-values of different tests that fall below 0,05.

So far, I have only analysed the power of the instruments. The second row of Table 2 reports the percentages of p-values from Wu-Hausman test that are smaller than 0,05 and the third row reports the same percentage from Sargan test. The null hypothesis of Wu-Hausman test is that the explanatory variable, output growth, is exogenous. According to the test results, the problem of endogeneity exists only in 22 per cent of the regressions. However, theoretically the endogeneity problem should exist. Additionally, about 45 per cent of the p-values fall between 0 and 0,2, thus, the usage of OLS would likely yield biased estimates. The null hypothesis of Sargan test is that the instruments – assumed to be exogenous – really are exogenous. The test results support this assumption as the null hypothesis is rejected only in 5 per cent of the regressions.

The correlation between the p-value of first-stage F-test and the p-value of Sargan test is positive and as high as 0,43. This means that the more powerful the instruments are the less likely it is that they are exogenous. This is a common problem of instrumental variables. Nevertheless, all in all the results show that the instrumental variables are at least decent.

4.2 Estimates of the ratio of price to marginal costs

I estimate equation (15) for every 63 industries using 2SLS.[10] To make the results easier to interpret, I average the results to top level industry classification weighting each industry by its average share in total value added. The results are shown in Table 3. The total weighted average

[10] See the OLS-estimates in Appendix C.

of estimated markup ratios is 1,25.[11] The estimated average markup ratio is very close to the previous estimates by Forsman et al. (1996) (between 0,99 and 1,32 in manufacturing) and by Christopoulou and Vermeulen (2012) (1,28). This is also approximately the same as the estimate by Hall (2018a).[12] The values of Lerner index are not reported, but one can calculate them using the equation (16).

Top level industry classification	**Markup ratio**	**Standard error**	**The lower bound of 95 % CI**	**The upper bound of 95 % CI**	**Per cent of value added (1975-2016 average)**	**Number of industries used to calculate the average**
Agriculture, forestry and fishing (A)	1,46	0,63	0,19	2,72	5,2 %	3
Mining and quarrying (B)	1,61	0,23	1,15	2,08	0,4 %	1
Manufacturing (C)	1,34	0,08	1,17	1,50	23,5 %	19
Electricity, gas, steam and air conditioning supply (D)	1,73	0,33	1,06	2,41	2,3 %	1
Water supply; sewerage, waste management and remediation activities (E)	2,15	0,26	1,63	2,67	0,7 %	2
Construction (F)	0,91	0,04	0,82	0,99	6,8 %	1
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	1,61	0,16	1,28	1,93	10,1 %	3
Transportation and storage (H)	1,46	0,15	1,17	1,76	6,1 %	5
Accommodation and food service activities (I)	1,14	0,14	0,86	1,41	1,5 %	1
Information and communication (J)	1,28	0,11	1,07	1,49	4,2 %	4
Financial and insurance activities (K)	2,12	0,81	0,49	3,75	3,0 %	3
Real estate activities (L)	0,90	0,06	0,78	1,01	9,0 %	1
Professional, scientific and technical activities (M)	1,04	0,08	0,88	1,19	3,3 %	5
Administrative and support service activities (N)	1,05	0,09	0,88	1,23	2,1 %	4
Public administration and defence; compulsory social security (O)	1,02	0,05	0,91	1,12	6,2 %	1
Education (P)	0,88	0,07	0,73	1,03	5,2 %	1
Human health and social work activities (Q)	1,00	0,07	0,86	1,15	7,9 %	2
Arts, entertainment and recreation (R)	1,09	0,07	0,95	1,23	1,1 %	2
Other service activities (S)	1,07	0,08	0,91	1,23	1,5 %	3
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use (T)	1,21	0,21	0,78	1,64	0,1 %	1
Average	1,25	0,15	0,96	1,55	100 %	63

Table 3: Estimates of markup ratios in different industries. The results are weighted averages.

There are some industries in which the instrumental variables are weak as was mentioned earlier.[13] This makes the results for these industries somewhat unreliable. The problem is severe in “A, agriculture, forestry and fishing”, “B, mining and quarrying” and “E, water supply; sewerage, waste management and remediation activities”. The problem might be one of the reasons why, for example, the estimate for “E, water supply; sewerage, waste management and remediation activities” is very high. Fortunately, most top level industries (51/63=81 per cent of the

[11] Statistics Finland also provides the productivity data purged from the public sector. The estimated average markup ratio for the private sector only is 1,30 (average standard error 0,10).

[12] The weighted average calculated from Hall’s (2018a) Table 2 is 1,30 and the unweighted average of markup ratio, calculated from Hall’s (2018a) Table 3, is 1,31.

[13] The following top level industries include industries with weak instruments (The share of industries with weak instruments, i.e. p-value of the F-test greater than 0,05, is in parenthesis. The share means the ratio of value added of industries with weak instrument to the value added of the top level industry.): A (51 %), B (100 %), C (8 %), E (35 %), H (11 %), J (12 %), K (27 %), S (7 %).

industries or 93 per cent of total value added) do not have problems with the power of the instruments.

The markup ratios for every 63 industries are reported in Appendix A. There are some industries which may be interesting for current policy debate. For example, many subindustries of "47, retail trade" and "49, land transport" have been subject to recent public debate. More specifically, these two industries include pharmacies, grocery stores, taxi services, railway transport and bus traffic, which are known to be highly concentrated and lack competition. The estimated markup ratio for retail trade is 1,52. The estimate for land transport is 1,38. In both industries, perfect competition is rejected at 5 per cent risk level and values are substantially higher than the estimated average mark-up ratio.

Theoretically, the markup ratio should not be lower than one. There are, however, number of industries in which the estimate of markup ratio falls below its theoretical minimum due to sampling error. To disentangle the distribution of the true values of the markup ratio across industries from the distribution of sampling error, Hall (2018a, p. 9) proposes the following statistical model:

$$\hat{\mu} = \eta + v + 1, \tag{20}$$

where $\hat{\mu}$ is the estimate of markup ratio, $\eta \sim N(0, \gamma^2)$ is the sample error and $v \sim N(\delta, \sigma^2)$ is the natural logarithm of the true markup's random component. The components η and v are independent. It is assumed that $\mu = v + 1 \geq 1$. To find the parameters, the first three moments of $\hat{\mu} - 1$ are matched (see Hall, 2018a, p. 11):

$$Mean(\hat{\mu} - 1) = e^{\delta + \frac{1}{2}\sigma^2}, \tag{21}$$

$$Mean(\hat{\mu} - 1)^2 = \gamma^2 + e^{2\delta + 2\sigma^2}, \tag{22}$$

$$Mean(\hat{\mu} - 1)^3 = e^{3\delta + \frac{9}{2}\sigma^2} + 3\gamma^2 e^{\delta + \frac{1}{2}\sigma^2}. \tag{23}$$

The system is solved using the Newton's method.

The results are summarized in Table 4. Table 4 also reports Hall's (2018a, Table 3) results for comparison. The table is organized the following way. The upper part of the table reports the first three moments (mean, variance and skewness) of the estimated markup ratios $\hat{\mu}$. The middle part shows the solved parameter values of the statistical model. The lower part shows the mean, standard deviation, skewness and kurtosis of the true markup ratio.

Because some industries have problems with the strength of the instruments, I also show the results after excluding these industries[14]. It appears that weak instruments are the major cause for unrealistic estimates as is shown in Figure 1. The results are greatly affected by excluding some of the industries. If all the industries are included, the mean becomes very high and so does the variance. This is not surprising since the markup estimates are not weighted in this analysis, and in some of the industries markup estimates are unrealistically high. For example, the industry "03, fishing and aquaculture" has a markup estimate over 7. All these obvious outliers are caused by weak instruments as is shown in Figure 1. After the exclusion of these industries, the parameter estimates become very close to the equivalent parameters in the USA. This is very interesting since the US and Finnish economies differ considerably. The inferred distributions are drawn in Figure 2. The large majority of the true markup ratios are concentrated in the range between 1 and 1,5 (the value of the cumulative distribution is about 0,9 as the markup ratio is 1,5).

[14] The industries, in which the p-value of the F-test of first stage regression is greater than 0,05, are excluded.

		All industries included	**Industries with the problem of weak instruments excluded**	**USA, 1988-2015 (Hall, 2018a)**
Moments of $\hat{\mu} - 1$	**1.**	0,46	0,27	0,31
	2.	1,12	0,15	0,27
	3.	5,06	0,10	0,23
Standard deviation of sampling error	$\boldsymbol{\gamma}$	0,60	0,21	0,34
Mean of log of (true markup -1)	$\boldsymbol{\delta}$	-1,42	-1,51	-1,43
Standard deviation of log of (true markup -1)	$\boldsymbol{\sigma}$	1,13	0,64	0,70
Mean of true markup ratio		1,46	1,27	1,31
Standard deviation of true markup ratio		0,74	0,19	0,24
Skewness of true markup ratio		9,05	2,50	2,89
Kurtosis of true markup ratio		296,21	12,84	17,79

Table 4: Moments of the distribution of $\hat{\mu} - 1$, solved parameters of the assumed model and inferred properties of the distribution of true markup ratio, μ.

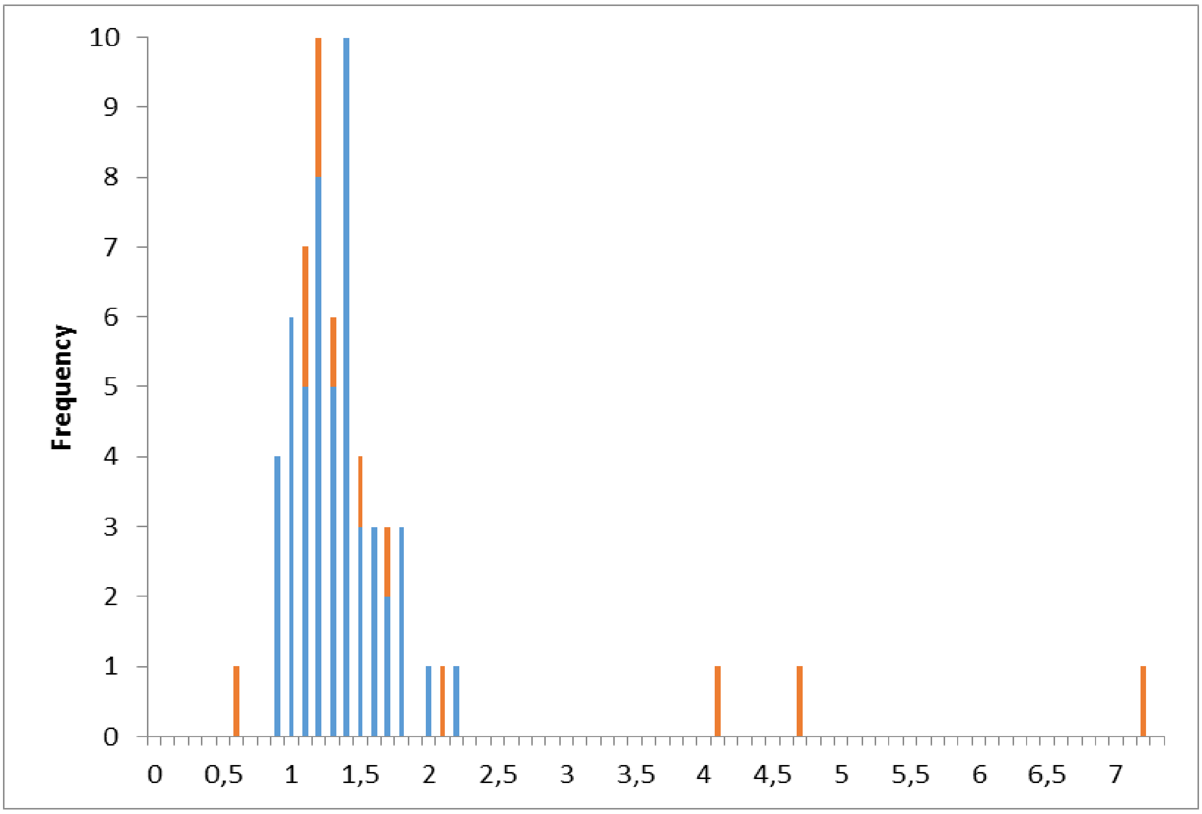

Figure 1: The histogram of markup estimates. Orange colour describes the markup estimates in industries that have the problem of weak instruments.

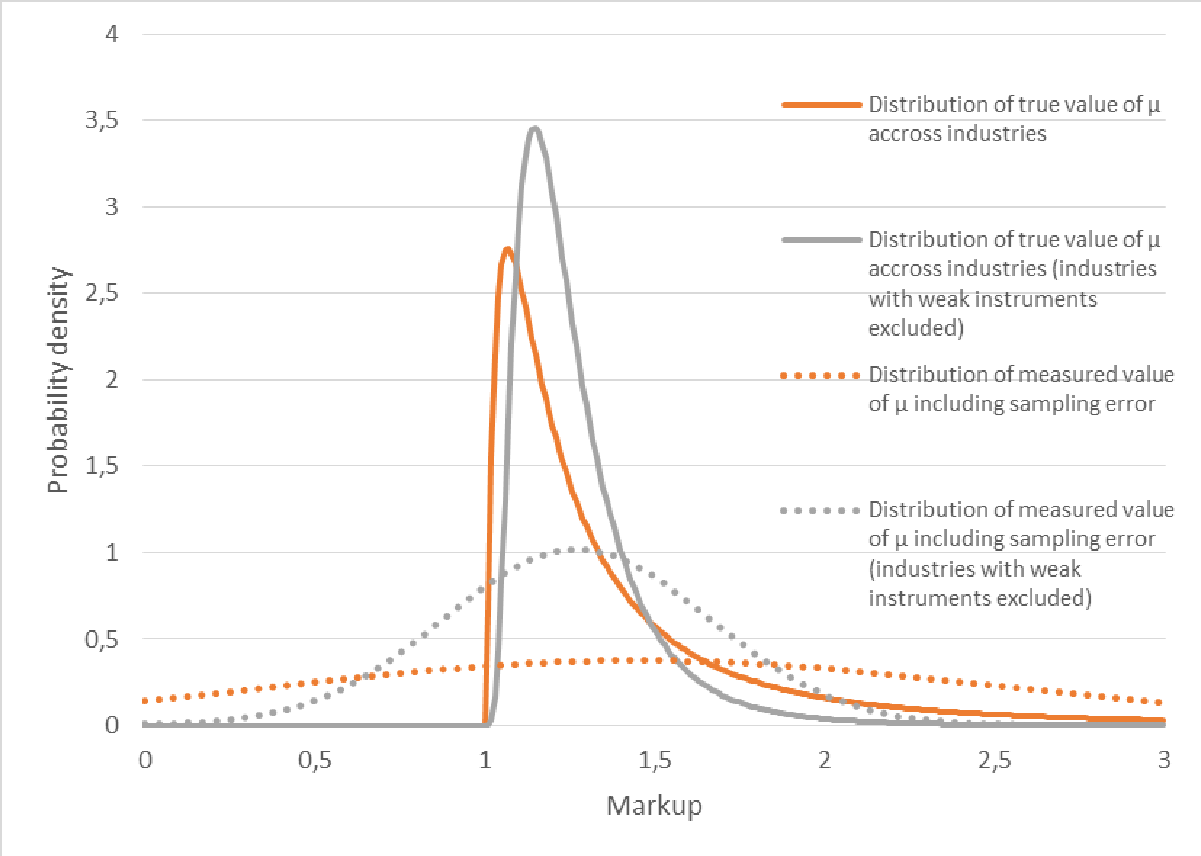

Figure 2: Inferred distributions of true markup ratio, μ, and distribution including sampling errors.

So far, I have considered only the markup ratio as a measure of market power. The equivalent measure is the Lerner index (see the equation (16)). The values of Lerner index should be theoretically between 0 and 1. Because there are markup estimates that fall below the theoretical minimum, there are also negative values of Lerner index that are theoretically impossible. Hall (2018b) considers this problem assuming the following statistical model:

$$\hat{L} = L + \theta, \quad (24)$$

where $\hat{L}$ is the estimate of Lerner index value, $L \sim Beta(\tau, \beta)$ is the value of true Lerner index and θ is the sampling error. The parameter β is assumed to be 8 and the sampling error, θ, is assumed to have mean of zero. The parameter τ can be identified as follows (see Hall 2018b):

$$Mean(\hat{L}) = \frac{\tau}{\tau+\beta}, \quad (25)$$

$$\tau = \frac{\beta Mean(\hat{L})}{1-Mean(\hat{L})}. \quad (26)$$

If one uses all the industries, the mean of $\hat{L}$ is about 0,19, and the value of τ is about 1,94. Excluding industries with the problem of weak instrument leads mean value of $\hat{L}$ to be about 0,18 and τ about 1,72.[15] The inferred distributions are drawn in Figure 3. Comparing to Hall (2018b), my estimates of τ are somewhat larger (Hall estimates the equivalent shape parameter to be 1,36). This means that values of Lerner index are a bit more concentrated to small values in the USA than in Finland.

[15] Plugging these values of $Mean(\hat{L})$ in the equation (26) does not produce exactly these values of τ since the values are rounded.

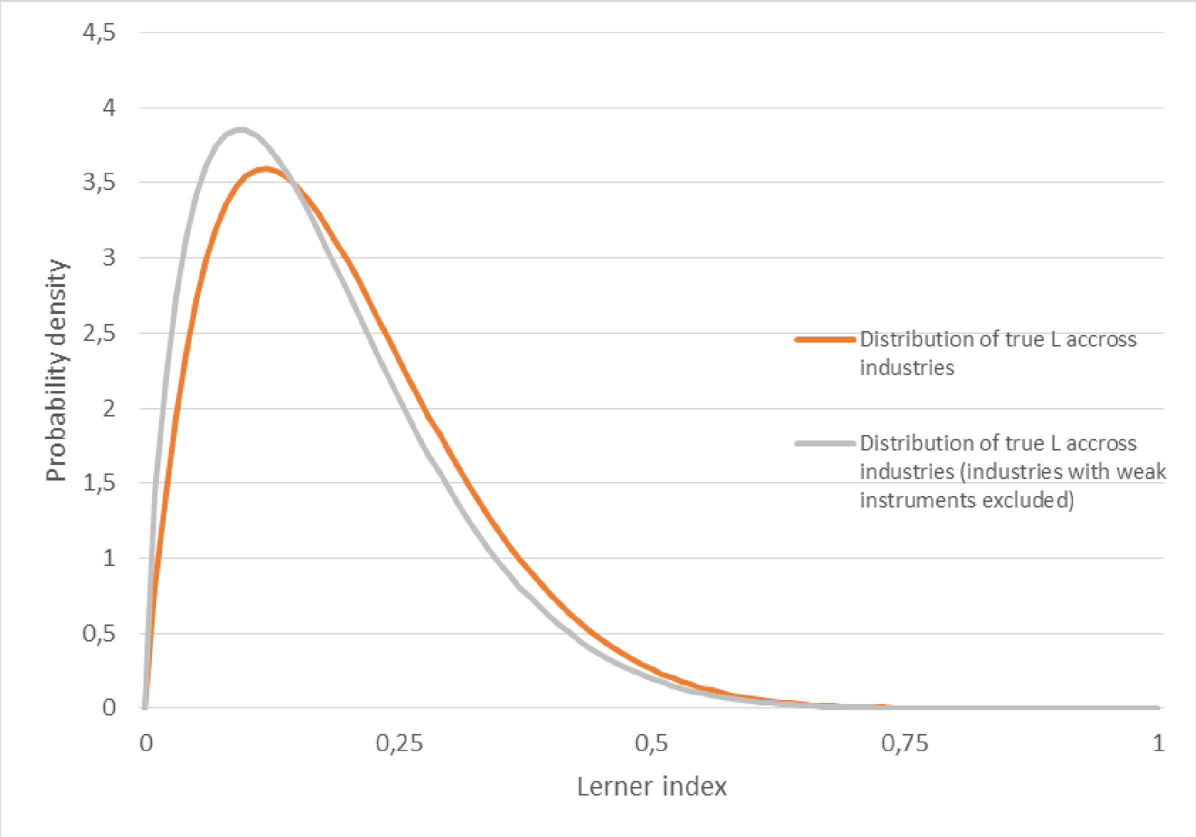

Figure 3: Inferred distributions of true Lerner index, L.

All in all, the distribution of market power across industries seems to be very similar in Finland and in the USA. The markup ratio approach and the Lerner index approach produce slightly different results. According to the markup ratio approach, the distribution of market power is slightly less dispersed than in the USA. In this approach, it matters a lot whether one excludes or includes the industries with weak instruments. According to the Lerner index approach, the distribution of market power is a bit less concentrated to low levels of market power than in the USA, which is contradictory to the result produced by the markup ratio approach. In this approach the results are much less sensitive to the exclusion of industries.

4.3 The change over time

An interesting issue is how the market power of firms has developed over time in Finland. There has been some evidence that market power might have been increasing in the USA (e.g. Hall 2018a and 2018b) and globally (e.g. Diez et al., 2018). To consider the development over time, I follow Hall (2018a, p. 12) and include an industry specific linear time trend in equation (15):

$$\sum_i \alpha_{i,t}\,\Delta \ln\left(x_{i,t}\right) = (\phi + \psi t)\Delta \ln(y_t) + a_t, \qquad (27)$$

and thus,

$$\mu_t = \frac{1}{\phi + \psi t}. \qquad (28)$$

The parameter of interest is ψ. If the parameter is negative the markup ratio has been increasing. Again, I estimate the equation for every 63 industry and average the results. I use the whole sample period from 1976 to 2016. I use the same set of instruments as before augmented with the product of the variables and the time trend. That means there are altogether 16 instruments.

The country level average of the time trend coefficient ψ has surprisingly been positive, though not statistically significant (see Table 5). So at least at the aggregate level, the results do not suggest that the level of market power would have been increasing in last decades in Finland. But as the coefficient is not even near statistical significance, one cannot argue that the markup ratios had been decreasing either.[16]

Another interesting observation is that the addition of the time trend makes the markup estimates slightly smaller. The previously estimated weighted average of markup ratio was 1,25 (see Table 3). Now, the average estimated level of the markup is 1,16 (average standard error 0,1142). The development of the average markup ratio is drawn in Figure 4.

Top level industry classification	ψ	**Weighted average of standard error**	**The lower bound of 95 % CI**	**The upper bound of 95 % CI**	**Per cent of value added (1975-2016 average)**	**Number of industries used to calculate the average**
Agriculture, forestry and fishing (A)	0,0087	0,0160	-0,0236	0,0410	5,2 %	3
Mining and quarrying (B)	-0,0009	0,0047	-0,0105	0,0087	0,4 %	1
Manufacturing (C)	-0,0012	0,0037	-0,0087	0,0063	23,5 %	19
Electricity, gas, steam and air conditioning supply (D)	-0,0029	0,0123	-0,0278	0,0221	2,3 %	1
Water supply; sewerage, waste management and remediation activities (E)	0,0094	0,0069	-0,0045	0,0233	0,7 %	2
Construction (F)	-0,0046	0,0039	-0,0125	0,0033	6,8 %	1
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	-0,0061	0,0068	-0,0199	0,0076	10,1 %	3
Transportation and storage (H)	-0,0002	0,0064	-0,0131	0,0127	6,1 %	5
Accommodation and food service activities (I)	-0,0011	0,0102	-0,0217	0,0194	1,5 %	1
Information and communication (J)	-0,0011	0,0060	-0,0131	0,0110	4,2 %	4
Financial and insurance activities (K)	-0,0056	0,0232	-0,0525	0,0413	3,0 %	3
Real estate activities (L)	0,0084	0,0074	-0,0066	0,0234	9,0 %	1
Professional, scientific and technical activities (M)	0,0028	0,0079	-0,0133	0,0189	3,3 %	5
Administrative and support service activities (N)	-0,0039	0,0061	-0,0162	0,0084	2,1 %	4
Public administration and defence; compulsory social security (O)	0,0071	0,0043	-0,0016	0,0158	6,2 %	1
Education (P)	-0,0022	0,0103	-0,0229	0,0186	5,2 %	1
Human health and social work activities (Q)	0,0127	0,0048	0,0031	0,0223	7,9 %	2
Arts, entertainment and recreation (R)	-0,0040	0,0051	-0,0143	0,0064	1,1 %	2
Other service activities (S)	0,0061	0,0075	-0,0091	0,0214	1,5 %	3
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use (T)	-0,0061	0,0118	-0,0299	0,0177	0,1 %	1
Average	0,0011	0,0069	-0,0128	0,0150	100 %	63

Table 5: Estimates of ψ in different industries. The results are weighted averages.

[16] Statistics Finland also provides the productivity data purged from the public sector. For the private sector, the estimated average of ψ is -0,0006 and the estimated average of the level parameter ϕ is 0,79. This means that the markup ratio is estimated to be grown from 1,24 to 1,28 in the private sector. This does not change the general conclusion that the market power of firms has probably not increased, at least as in other developed countries (see Diez et al., 2018). The observed change in the private sector is minor and not statistically significant (average standard error of ψ is 0,0081).

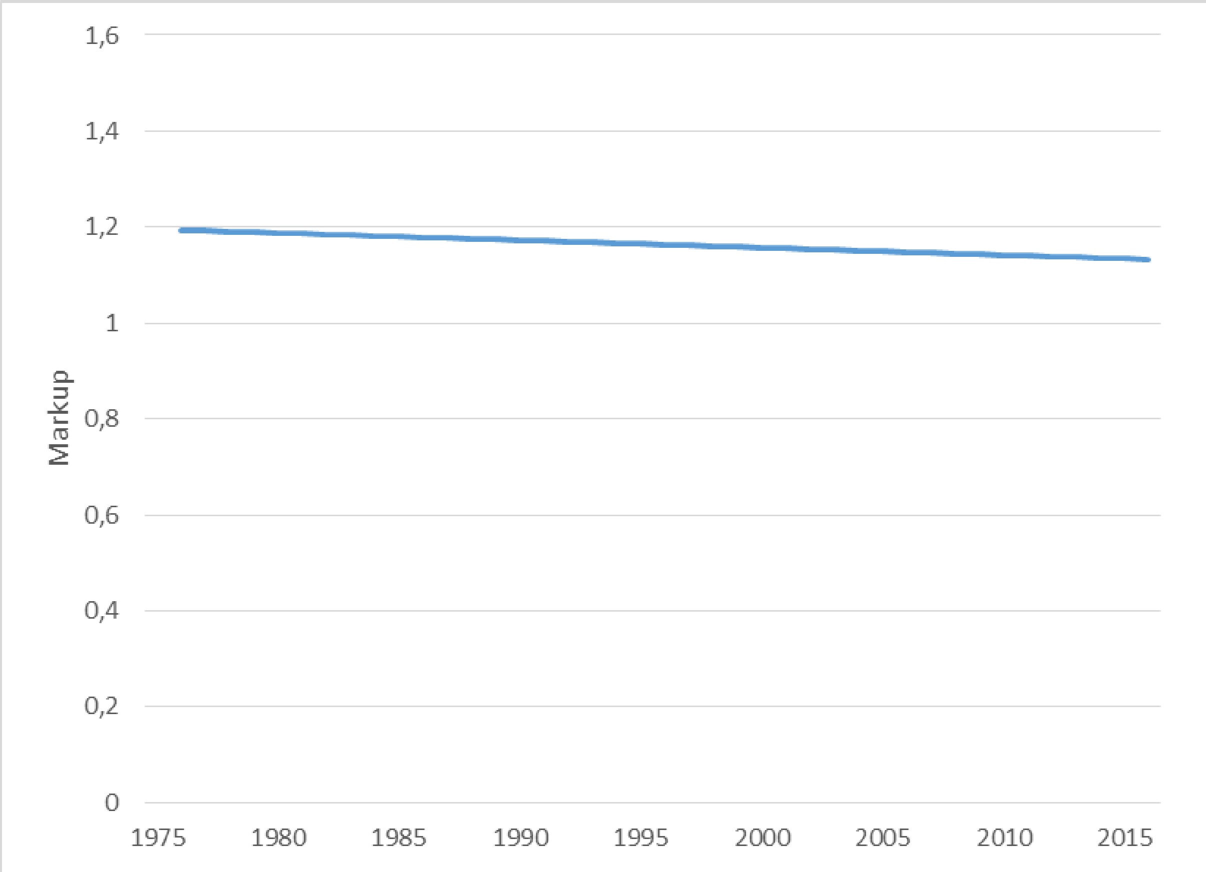

Figure 4: The development of the average markup ratio over time.

Table 5 shows the results averaged in top level industry classification level.[17] There is no statistically significant growth nor decrease in any industry. The smallest estimates (i.e. highest growth rates in markup ratio) are in "G, wholesale and retail trade, repair of motor vehicles and motorcycles" and in "T, activities of households as employers; undifferentiated goods- and services-producing activities of households for own use". However, neither of the estimates is statistically significant at conventional risk levels.

There are some features that might affect the results. One could argue that some of the instruments are not exogenous. It could be possible that, say, the GDP growth in Sweden would be somehow associated with the productivity growth in Finland. To test if the results are sensitive to the chosen set of instruments, I excluded some of the instruments. I estimated the same statistics as in Table 5 using only the political party dummies and 10-year real interest rate of Germany and their product with the time trend as instruments. The results changed very little. The average ψ was about 0,0004 and its standard error 0,0117. The other concern is the usage of annual changes. If there was measurement error in dependent variable $\sum_i \alpha_{i,t}\, \Delta \ln(x_{i,t})$ standard errors would increase. Measurement error in the explanatory variable $\Delta \ln(y_t)$ would bias the results. To diminish this possible problem I used overlapping three-year average growth rates instead of annual growth rates. This method did not affect the results either. The average ψ was about 0,0008 and its standard error 0,0065.[18] When it comes to industry level coefficients, there are no top level industries which were sensitive to dropping instrumental variables or using average growth rates.

[17] The OLS-estimates are reported in Appendix D for comparison.

[18] Due to autocorrelation created by the usage of overlapping observations it would be more appropriate to use HAC standard errors that would possibly increase the standard errors a bit. However, it is already clear that the results are hardly affected by using average growth rates.

In addition to these sensitivity analyses, I considered several different timespans. The timespan from 1975 to 2016 is quite long and there could be ups and downs in the development of the markup ratio, as during the last decades, the Finnish economy has undergone several economic crises and structural changes in many industries. However, I could not find such a period of time during which the average market power of firms had clearly increased or decreased. Depending on timespan, the estimates for average ψ were either slightly positive or slightly negative but the average t-values were typically very close to zero.

4.4 Do Exporters Have Higher Markups?

Bernard, Eaton, Jensen and Kortum (2003) propose that more efficient firms are more likely to export and to have high markup ratios. Hence, exporters have typically higher markups than non-exporters. De Loecker and Warzynski (2012) test this relationship using plant-level data. They find that markup ratios are considerably higher in exporting firms than in non-exporting firms. However, Tamminen and Chang (2013) find that domestic firms have higher markups than exporting firms in Finland.

Next, I will analyse this potential relationship briefly. I use World Input–Output Database (WIOD) "national supply and use table" of Finland to measure the general level of exports in different industries (See Timmer, Dietzenbacher, Los, Stehrer and de Vries, 2015). The data are from 2000 to 2014. For every industry, I calculate the average share of exports in total use.[19] The shares are shown in Figure 5.

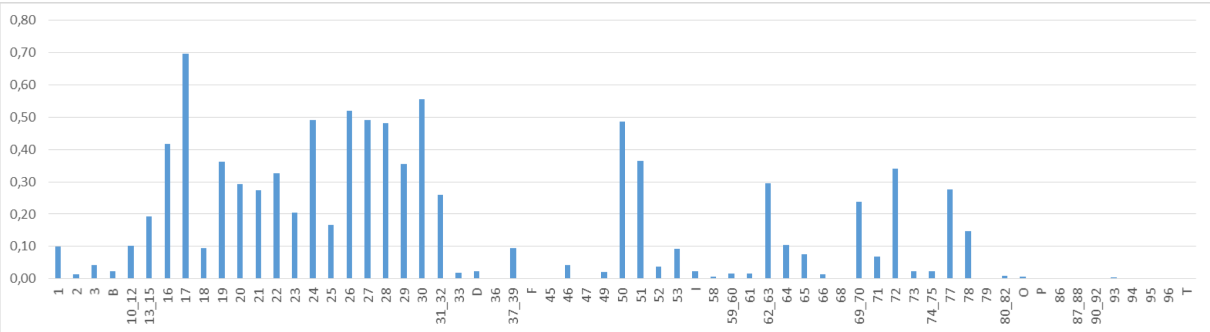

Figure 5: Average share of exports by industry between 2000 and 2014.

Sector		Estimate	Standard error	The lower bound of 95 % CI	The upper bound of 95 % CI	Per cent of value added (1975-2016 average)	Number of industries used to calculate the average
Export sector	ψ	-0,0010	0,0025	-0,0062	0,0041	23,8 %	22
	μ	1,34	0,08	1,18	1,51		
Domestic sector	ψ	0,0018	0,0054	-0,0091	0,0127	76,2 %	41
	μ	1,22	0,10	1,02	1,42		

Table 6: Markup and trend coefficient estimates for export and domestic sector.

To evaluate the possible connection between exports and market power I divide the 63 industries into two groups, labelled as the export and the domestic sector. The export sector includes the industries in which the share of exports is higher than average (0,15) and the domestic sector includes the industries in which the share is smaller than average. I calculate weighted averages of the markup and the trend coefficient estimates for both groups. The results are summarized in Table 6.

[19] The table provides the following information by industry: $total\ supply = total\ domestic\ supply + imports = total\ intermediate\ consumption + final\ consumption\ expenditures + gross\ fixed\ capital\ formation + changes\ in\ inventories\ and\ valuables + exports = total\ use.$

The results are consistent with previous research by De Loecker and Warzynski (2012). The markup estimate for the export sector is about 10% higher than for the domestic sector. Also the trend coefficients have different signs – the markups have grown in the export sector and declined in the domestic sector according to point estimates. However, there is a lot of uncertainty as the 95 % confidence intervals clearly overlap, both, in case of parameter ψ and in case of parameter μ.

5. Conclusions

The results provide some evidence that the average markup ratio does not exhibit trend like change over time in Finland. The result is very interesting because the markups have been seen increasing globally, especially, in advanced economies (Diez et al., 2018).

The analyses, in which I examine the level of markup, also support the idea that the average markup ratio has remained rather stable. The weighted average for the country level markup ratio in Finland is 1,25. The estimate is similar as observed in earlier studies. For example, Christopoulou's & Vermeulen's (2012) country level estimate for Finland was 1,28.

When it comes to the distribution of markup ratios across industries, there are, as far as I know, no comparable earlier analyses made in Finland. In comparison to the markup distribution in the USA (see Hall, 2018a; Hall, 2018b), the inferred distributions are very similar. This result is perhaps surprising as Finland and the USA differ in many respects.

Finally, the results are consistent with the results by De Loecker and Warzynski (2012). Exporting firms are estimated to have higher markups than domestic firms.

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Appendix

The appendix tables A and B contain parameter estimates for 63 industries. One should be cautious when interpreting these numbers as there are some industries in which the estimates are clearly not reliable. For example, in Appendix A the industry “03, Fishing” has a large markup estimate but also a huge standard error. Tables C and D contain OLS estimates for comparison.

A: The markup estimates in 63 industries

Industry	Markup	Standard error	Avergae share of total value added (1975-2016)	Top level industry classification	Weak instruments (p-value)	Wu-Hausman (p-value)	Sargan (p-value)
01 Agriculture and hunting	0,53	0,43	2,5 %	A	1,00	0,01	1,00
02 Forestry	2,11	0,60	2,6 %	A	0,03	0,08	0,26
03 Fishing and aquaculture	7,17	29,63	0,1 %	A	0,84	0,42	0,78
B Mining and quarrying	1,61	0,23	0,4 %	B	0,41	0,79	0,10
10_12 Food industry, etc.	1,27	0,13	2,3 %	C	0,00	0,49	0,56
13_15 Textile, clothing and leather industries	1,00	0,06	1,0 %	C	0,00	0,01	0,39
16 Woodworking industry	1,21	0,05	1,2 %	C	0,01	0,23	0,56
17 Paper industry	1,58	0,09	3,1 %	C	0,00	0,33	0,07
18 Printing	1,18	0,08	0,7 %	C	0,00	0,08	0,07
19 Manufacture of coke and refined petroleum products	1,08	0,12	0,5 %	C	0,30	0,02	0,73
20 Manufacture of chemicals and chemical products	1,17	0,10	1,2 %	C	0,01	0,96	0,96
21 Pharmaceutical industry	1,78	0,30	0,4 %	C	0,00	0,28	0,19
22 Manufacture of rubber and plastic products	1,32	0,06	0,7 %	C	0,00	0,12	0,59
23 Manufacture of other non-metallic mineral products	1,34	0,06	0,9 %	C	0,00	0,10	0,05
24 Manufacture of basic metals	1,38	0,10	1,1 %	C	0,00	0,75	0,65
25 Manufacture of fabricated metal products	1,30	0,06	1,5 %	C	0,00	0,86	0,11
26 Electronics industry	1,34	0,11	3,0 %	C	0,00	0,97	0,84
27 Manufacture of electrical equipment	1,63	0,13	0,9 %	C	0,00	0,60	0,24
28 Manufacture of machinery and equipment n.e.c.	1,36	0,06	2,4 %	C	0,02	0,97	0,64
29 Manufacture of motor vehicles, etc.	1,30	0,04	0,3 %	C	0,00	0,54	0,36
30 Manufacture of other transport equipment	1,11	0,11	0,6 %	C	0,74	0,89	0,79
31_32 Manufacture of furniture and other products	1,43	0,07	0,8 %	C	0,00	0,13	0,73

33 Repair and installation of machinery and equipment	1,24	0,12	0,8 %	C	0,39	0,44	0,63
D Electricity, gas, steam and air conditioning supply	1,73	0,33	2,3 %	D	0,03	0,53	0,28
36 Water collection, treatment and supply	4,00	2,26	0,2 %	E	0,07	0,77	0,46
37_39 Sewerage and waste management	1,15	0,10	0,4 %	E	0,00	0,03	0,22
F Construction	0,91	0,04	6,8 %	F	0,00	0,02	0,89
45 Trade and repair of motor vehicles, etc.	1,34	0,13	1,4 %	G	0,00	0,09	0,25
46 Wholesale trade (excl. motor vehicles, etc.)	1,76	0,15	4,8 %	G	0,00	0,65	0,54
47 Retail trade (excl. motor vehicles, etc.)	1,52	0,19	3,9 %	G	0,00	0,74	0,13
49 Land transport	1,38	0,16	3,2 %	H	0,00	0,13	0,40
50 Water transport	2,06	0,40	0,6 %	H	0,09	0,10	0,56
51 Air transport	1,97	0,24	0,4 %	H	0,00	0,15	0,45
52 Warehousing and support activities for transportation	1,08	0,06	1,1 %	H	0,00	0,87	0,71
53 Postal and courier activities	1,60	0,28	0,7 %	H	0,00	0,37	0,61
I Accommodation and food service activities	1,14	0,14	1,5 %	I	0,00	0,27	0,36
58 Publishing activities	1,32	0,11	0,8 %	J	0,00	0,89	0,51
59_60 Audio-visual activities	1,46	0,24	0,5 %	J	0,10	0,86	0,25
61 Telecommunications	1,42	0,12	1,4 %	J	0,00	0,03	0,21
62_63 Computer and information service activities	1,05	0,07	1,4 %	J	0,00	0,00	0,45
64 Financial activities	1,54	0,50	2,2 %	K	0,00	0,95	0,25
65 Insurance activities	4,69	16,20	0,6 %	K	0,61	0,66	0,87
66 Activities auxiliary to financial and insurance activities	1,17	0,27	0,2 %	K	0,16	0,13	0,71
68 Real estate activities	0,90	0,06	9,0 %	L	0,00	0,61	0,02
69_70 Business management activities	0,97	0,07	0,8 %	M	0,00	0,13	0,11
71 Architectural and engineering activities, etc.	0,99	0,08	1,3 %	M	0,00	0,05	0,53
72 Scientific research and development	1,21	0,16	0,7 %	M	0,00	0,00	0,86
73 Advertising and market research	1,16	0,04	0,3 %	M	0,00	0,30	0,71
74_75 Other business activities and veterinary activities	0,88	0,07	0,2 %	M	0,00	0,25	0,25
77 Rental and leasing activities	0,92	0,12	0,3 %	N	0,00	0,03	0,05
78 Employment activities	1,11	0,06	0,4 %	N	0,00	0,03	0,29

79 Travel agencies, etc.	1,42	0,15	0,1 %	N	0,00	0,30	0,58
80_82 Other support services	1,03	0,09	1,2 %	N	0,00	0,01	0,23
O Public administration and social security	1,02	0,05	6,2 %	O	0,00	0,16	0,58
P Education	0,88	0,07	5,2 %	P	0,00	0,11	0,36
86 Human health activities	0,88	0,06	4,8 %	Q	0,00	0,01	0,13
87_88 Social work activities	1,18	0,08	3,2 %	Q	0,00	0,27	0,03
90_92 Cultural activities and gambling	1,15	0,08	0,6 %	R	0,00	0,12	0,42
93 Sport, amusement and recreation activities	1,02	0,06	0,5 %	R	0,00	0,89	0,10
94 Activities of membership organisations	0,97	0,05	1,0 %	S	0,00	0,05	0,30
95 Repair of household goods	1,02	0,27	0,1 %	S	0,21	0,48	0,99
96 Other personal service activities	1,34	0,24	0,4 %	S	0,00	0,98	0,02
T Household service activities	1,21	0,21	0,1 %	T	0,01	0,75	0,41

B: The estimates for ϕ and ψ in 63 industries

Industry	ϕ	ψ	Standard error of ϕ	Standard error of ψ	Weak instruments (p-value) (ϕ)	Weak instruments (p-value) (ψ)	Wu-Hausman	Sargan
01 Agriculture and hunting	1,11	0,0140	0,41	0,0228	0,99	0,44	0,02	0,98
02 Forestry	0,42	0,0028	0,13	0,0087	0,02	0,00	0,29	0,13
03 Fishing and aquaculture	0,73	0,0259	0,40	0,0283	0,93	0,34	0,77	0,68
B Mining and quarrying	0,57	-0,0009	0,07	0,0047	0,58	0,00	0,39	0,17
10_12 Food industry, etc.	0,76	-0,0054	0,06	0,0050	0,00	0,00	0,55	0,63
13_15 Textile, clothing and leather industries	0,94	-0,0078	0,06	0,0054	0,00	0,00	0,12	0,41
16 Woodworking industry	0,80	0,0001	0,03	0,0023	0,00	0,00	0,50	0,15
17 Paper industry	0,66	-0,0036	0,03	0,0024	0,01	0,00	0,95	0,09
18 Printing	0,81	-0,0025	0,05	0,0040	0,00	0,00	0,64	0,07
19 Manufacture of coke and refined petroleum products	0,84	-0,0031	0,07	0,0039	0,42	0,04	0,24	0,60
20 Manufacture of chemicals and chemical products	0,86	0,0063	0,06	0,0045	0,01	0,03	0,90	0,70
21 Pharmaceutical industry	0,49	-0,0046	0,07	0,0062	0,00	0,00	0,67	0,37
22 Manufacture of rubber and plastic products	0,73	0,0017	0,03	0,0026	0,00	0,00	0,54	0,41
23 Manufacture of other non-metallic mineral products	0,74	-0,0065	0,03	0,0025	0,00	0,00	0,58	0,03
24 Manufacture of basic metals	0,73	-0,0029	0,05	0,0038	0,00	0,00	0,45	0,42
25 Manufacture of fabricated metal products	0,75	0,0000	0,03	0,0027	0,00	0,00	0,67	0,02
26 Electronics industry	0,76	0,0020	0,06	0,0058	0,00	0,00	0,58	0,74

27 Manufacture of electrical equipment	0,64	-0,0054	0,04	0,0037	0,00	0,00	0,37	0,54
28 Manufacture of machinery and equipment n.e.c.	0,74	0,0000	0,03	0,0024	0,02	0,00	0,51	0,63
29 Manufacture of motor vehicles, etc.	0,80	-0,0056	0,03	0,0023	0,00	0,00	0,14	0,81
30 Manufacture of other transport equipment	0,84	0,0067	0,05	0,0037	0,40	0,46	0,78	0,80
31_32 Manufacture of furniture and other products	0,67	0,0005	0,03	0,0026	0,00	0,00	0,15	0,21
33 Repair and installation of machinery and equipment	0,81	0,0064	0,05	0,0046	0,13	0,04	0,15	0,96
D Electricity, gas, steam and air conditioning supply	0,61	-0,0029	0,17	0,0123	0,29	0,14	0,51	0,19
36 Water collection, treatment and supply	0,62	0,0322	0,13	0,0070	0,00	0,00	0,19	0,62
37_39 Sewerage and waste management	0,85	-0,0028	0,07	0,0068	0,00	0,00	0,02	0,66
F Construction	1,05	-0,0046	0,04	0,0039	0,00	0,00	0,20	0,44
45 Trade and repair of motor vehicles, etc.	0,72	-0,0114	0,06	0,0071	0,00	0,00	0,12	0,59
46 Wholesale trade (excl. motor vehicles, etc.)	0,56	0,0012	0,05	0,0053	0,00	0,00	0,14	0,40
47 Retail trade (excl. motor vehicles, etc.)	0,61	-0,0133	0,08	0,0086	0,00	0,00	0,59	0,37
49 Land transport	0,67	0,0006	0,08	0,0071	0,00	0,00	0,02	0,26
50 Water transport	0,54	-0,0025	0,08	0,0079	0,01	0,00	0,51	0,23
51 Air transport	0,50	-0,0133	0,05	0,0041	0,00	0,00	0,34	0,50
52 Warehousing and support activities for transportation	0,90	0,0040	0,05	0,0042	0,00	0,00	0,72	0,06
53 Postal and courier activities	0,59	0,0000	0,09	0,0062	0,00	0,00	0,51	0,46
I Accommodation and food service activities	0,83	-0,0011	0,10	0,0102	0,00	0,01	0,84	0,55
58 Publishing activities	0,68	-0,0126	0,06	0,0051	0,00	0,00	0,07	0,38
59_60 Audio-visual activities	0,71	-0,0021	0,10	0,0067	0,36	0,45	0,31	0,57
61 Telecommunications	0,74	0,0099	0,05	0,0064	0,00	0,08	0,59	0,05
62_63 Computer and information service activities	0,91	-0,0051	0,06	0,0057	0,00	0,00	0,01	0,64
64 Financial activities	0,72	0,0001	0,19	0,0159	0,00	0,00	0,28	0,54
65 Insurance activities	0,07	-0,0325	0,62	0,0526	0,94	0,62	0,83	0,74
66 Activities auxiliary to financial and insurance activities	0,69	0,0070	0,16	0,0181	0,31	0,23	0,90	0,12
68 Real estate activities	1,20	0,0084	0,09	0,0074	0,00	0,00	0,41	0,05
69_70 Business management activities	1,01	0,0010	0,09	0,0081	0,00	0,00	0,15	0,44

71 Architectural and engineering activities, etc.	0,95	-0,0024	0,07	0,0065	0,00	0,00	0,63	0,27
72 Scientific research and development	0,86	0,0114	0,14	0,0104	0,00	0,00	0,00	0,89
73 Advertising and market research	0,86	0,0041	0,03	0,0037	0,00	0,00	0,87	0,73
74_75 Other business activities and veterinary activities	1,23	0,0113	0,16	0,0143	0,00	0,00	0,08	0,37
77 Rental and leasing activities	0,91	0,0013	0,12	0,0112	0,01	0,01	0,73	0,01
78 Employment activities	0,86	0,0008	0,05	0,0042	0,00	0,00	0,18	0,40
79 Travel agencies, etc.	0,70	0,0031	0,07	0,0083	0,00	0,03	0,51	0,15
80_82 Other support services	0,93	-0,0074	0,07	0,0051	0,00	0,00	0,02	0,23
O Public administration and social security	1,00	0,0071	0,05	0,0043	0,00	0,00	0,54	0,10
P Education	1,10	-0,0022	0,12	0,0103	0,00	0,00	0,14	0,73
86 Human health activities	1,09	0,0086	0,07	0,0048	0,00	0,00	0,13	0,12
87_88 Social work activities	1,02	0,0189	0,06	0,0047	0,00	0,00	0,01	0,29
90_92 Cultural activities and gambling	0,83	-0,0036	0,06	0,0055	0,00	0,00	0,35	0,36
93 Sport, amusement and recreation activities	0,99	-0,0044	0,06	0,0046	0,00	0,00	0,49	0,01
94 Activities of membership organisations	0,99	0,0003	0,06	0,0047	0,00	0,00	0,21	0,30
95 Repair of household goods	0,82	0,0060	0,19	0,0149	0,15	0,07	0,88	0,74
96 Other personal service activities	0,79	0,0208	0,12	0,0125	0,02	0,00	0,59	0,07
T Household service activities	0,92	-0,0061	0,14	0,0118	0,02	0,00	0,26	0,10

C: Comparison of OLS- and IV-estimates of equation (15)

	OLS		**2SLS**		**Difference**	
Top level industry classification	**Markup**	**Standard error**	**Markup**	**Standard error**	**Markup**	**Standard error**
Agriculture, forestry and fishing	3,07	0,87	1,46	0,63	1,61	0,25
Mining and quarrying	1,56	0,10	1,61	0,23	-0,05	-0,13
Manufacturing	1,37	0,06	1,34	0,08	0,03	-0,02
Electricity, gas, steam and air conditioning supply	1,58	0,17	1,73	0,33	-0,15	-0,17
Water supply; sewerage, waste management and remediation activities	2,45	0,26	2,15	0,26	0,30	0,00
Construction	0,98	0,03	0,91	0,04	0,07	-0,01
Wholesale and retail trade; repair of motor vehicles and motorcycles	1,66	0,14	1,61	0,16	0,05	-0,02
Transportation and storage	1,55	0,13	1,46	0,15	0,09	-0,02
Accommodation and food service activities	1,25	0,12	1,14	0,14	0,11	-0,02
Information and communication	1,28	0,08	1,28	0,11	0,00	-0,02
Financial and insurance activities	1,64	0,41	2,12	0,81	-0,48	-0,39
Real estate activities	0,89	0,05	0,90	0,06	-0,01	0,00

Professional, scientific and technical activities	1,18	0,08	1,04	0,08	0,14	0,00
Administrative and support service activities	1,20	0,08	1,05	0,09	0,15	0,00
Public administration and defence; compulsory social security	1,06	0,05	1,02	0,05	0,04	0,00
Education	0,93	0,08	0,88	0,07	0,05	0,00
Human health and social work activities	1,08	0,07	1,00	0,07	0,08	0,00
Arts, entertainment and recreation	1,13	0,06	1,09	0,07	0,04	-0,01
Other service activities	1,13	0,07	1,07	0,08	0,05	-0,01
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	1,26	0,15	1,21	0,21	0,05	-0,06
Average	1,36	0,13	1,25	0,15	0,11	-0,02

D: Comparison of OLS- and IV-estimates of equation (27)

	OLS		2SLS		Difference	
Top level industry classification	***ψ***	**Standard error**	***ψ***	**Standard error**	***ψ***	**Standard error**
Agriculture, forestry and fishing	0,0067	0,0088	0,0087	0,0160	-0,0020	-0,0071
Mining and quarrying	-0,0010	0,0041	-0,0009	0,0047	-0,0002	-0,0006
Manufacturing	-0,0009	0,0032	-0,0012	0,0037	0,0003	-0,0005
Electricity, gas, steam and air conditioning supply	0,0045	0,0054	-0,0029	0,0123	0,0074	-0,0070
Water supply; sewerage, waste management and remediation activities	0,0108	0,0054	0,0094	0,0069	0,0014	-0,0015
Construction	-0,0034	0,0036	-0,0046	0,0039	0,0013	-0,0004
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0,0030	0,0060	-0,0061	0,0068	0,0031	-0,0008
Transportation and storage	0,0050	0,0053	-0,0002	0,0064	0,0052	-0,0010
Accommodation and food service activities	-0,0047	0,0075	-0,0011	0,0102	-0,0036	-0,0026
Information and communication	0,0028	0,0048	-0,0011	0,0060	0,0039	-0,0011
Financial and insurance activities	-0,0132	0,0179	-0,0056	0,0232	-0,0075	-0,0052
Real estate activities	0,0069	0,0073	0,0084	0,0074	-0,0016	-0,0002
Professional, scientific and technical activities	-0,0038	0,0062	0,0028	0,0079	-0,0066	-0,0017
Administrative and support service activities	-0,0025	0,0053	-0,0039	0,0061	0,0015	-0,0008
Public administration and defence; compulsory social security	0,0058	0,0039	0,0071	0,0043	-0,0014	-0,0004
Education	-0,0107	0,0091	-0,0022	0,0103	-0,0085	-0,0012
Human health and social work activities	0,0104	0,0043	0,0127	0,0048	-0,0023	-0,0004
Arts, entertainment and recreation	-0,0049	0,0046	-0,0040	0,0051	-0,0010	-0,0005
Other service activities	0,0034	0,0067	0,0061	0,0075	-0,0027	-0,0009
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	-0,0066	0,0091	-0,0061	0,0118	-0,0005	-0,0026
Average	0,0008	0,0056	0,0011	0,0069	-0,0003	-0,0013