Mark-ups in the Hungarian Corporate Sector

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Abstract

One of the major tasks facing a transition economy is to create the competitive environment of a properly functioning market economy. This paper attempts to analyse the relationship of market structure, market imperfections and corporate performance by mark-up pricing. There is a clear evidence for the existence of such market imperfections. However, these imperfections cannot be attributed to one single factor. We develop a varying coefficient model for the relationship between the factors facilitating rent-collection and the sectoral mark-ups.

JEL Classification: C23, D21, D24

Keywords: Firm in transition economy; market imperfections; mark-up pricing.

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1. Introduction

Our previous paper (*Halpern and Kőrösi* (2000)) was basically concerned with the productive efficiency of Hungarian firms. We used dynamic frontier production functions for the analysis. It was found that corporate performance followed a clearly visible path: Productive efficiency collapsed almost uniformly during the initial phase of the transition, but the very rapid consolidation period was followed by a period of gradual improvement starting around 1994-5. However, this recovery had very different characteristics for different groups of firms, basically according to ownership (foreign owned firms were more efficient than domestic ones) and size (small firms were clearly disadvantaged in the process).

Halpern and Kőrösi (2000) also tried to analyse the relationship between firm level efficiency and market structure. We found that market structure variables did not seem to have a strong influence on corporate performance, but there was a rather strong evidence of a reverse relationship: Efficient firms gain market share.

Centrally planned economies had a very highly concentrated market structure. There were only a very few firms in most sectors, and all industrial sectors were clearly dominated by a very small number of relatively large firms. These large firms could clearly use their market power in bargaining with central planners, thus their prices (formally fixed by the planners) were usually high enough that most companies seemed to be financially sound.

The situation quickly changed when transition started (in Hungary in 1988) with price and import liberalization, quickly followed by the substantial, although more gradual liberalization of capital markets. Many former oligopolists dwindled or disappeared as they had to compete with imports and newly emerging firms. Most former state-owned enterprises were privatized, and the larger ones were frequently sold to foreign investors. All these have completely reshaped the Hungarian corporate landscape by the mid-1990's. It does not necessarily mean that Hungarian manufacturing is much less concentrated than it used to be, but the new market leaders are private companies (frequently Hungarian subsidiaries of multinational corporations), and the corporate environment is completely different.

This paper attempts to identify the influence of this emerging market structure on corporate behaviour in a different way as our earlier studies. We use a mark-up pricing model for describing the consequences of market imperfections in the Hungarian manufacturing sector. This part follows the ideas developed by *Hall* (1988) and *Roeger* (1995).

The remainder of the study is organized as follows: Section 2 sets out the basic model for mark-up prices. Section 3 discusses data issues. Empirical findings are analysed in Section 4. Finally, conclusions are drawn. Appendix A explains notation and defines variables, while Appendix B presents results.

2. Mark-up pricing

One of the most important results of production theory is that firms will set prices at their marginal cost in an efficiently competitive market. Only those firms having excess market power can achieve higher prices. As firms maximise profits, they will obviously recoup rents if possible. Thus, discrepancies between marginal cost and price, called mark-up, can be treated as indicators of market imperfections. In his seminal paper *Hall* (1988) developed a simple method for estimating mark-ups from Solow residuals.

Hall's measurement, however, is hampered by the endogeneity of the regressor. It is difficult to find truly exogenous instrumental variables. *Roeger* (1995) suggested an alternative measurement: The information contained in the production and in the dual cost functions are identical under the null hypothesis of perfectly competitive markets. Their systematic discrepancies thus must be the consequence of market imperfections, and their distance can be interpreted as a measure of mark-up pricing.

It is assumed that a Cobb-Douglas production function with constant returns to scale gives the correct description of the productive technology of any firm in a perfect market. The Solow residual is computed from both the primal production and the dual cost functions. The elasticity of labour (α) is estimated as the labour share of value added: $\alpha_t = W_t L_t / P_t Y_t$, where P_t stands for the GDP deflator. The Solow residual from the production function (according to *Hall* (1988)) is:

$$SR_t^{(p)} = (\Delta y_t - \Delta k_t) - \alpha_t(\Delta l_t - \Delta k_t) = B(\Delta y_t - \Delta k_t) - (1-B)\Delta e_t\,,$$

where lower case variables are logarithms and B is the Lerner index, directly related to the mark-up of prices over the marginal cost (μ): $\mu = 1/(1-B)$. The difficulty of the unbiased estimation of B stems from the correlation between $(\Delta y_t - \Delta k_t)$ and Δe_t.

Roeger (1995) derived the corresponding Solow residuals for the dual cost function:

$$SR_t^{(d)} = \alpha_t \Delta w_t + (1-\alpha_t)\Delta r_t - \Delta p_t = -B(\Delta p_t - \Delta r_t) + (1-B)\Delta e_t$$

The difference of the two Solow residuals should just be a random noise. However, expressing their difference from the above expressions yields

$$SR_t^{(p)} - SR_t^{(d)} = B\Delta x_t + u_t$$

with $\Delta x_t = (\Delta y_t - \Delta k_t) + (\Delta p_t - \Delta r_t) = \Delta(p_t y_t) - \Delta(r_t k_t)$, *i.e.,* x_t is just the difference of the logarithmic growth rate of the nominal value added and capital cost. If $B = 0$, *i.e.,* the market is perfect, $\mu = 1/(1-B) = 1$.

However, *Oliveira Martins et al.* (1996) show that mark-up ratios estimated from value added may be biased upwards and suggest to use the sales total instead. *Hylleberg and Joergensen* (1998) also show that mark-up estimates can be biased if the returns to scale is different from unity. Their paper also suggests, however, that the size of the bias is rather small, unless the returns to scale is substantially different from unity.

3. Data

The database for this empirical study consists of the profit and loss account and balance sheet data of main Hungarian manufacturing firms between 1995 and 1998.[1]

The corporate dataset covers manufacturing firms employing at least 10 people. Sample selection is, however, biased towards large firms. The sample includes at least 15% of all manufacturing firms in every year, (usually more than 20%), however, representation is much larger with respect to sales volume: at least 70% of manufacturing sales were at firms included in our sample every year.

Halpern and Kőrösi (2000) used a rather simplistic measure of competitive pressure, the number of firms in the sector, for lack of more appropriate information. We managed to get more detailed sectoral information for the present study. We experimented with several concentration measures: the Hirschmann–Herfindahl index, a distance measure, relative standard deviation, and the share of top three companies in the sector; all of them for employment and exports as well as for sales totals.

The models used in this study are based on a Cobb-Douglas production function. Capital is a key variable of such production models. It is always difficult to measure capital stock appropriately. It probably is an even more problematic task in a transition economy. The assets of practically all pre-existing firms were revalued at least once (frequently for several times), during the process of commercialisation and privatisation. This process was completed by 1995 at most firms, but not everywhere. The asset value could change substantially without any change in the physical composition of the capital, and the timing of the revaluation(s) is unknown. Inflation was not negligible in the period; we tried to calculate the capital stock at fixed prices, but that cannot be done very reliably for various reasons, one of which is the possibility of revaluation. These factors may certainly influence our results. However, their effect was relatively small in our sample period, compared to the previous period.

The cost of capital is an essential variable in the mark-up models. However, the measurement of the cost of capital is probably the most problematic task for Hungary, using corporate balance sheets. There are many firms with clearly invalid reported depreciation: For more than 10% of the sample depreciation is either greater than half the net value of fixed assets, or less than 1% of the value of fixed assets, both of which is impossible. Apparently some firms use depreciation as a balancing item in their books: This is the only relatively large expenditure item which does not have to be substantiated by bills. Approximately 25% of the firms reported 0 profits with the precision of our observations (one million forints); for more than half of these firms the rounding error was less than 0.5% of the sales total. We suspect that many such firms applied creative accounting practices to avoid the necessity of reporting either losses or profits.

When we tried to use a cost of capital variable computed from these depreciation figures we got weird results. We believe that those results are the consequences of systematic biases in reporting. The cost of capital was approximated in a model consistent way

[1] We would like to express our gratitude to Mr. József Becsei and his collaborators for their help in compiling the revised and extended data base.

instead: Under the assumption of Cobb-Douglas technology with unit returns to scale—which is the maintained hypothesis in the mark-up pricing model we use—value added is decomposed to wage cost and capital cost. As the value added and wage bill are given, the cost of capital was calculated as their difference. This way we certainly introduce an unknown, but substantial measurement error into the cost of capital variable; we tried to deal with that in the estimation process.

4. Empirical evidence of mark-up pricing

The derivation of a mark-up based measure of market imperfections in Section 2 is built on the maintained hypothesis of Cobb-Douglas technology with constant returns to scale. The assumption of constant returns to scale, however, is clearly invalid for the transitional recession, when returns to scale was much below unity. As it is evident from our former production function estimates, reported in *Halpern and Kőrösi* (2000) that the returns to scale becomes one, or slightly larger in 1995. In fact, when static production models are estimated for the Hungarian corporate sector annually (the Hall–Roeger measurement is based on a static model), the unit returns to scale assumption is not rejected for the period after 1994 (*c.f., Halpern and Kőrösi* (1998a) and (1998b)). Evidence presented by *Hylleberg and Joergensen* (1998) suggests that this small discrepancy from the constant returns to scale are unlikely to exert a substantial influence on our results.

As it was pointed out in the data section, our capital cost variable is rather noisy. It certainly includes a substantial measurement error. Even if we assume that this measurement error is independent of the error term u_t, the OLS estimator of B will be (downward) biased. Thus, the mark-up estimates are also downward biased by the measurement error. Good instruments would obviously solve the problem, however, our information set basically is the balance sheet of the firm: Thus, the measurement error of the cost of capital may not be independent of the information derived from the balance sheets. Alternatively, we may assume that this measurement error is firm specific, in which case differencing eliminates the constant firm specific effect.

Thus, mark-up ratios were estimated from panel data covering the period when the constant returns to scale assumption seems to be valid, *i.e.,* for 1995-8, and for each sector separately. We used both value added and sales total; the estimated mark-up are presented in Tables 1 (for two digit NACE sectors) and 2 (for three digit sectors). Figures 1-8 present graphic pictures of the empirical distribution of mark-ups estimated from value added, or sales, at the three and four digits levels.

There are some differences among the various mark-up estimates. Curiously, and contrary to our expectations, mark-ups estimated from value added tend to be smaller than the ones estimated from total sales. These latter mark-ups are higher than expected on average. However, it is obvious that the estimated μ is significantly greater than 1 for most of the sectors.

These estimated mark-ups provide clear evidence of market imperfections. It is possible to identify the sectors where market seems to be the most distorted. However, different model estimates sometimes give contradictory rankings of the sectors by the magnitude

of apparent market distortions. For example, all four two digit estimates agree that the mark-up in sector 25 (Rubber and plastic products) is higher than usual, however, for sector 24 (Chemical materials, etc) the results are ambiguous. And at three or four digit level the evidence seems to be less and less homogeneous. Thus it seems that it is not sufficient to estimate these mark-ups. We would also like to know the factors influencing market imperfections, and their importance.

The obvious proposition is to relate market imperfections to the structure of the market. One could do that by regressing mark-ups on variables describing some charecteristics of the market structure.[2] However, as we use panel estimates, we only have one single estimated mark-up for the entire period of 1995-8, instead of having a separate observation for each sector each year, while market structure variables are measured annually.

As the mark-up is just a transformed value of the Lerner index, which is a single parameter estimated in the model, we rather assume that this parameter is not constant over the entire sample. We employ a simple varying coefficient model:

$$SR_{i,t}^{(p)} - SR_{i,t}^{(d)} = B_{i,t}(z_{i,t})\Delta x_{i,t} + u_{i,t}\,,$$

where the parameter $B_{i,t}$ is a linear function of variables $z_{i,t}$. This solution provides an implicit explanation of factors driving mark-up ratios.

We experimented with several sets of explanatory variables. First, we just described changes of the Lerner index by lagged market share, import penetration and concentration. We estimated the model using several alternative concentration measures; Tables 3 and 4 summarize these results. While market structure variables significantly influence mark-ups for many sectors, there is not one single case which stands out as the one clearly dominating all other. Interestingly, while concentration was irrelevant for explaining corporate performance, this seems to be the most important market structure variable enabling companies to charge prices in excess of their marginal costs. However, all three market structure variables are usually not significant individually. This may indicate multicollinearity among the variables; however, it is likely that not all three variables influence mark-ups with the same intensity.

An alternative possibility is that market imperfections are also related to other factors; most importantly to ownership. Ownership causes very characteristic differences in corporate efficiency; it may also be related to market imperfections. Ownership structure may obviously influence the ability of firms to exploit market imperfections. When analysing productive efficency, we found significant structural breaks among firms by ownership categories, indicating different productive practices, which may be related to differences in corporate culture. That may certainly influence the behaviour of firms. However, sample sizes in most sectors are too small for testing for structural breaks by ownership and splitting the sample accordingly. Instead of exploring structural breaks the same way as we did when studying efficiency, we alternatively assumed that $B_{i,t}$ depends on ownership variables rather than on market share or import penetration, keeping the probably best performing measure of concentration: the relative standard deviation of the production. As the different estimates give very similar results, we only present the most consistent one: value added based estimation with random effects. Table 5 summarizes estimation results

[2] For example, *Markov et al.* (2000) and *Dobrinsky* (2001) folow that route.

for two digit sectors. Ownership seems to matter for many sectors, although not for all. Foreign owned firms tend to have higher markups than other firms, while—surprisingly—domestic private firms seem to have lower markups on the average than other firms in the same sector.

5. Conclusions

Halpern and Kőrösi (2000) found some evidence of market structure influencing corporate performance. However, that evidence was not very strong, and mostly stemmed from the market share of the firm. Curiously, concentration did not seem to have any effect on performance.

When analysing mark-up pricing, however, we find that the probably most important factor is concentration in distinguishing between sectors where prices are equal to marginal cost and where they exceed that.

Our results clearly indicate that substantial market imperfections exist in the Hungarian manufacturing sector. These imperfections can yield substantial rents.[3] However, foreign owned firms seem to have a larger chance for exploiting market imperfections and can collect larger rents than domestic firms. As many foreign firms are Hungarian subsidiaries of multinationals, this may just indicate that their true market power cannot be correctly assessed from the balance sheets of this Hungarian subsidiary. Private firms, owned by domestic investors, on the other hand, seem to be less able to recoup rents from their market power than firms (at least to a significant extent) owned by the state. This indicates that state ownership probably still provides firms with some residual bargaining power against authotorities, enabling them to rig the markets to a limited extent.

[3] The mark-ups estimated for Hungarian firms are much higher on average than mark-ups estimated for Bulgarian manufacturing firms by *Markov et al.* (2000) and *Dobrinsky* (2001).

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Appendix A: Definitions

All variables (except employment) were deflated, usually with four digit sectoral producer price indices. There were some—usually small—sectors, where the price index was only available at a higher level of aggregation (2 or 3 digit sectors). Variables are measured in million Forints at 1991 prices. The variables are:

Valued added (Y): Sales less broadly defined material costs.

Labour (L): Annual average employment at the firm.

Cost of labour (W): Annual wage bill relative to average employment at the firm.

Capital (K): Fixed assets. See data section for qualifications.

Cost of capital (R): Value added less wage bill relative to fixed assets. See data section for qualifications.

Market share: Sales of the firm divided by the market size, where market size is the sectoral production plus competing imports less exports, all measured at the NACE four digit sectoral level. The sectoral classification of imports is based on the four-digit product classification.

Import penetration: The ratio of the sectoral imports to the above defined market size.

Concentration: Herfindahl–Hirschmann index of concentration of total sales, measured at the NACE four digit sectoral level.

State owned firm: A firm where the central and local governments together owned more than 50% of the equity capital.

Foreign owned firm: Foreign investors owned more than 50% of the equity capital.

Foreign owned firm: Domestic private investors owned more than 50% of the equity capital.

Legend to the tables: Asterisks after the coefficients and test statistics indicate that the test is significant at 0.05 level ($*$) or at 0.01 level ($**$). Wald test is the joint test for no varying components in B. The null of the t-test on mark-up is that $\mu = 1$. $\overline{\mu}$ is the average mark-up in the sector.

Appendix B: Selected estimation results

Table 1: Estimated markup, 2 digits level, based on

	Value added				Sales total			
Nace	Random effects	R^2	Fixed effects	R^2	Random effects	R^2	Fixed effects	R^2
15	1.18 **	0.24	1.16 **	0.60	1.46 **	0.53	1.42 **	0.72
16	1.16	0.45	1.16	0.84	1.51 **	0.77	1.50 **	0.92
17	1.13 **	0.19	1.11 **	0.54	1.30 **	0.38	1.30 **	0.59
18	1.08 **	0.15	1.07 **	0.60	1.19 **	0.28	1.19 **	0.54
19	1.13 **	0.24	1.14 **	0.62	1.27 **	0.33	1.29 **	0.71
20	1.18 **	0.18	1.21 **	0.60	1.32 **	0.39	1.39 **	0.65
21	1.21 **	0.29	1.14 **	0.59	1.40 **	0.56	1.38 **	0.69
22	1.29 **	0.43	1.26 **	0.62	1.50 **	0.60	1.47 **	0.74
24	1.21 **	0.25	1.21 **	0.65	1.62 **	0.65	1.66 **	0.80
25	1.41 **	0.47	1.35 **	0.70	1.52 **	0.60	1.49 **	0.76
26	1.20 **	0.28	1.21 **	0.60	1.41 **	0.52	1.44 **	0.71
27	1.16 **	0.21	1.18 **	0.65	1.39 **	0.50	1.44 **	0.77
28	1.17 **	0.26	1.16 **	0.62	1.32 **	0.39	1.33 **	0.64
29	1.21 **	0.26	1.18 **	0.57	1.39 **	0.43	1.39 **	0.61
30	1.45 **	0.54	1.27 *	0.84	1.94 **	0.76	1.88 **	0.85
31	1.39 **	0.44	1.41 **	0.61	1.57 **	0.57	1.59 **	0.70
32	1.42 **	0.49	1.29 **	0.85	1.64 **	0.55	1.49 **	0.81
33	1.17 **	0.30	1.13 **	0.67	1.33 **	0.43	1.30 **	0.69
34	1.18 **	0.26	1.17 **	0.58	1.42 **	0.43	1.44 **	0.62
35	1.06	0.07	1.06	0.35	1.18 **	0.26	1.19 **	0.59
36	1.14 **	0.29	1.08 **	0.77	1.30 **	0.44	1.23 **	0.71
37	1.00	0.01	1.07	0.70	1.28 **	0.43	1.35 **	0.76

Table 2: Estimated markup, 3 digits level, based on

	Value added				Sales total			
Nace	Random effects	R^2	Fixed effects	R^2	Random effects	R^2	Fixed effects	R^2
151	1.13 **	0.28	1.12 **	0.66	1.39 **	0.52	1.34 **	0.75
153	1.32 **	0.32	1.38 **	0.73	1.58 **	0.61	1.63 **	0.82
154	0.99	0.13	1.06	0.27	1.27	0.24	1.42	0.33
155	1.06 **	0.15	1.04 *	0.59	1.24 **	0.48	1.19 **	0.69
156	1.24 **	0.27	1.26 **	0.55	1.54 **	0.62	1.51 **	0.77
157	1.52 **	0.57	1.43 **	0.72	1.91 **	0.73	1.82 **	0.81
158	1.16 **	0.23	1.12 **	0.65	1.39 **	0.51	1.36 **	0.72
159	1.12 **	0.12	1.11 *	0.51	1.49 **	0.44	1.51 **	0.67
160	1.16	0.45	1.16	0.84	1.51 **	0.77	1.50 **	0.92
171	1.02	0.21	1.01	0.52	1.34 **	0.32	1.35 *	0.50
172	1.04	0.12	1.04	0.51	1.14 **	0.32	1.14 **	0.74
173	1.12	0.48	1.15	0.61	1.15 **	0.63	1.12	0.75
174	1.09 **	0.22	1.08 **	0.55	1.23 **	0.40	1.26 **	0.57
175	1.12 **	0.25	1.11 **	0.54	1.22 **	0.44	1.21 **	0.58
176	1.96 **	0.64	1.79 *	0.83	2.34 **	0.78	2.19 *	0.89
177	1.15 **	0.29	1.13 *	0.59	1.75 **	0.57	1.77 **	0.77
182	1.08 **	0.15	1.07 **	0.60	1.19 **	0.28	1.19 **	0.55
183	1.11 **	0.57	1.11 **	0.90	1.35 **	0.74	1.30	0.84
191	0.93	0.37	1.03	0.79	1.04	0.14	1.12	0.90
192	1.10 **	0.37	1.08 **	0.84	1.22 **	0.37	1.17 **	0.76
193	1.13 **	0.24	1.15 **	0.60	1.28 **	0.34	1.30 **	0.71
201	1.30 **	0.49	1.29 **	0.70	1.53 **	0.67	1.53 **	0.80
202	1.20	0.24	1.54 *	0.58	1.47 **	0.49	1.65 **	0.85
203	1.15 **	0.09	1.20 **	0.61	1.24 **	0.27	1.35 **	0.60
204	1.23 **	0.35	1.22 **	0.56	1.31 **	0.50	1.32 **	0.66
205	1.10 **	0.18	1.11 **	0.57	1.26 **	0.36	1.31 **	0.54
211	1.20 **	0.30	1.21 *	0.87	1.27 *	0.46	1.31	0.79
212	1.23 **	0.30	1.14 **	0.56	1.43 **	0.60	1.40 **	0.71
221	1.30 **	0.48	1.32 **	0.72	1.61 **	0.68	1.67 **	0.82
222	1.28 **	0.42	1.25 **	0.60	1.45 **	0.58	1.40 **	0.71
223	0.83	0.31	0.82	0.72	1.07	0.19	1.06	0.65
241	1.13 **	0.12	1.16 **	0.64	1.59 **	0.66	1.70 **	0.81
242	1.52 **	0.58	1.47 **	0.86	2.26 **	0.91	2.25 **	0.95
243	1.17 **	0.19	1.14 *	0.47	1.59 **	0.68	1.60 **	0.76
244	1.15 **	0.18	1.11 *	0.60	1.60 **	0.71	1.64 **	0.82
245	1.55 **	0.62	1.52 **	0.79	1.90 **	0.73	1.79 **	0.85
246	1.23 **	0.31	1.19 **	0.75	1.46 **	0.61	1.42 **	0.79
251	1.21 **	0.45	1.14 **	0.86	1.45 **	0.63	1.33 **	0.80
252	1.44 **	0.48	1.39 **	0.70	1.53 **	0.60	1.52 **	0.76
261	1.05	0.08	1.06	0.36	1.28 **	0.36	1.34 **	0.54
262	1.18 **	0.33	1.20 **	0.54	1.39 **	0.45	1.46 **	0.57
263	1.76 **	0.76	1.76 **	0.97	1.63 **	0.90	1.62 **	1.00
264	1.14 **	0.15	1.18 **	0.64	1.47 **	0.50	1.51 **	0.74
265	1.56 **	0.65	4.29	0.73	1.48 **	0.79	1.75 *	0.90
266	1.31 **	0.50	1.30 **	0.72	1.49 **	0.70	1.47 **	0.80
268	1.16 **	0.31	1.20 **	0.69	1.35 **	0.50	1.41 **	0.84

Table 2: (Continued)

	Value added				Sales total			
Nace	Random effects	R^2	Fixed effects	R^2	Random effects	R^2	Fixed effects	R^2
265	1.56 **	0.65	4.29	0.73	1.48 **	0.79	1.75 *	0.90
266	1.31 **	0.50	1.30 **	0.72	1.49 **	0.70	1.47 **	0.80
268	1.16 **	0.31	1.20 **	0.69	1.35 **	0.50	1.41 **	0.84
271	1.09 **	0.37	1.11 *	0.68	1.38 **	0.72	1.46 **	0.92
272	1.16 *	0.30	1.17 *	0.92	1.28 **	0.58	1.27	0.69
273	1.10 *	0.00	1.20 **	0.93	1.21 *	0.07	1.44 **	0.84
274	1.48 **	0.51	1.42 *	0.64	1.66 **	0.78	1.59 **	0.91
275	1.15 **	0.33	1.14 **	0.70	1.34 **	0.53	1.35 **	0.69
281	1.14 **	0.20	1.15 **	0.61	1.25 **	0.31	1.28 **	0.59
282	1.08 **	0.10	1.07 *	0.58	1.18 **	0.18	1.24 **	0.52
283	1.43 **	0.60	1.51 **	0.85	1.63 **	0.67	1.81 **	0.89
284	1.28 **	0.52	1.43 **	0.83	2.30 **	0.82	2.68 **	0.94
285	1.22 **	0.35	1.18 **	0.62	1.39 **	0.47	1.37 **	0.70
286	1.24 **	0.48	1.26 **	0.69	1.42 **	0.55	1.43 **	0.74
287	1.22 **	0.34	1.18 **	0.65	1.45 **	0.57	1.39 **	0.73
291	1.38 **	0.52	1.35 **	0.68	1.60 **	0.66	1.60 **	0.79
292	1.32 **	0.35	1.28 **	0.62	1.58 **	0.53	1.59 **	0.69
293	1.16 **	0.22	1.16 **	0.47	1.30 **	0.44	1.31 **	0.62
294	1.06	0.13	1.01	0.65	1.16 **	0.19	1.13	0.50
295	1.08 **	0.13	1.06 **	0.55	1.21 **	0.33	1.20 **	0.53
297	1.40 **	0.51	1.43 **	0.71	1.51 **	0.57	1.55 **	0.70
300	1.45 **	0.54	1.27 *	0.84	1.94 **	0.76	1.88 **	0.85
311	1.09 **	0.26	1.08 **	0.45	1.26 **	0.43	1.26 **	0.55
312	1.38 **	0.38	1.37 **	0.54	1.73 **	0.57	1.74 **	0.69
313	1.00	0.12	0.98	0.48	1.30 **	0.32	1.51	0.50
314	1.45 **	0.76	1.28	0.94	2.04 **	0.90	2.12 **	0.95
315	1.22 **	0.48	1.25 **	0.67	1.35 **	0.60	1.35 **	0.75
316	1.71 **	0.61	1.73 **	0.73	1.86 **	0.68	1.86 **	0.79
321	1.22 **	0.29	1.24 **	0.67	1.34 **	0.40	1.36 **	0.73
322	2.11 **	0.79	1.53 **	0.93	2.58 **	0.81	2.06 **	0.90
323	1.15 **	0.32	1.17 **	0.61	1.30 **	0.31	1.31 **	0.68
331	1.20 **	0.40	1.15 **	0.67	1.39 **	0.61	1.36 **	0.71
332	1.10 **	0.22	1.09 **	0.68	1.21 **	0.29	1.21 **	0.65
333	1.99 **	0.72	1.58	0.80	2.77 **	0.85	1.61	0.93
334	1.11 **	0.37	1.10 *	0.61	1.23 **	0.39	1.25 **	0.61
341	1.01	0.00	1.17	0.86	1.40 *	0.16	1.83 *	0.86
342	1.26 **	0.33	1.25 *	0.53	2.01 **	0.72	1.91 **	0.79
343	1.19 **	0.33	1.16 **	0.60	1.32 **	0.41	1.31 **	0.60
352	1.24 **	0.53	1.22 **	0.65	1.27 **	0.64	1.24 **	0.77
353	1.13 **	0.88	1.12 **	0.95	1.25 **	0.75	1.20	0.81
355	1.44 **	0.89	1.41 **	0.94	1.71 **	0.87	1.74 **	0.92
361	1.11 **	0.26	1.06 **	0.79	1.26 **	0.41	1.19 **	0.71
362	1.12 *	0.51	1.13	0.75	1.26	0.52	1.24	0.80
364	1.05	0.11	1.02	0.74	1.60	0.49	1.43	0.68
366	1.40 **	0.69	1.30 **	0.85	1.57 **	0.77	1.53 **	0.84
371	0.96	0.14	1.05	0.69	1.25 **	0.44	1.37 **	0.72

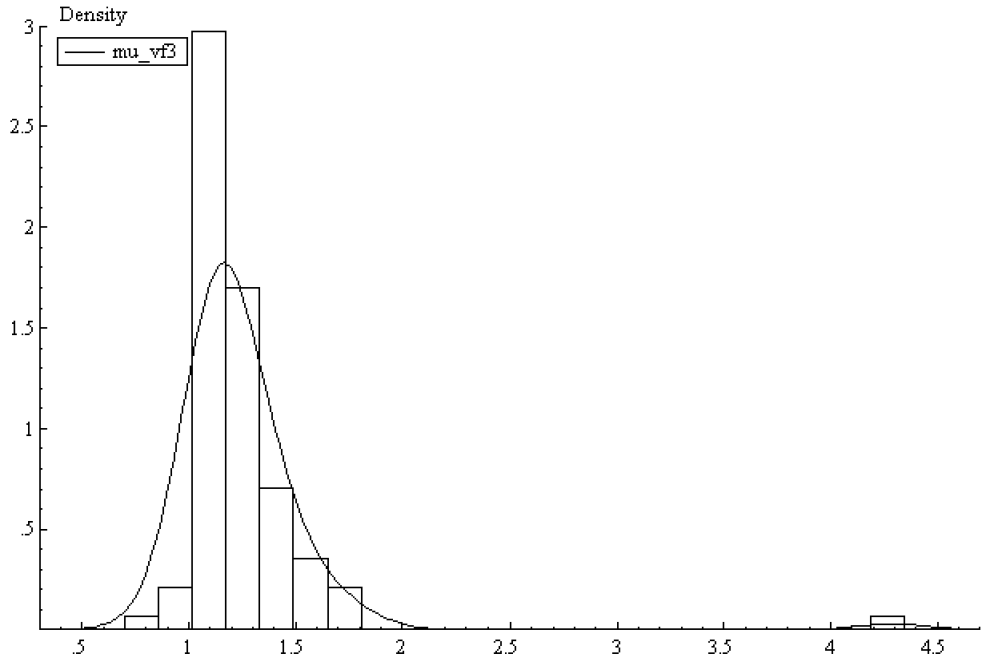

Figure 1. Histogram of markups estimated from value added at NACE3, fixed effects

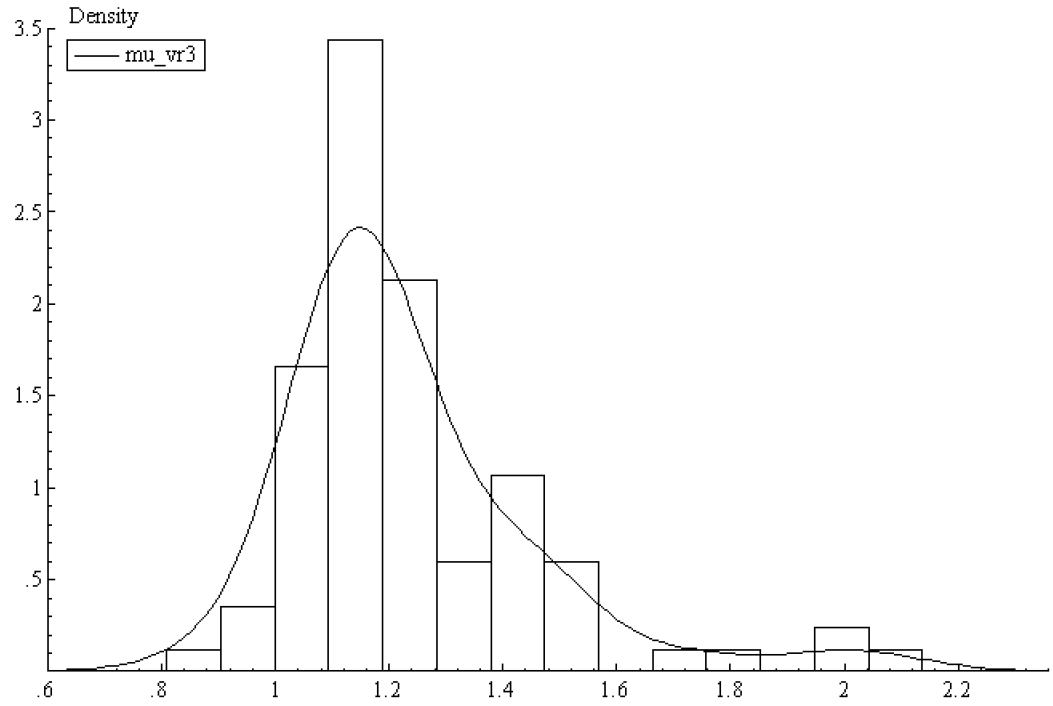

Figure 2. Histogram of markups estimated from value added at NACE3, random effects

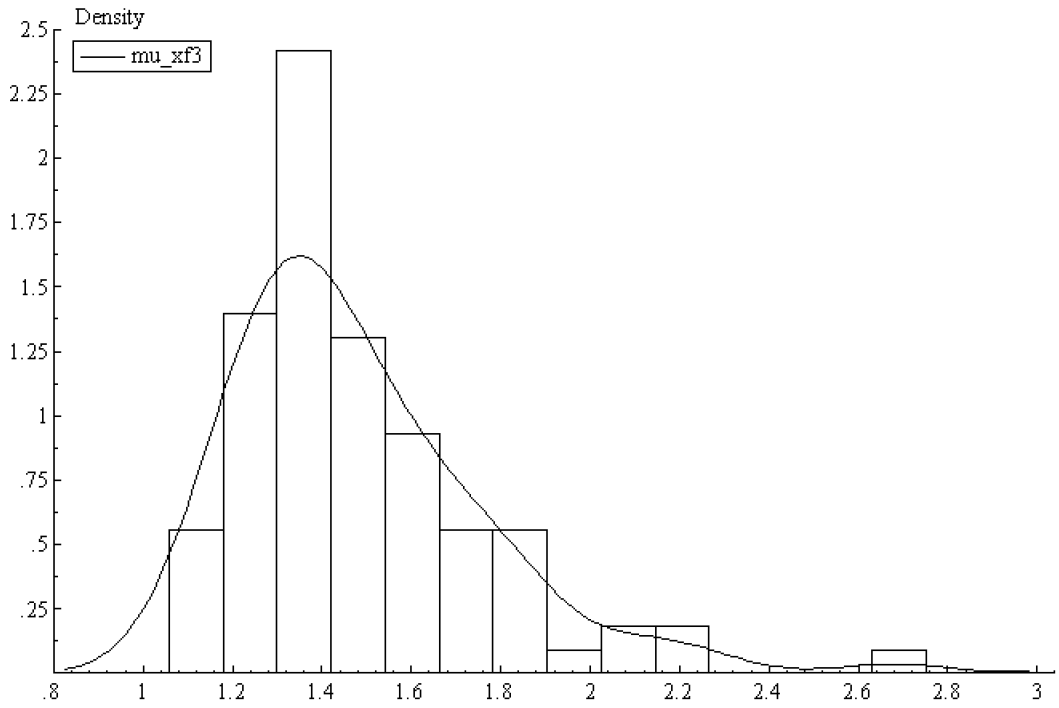

Figure 3. Histogram of markups estimated from sales at NACE3, fixed effects

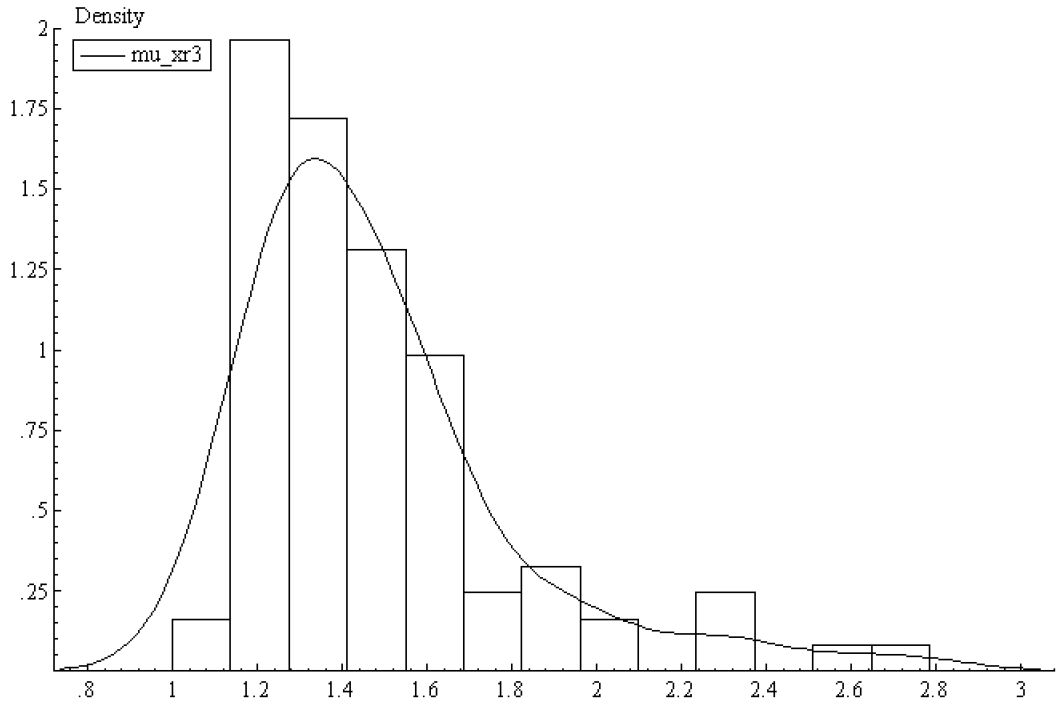

Figure 4. Histogram of markups estimated from sales at NACE3, random effects

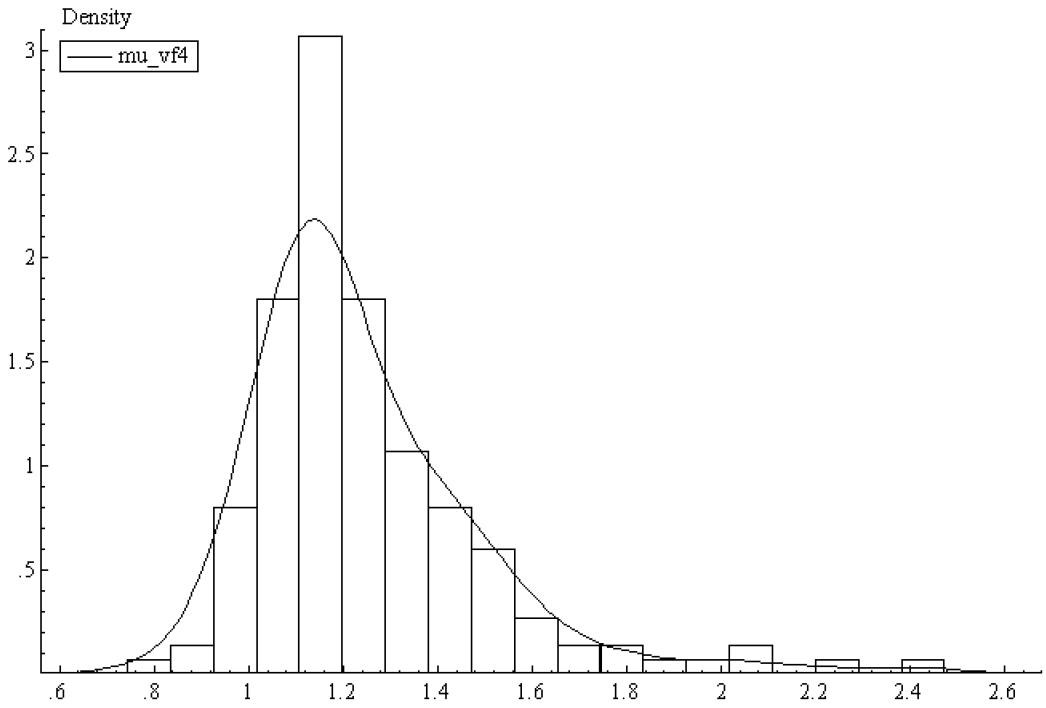

Figure 5. Histogram of markups estimated from value added at NACE4, fixed effects

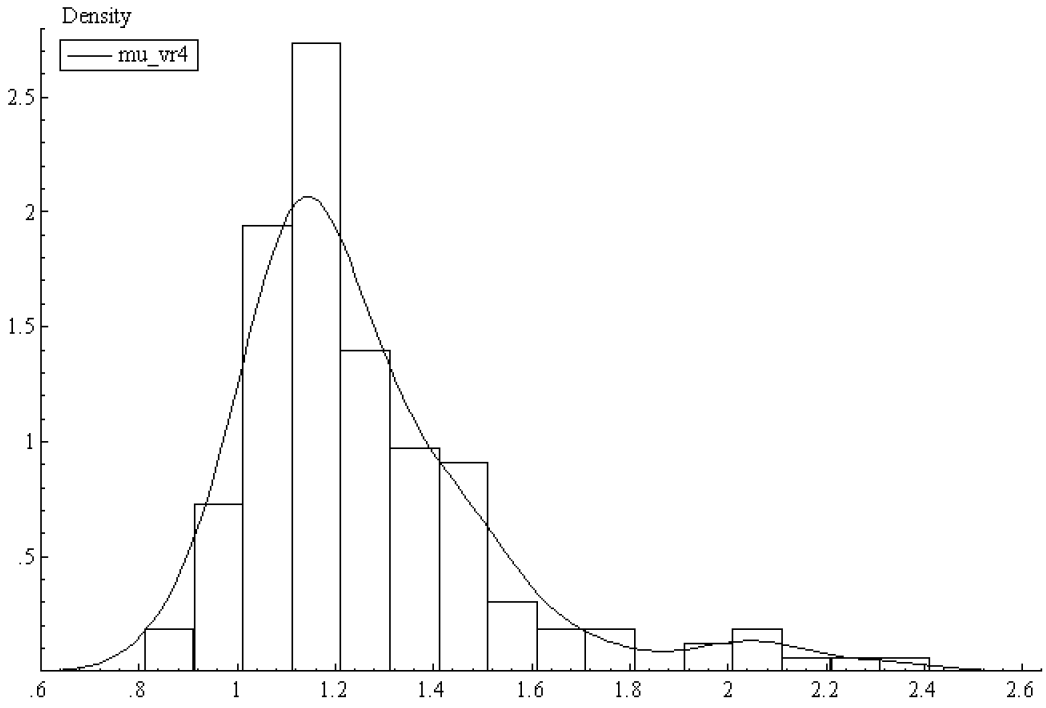

Figure 6. Histogram of markups estimated from value added at NACE4, random effects

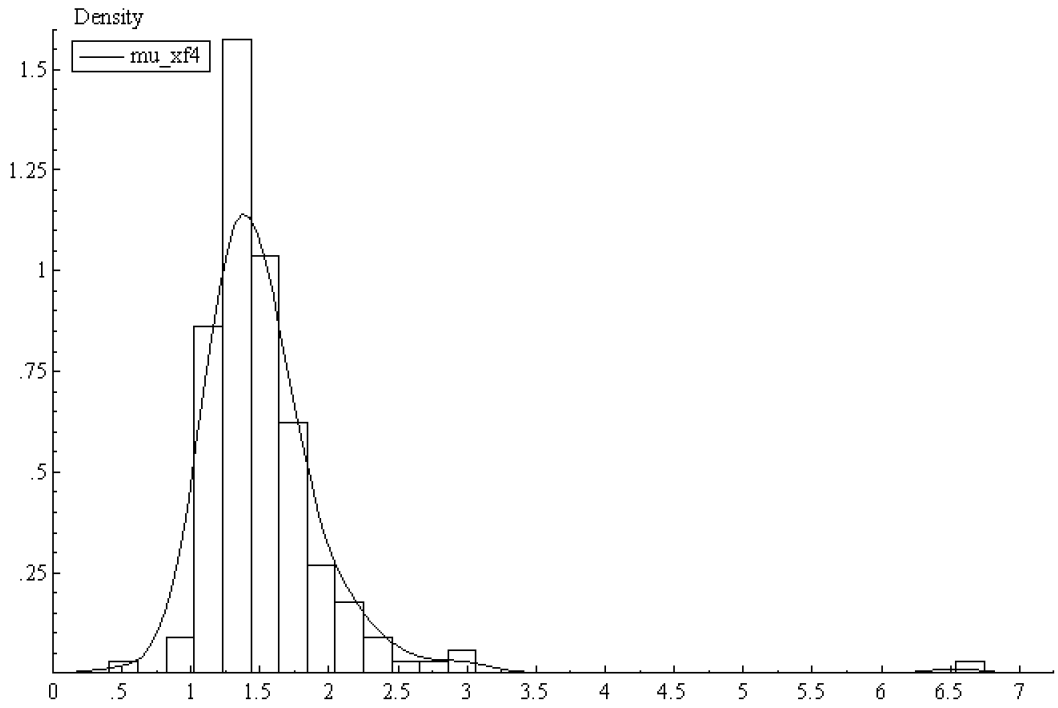

Figure 7. Histogram of markups estimated from sales at NACE4, fixed effects

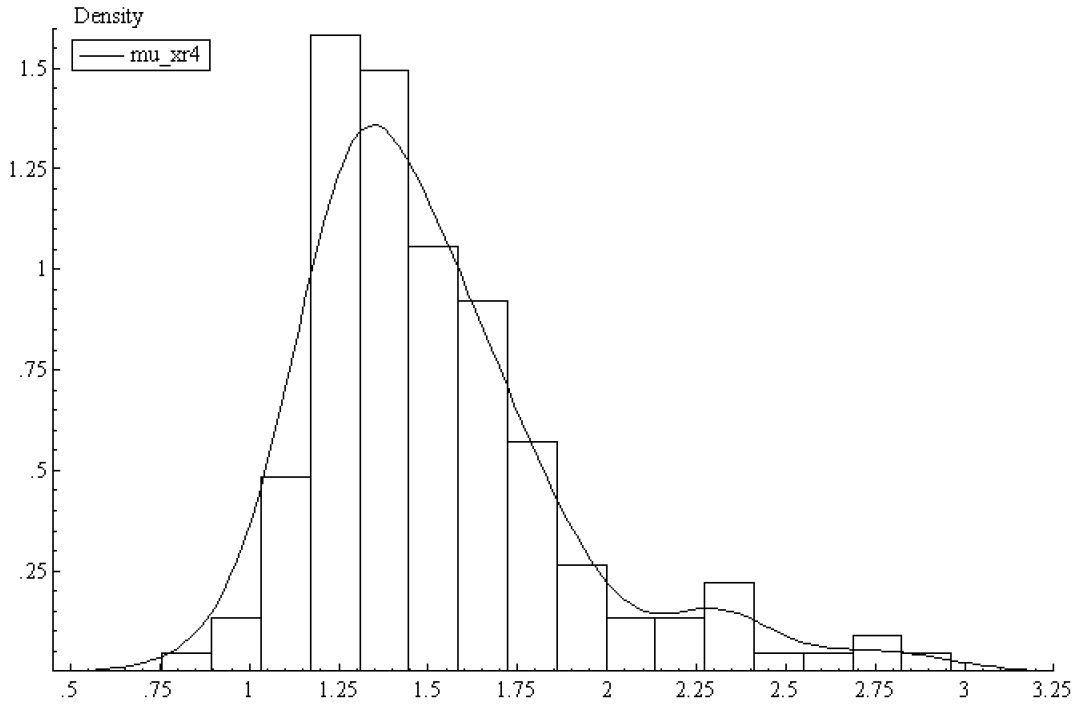

Figure 8. Histogram of markups estimated from sales at NACE4, random effects

Table 3: Summary of varying coefficient models with concentation variables and value added

Concentration var and model	constant	share$_{t-1}$	impp	conc	joint-F	$\overline{\mu}$	$\mu \neq 1$
hh for prod, rand.eff., nace 2	80.9	23.8	38.1	33.3	57.1	1.18	90.4
hh for prod, fixd.eff., nace 2	61.9	14.2	28.5	23.8	52.3	1.17	90.4
dist for prod, rand.eff., nace 2	76.1	19.0	23.8	23.8	42.8	1.29	90.4
dist for prod, fixd.eff., nace 2	61.9	14.2	19.0	14.2	38.1	1.03	95.2
top3 for prod, rand.eff., nace 2	71.4	23.8	38.1	28.5	57.1	1.21	95.2
top3 for prod, fixd.eff., nace 2	57.1	14.2	23.8	14.2	38.1	0.83	90.4
rel sd for prod, rand.eff., nace 2	71.4	28.5	23.8	52.3	61.9	1.40	85.7
rel sd for prod, fixd.eff., nace 2	66.6	19.0	28.5	33.3	47.6	1.36	90.4
hh for emp, rand.eff., nace 2	71.4	23.8	38.1	42.8	71.4	1.41	100.0
hh for emp, fixd.eff., nace 2	61.9	9.5	23.8	23.8	52.3	1.23	100.0
dist for emp, rand.eff., nace 2	71.4	23.8	28.5	38.1	52.3	1.25	100.0
dist for emp, fixd.eff., nace 2	61.9	14.2	19.0	23.8	38.1	1.19	100.0
hh for exports, rand.eff., nace 2	71.4	23.8	28.5	57.1	71.4	1.16	85.7
hh for exports, fixd.eff., nace 2	61.9	14.2	28.5	42.8	61.9	1.16	100.0
1/No. firms, rand.eff., nace 2	76.1	23.8	38.1	33.3	66.6	1.04	76.1
1/No. firms, fixd.eff., nace 2	57.1	14.2	23.8	33.3	57.1	1.16	95.2
hh for prod, rand.eff., nace 3	80.9	14.2	42.8	42.8	52.3	1.18	95.2
hh for prod, fixd.eff., nace 3	71.4	0.0	23.8	23.8	38.1	1.20	90.4
dist for prod, rand.eff., nace 3	70.0	10.0	20.0	30.0	50.0	1.24	95.0
dist for prod, fixd.eff., nace 3	65.0	0.0	15.0	25.0	40.0	1.25	100.0
top3 for prod, rand.eff., nace 3	76.1	14.2	33.3	38.1	42.8	1.31	80.9
top3 for prod, fixd.eff., nace 3	57.1	0.0	23.8	14.2	23.8	1.29	100.0
rel sd for prod, rand.eff., nace 3	61.9	14.2	33.3	52.3	52.3	1.41	95.2
rel sd for prod, fixd.eff., nace 3	52.3	0.0	23.8	28.5	42.8	1.49	85.7
hh for emp, rand.eff., nace 3	80.9	14.2	47.6	42.8	61.9	1.12	90.4
hh for emp, fixd.eff., nace 3	66.6	0.0	23.8	14.2	38.1	1.20	100.0
dist for emp, rand.eff., nace 3	75.0	10.0	35.0	50.0	60.0	0.92	90.0
dist for emp, fixd.eff., nace 3	65.0	0.0	15.0	35.0	50.0	1.24	100.0
hh for exports, rand.eff., nace 3	71.4	14.2	42.8	57.1	76.1	1.49	76.1
hh for exports, fixd.eff., nace 3	66.6	4.7	28.5	42.8	47.6	1.24	85.7
1/No. firms, rand.eff., nace 3	71.4	14.2	19.0	47.6	57.1	1.18	90.4
1/No. firms, fixd.eff., nace 3	66.6	4.7	28.5	23.8	42.8	1.07	80.9
hh for prod, rand.eff., nace 4	58.6	20.0	45.3	42.6	62.6	1.01	77.3
hh for prod, fixd.eff., nace 4	38.6	13.3	29.3	29.3	46.6	0.88	73.3
dist for prod, rand.eff., nace 4	52.9	16.1	44.1	41.1	61.7	1.24	76.4
dist for prod, fixd.eff., nace 4	47.0	8.8	30.8	33.8	51.4	2.30	69.1
top3 for prod, rand.eff., nace 4	48.0	18.6	49.3	44.0	65.3	0.77	70.6
top3 for prod, fixd.eff., nace 4	33.3	12.0	36.0	30.6	50.6	0.59	74.6
rel sd for prod, rand.eff., nace 4	46.6	18.6	45.3	40.0	65.3	-3.81	70.6
rel sd for prod, fixd.eff., nace 4	37.3	17.3	32.0	26.6	50.6	0.38	76.0
hh for emp, rand.eff., nace 4	48.0	17.3	48.0	32.0	61.3	0.30	76.0
hh for emp, fixd.eff., nace 4	37.3	12.0	32.0	21.3	49.3	1.17	73.3
dist for emp, rand.eff., nace 4	52.9	11.7	52.9	33.8	60.2	1.27	79.4
dist for emp, fixd.eff., nace 4	41.1	10.2	36.7	20.5	47.0	1.39	77.9
hh for exports, rand.eff., nace 4	53.3	16.0	42.6	40.0	62.6	-0.45	80.0
hh for exports, fixd.eff., nace 4	44.0	10.6	28.0	34.6	50.6	1.00	74.6
1/No. firms, rand.eff., nace 4	57.3	18.6	45.3	37.3	64.0	1.30	81.3
1/No. firms, fixd.eff., nace 4	46.6	13.3	28.0	29.3	54.6	0.50	80.0

Note: Figures are percentages of tests significant at 5%, except for $\overline{\mu}$ which is the mean of sectoral mark-ups.

Table 4: Summary of varying coefficient models with concentation variables and sales

Concentration var and model	constant	share$_{t-1}$	impp	conc	joint-F	$\overline{\mu}$	$\mu \neq 1$
hh for prod, rand.eff., nace 2	90.4	23.8	42.8	28.5	61.9	1.47	100.0
hh for prod, fixd.eff., nace 2	80.9	14.2	33.3	23.8	52.3	1.51	100.0
dist for prod, rand.eff., nace 2	90.4	23.8	38.1	33.3	61.9	1.50	95.2
dist for prod, fixd.eff., nace 2	80.9	14.2	23.8	23.8	42.8	1.53	95.2
top3 for prod, rand.eff., nace 2	80.9	28.5	38.1	28.5	61.9	1.39	85.7
top3 for prod, fixd.eff., nace 2	76.1	14.2	38.1	19.0	47.6	2.28	85.7
rel sd for prod, rand.eff., nace 2	76.1	42.8	42.8	47.6	76.1	2.50	90.4
rel sd for prod, fixd.eff., nace 2	71.4	19.0	47.6	38.1	52.3	1.43	85.7
hh for emp, rand.eff., nace 2	85.7	19.0	42.8	33.3	61.9	1.41	95.2
hh for emp, fixd.eff., nace 2	80.9	14.2	42.8	9.5	42.8	1.35	95.2
dist for emp, rand.eff., nace 2	80.9	19.0	38.1	33.3	61.9	1.44	100.0
dist for emp, fixd.eff., nace 2	76.1	14.2	28.5	14.2	42.8	1.27	90.4
hh for exports, rand.eff., nace 2	90.4	28.5	42.8	47.6	71.4	1.10	90.4
hh for exports, fixd.eff., nace 2	76.1	19.0	33.3	38.1	57.1	1.28	100.0
1/No. firms, rand.eff., nace 2	90.4	23.8	42.8	33.3	66.6	1.50	100.0
1/No. firms, fixd.eff., nace 2	80.9	14.2	42.8	38.1	52.3	1.47	90.4
hh for prod, rand.eff., nace 3	76.1	14.2	23.8	38.1	52.3	1.48	100.0
hh for prod, fixd.eff., nace 3	76.1	14.2	19.0	19.0	38.1	-0.09	95.2
dist for prod, rand.eff., nace 3	80.0	10.0	20.0	35.0	45.0	1.37	95.0
dist for prod, fixd.eff., nace 3	75.0	5.0	20.0	25.0	40.0	1.35	90.0
top3 for prod, rand.eff., nace 3	71.4	14.2	23.8	33.3	42.8	2.21	80.9
top3 for prod, fixd.eff., nace 3	71.4	14.2	28.5	19.0	33.3	1.57	85.7
rel sd for prod, rand.eff., nace 3	61.9	19.0	33.3	47.6	57.1	1.38	66.6
rel sd for prod, fixd.eff., nace 3	71.4	9.5	19.0	38.1	47.6	2.92	76.1
hh for emp, rand.eff., nace 3	85.7	19.0	28.5	42.8	57.1	1.24	90.4
hh for emp, fixd.eff., nace 3	71.4	9.5	14.2	33.3	28.5	1.29	90.4
dist for emp, rand.eff., nace 3	85.0	15.0	30.0	40.0	60.0	1.46	90.0
dist for emp, fixd.eff., nace 3	70.0	5.0	15.0	35.0	30.0	1.47	90.0
hh for exports, rand.eff., nace 3	66.6	19.0	28.5	38.1	47.6	1.15	95.2
hh for exports, fixd.eff., nace 3	66.6	14.2	14.2	33.3	38.1	1.36	85.7
1/No. firms, rand.eff., nace 3	90.4	19.0	28.5	28.5	47.6	1.48	95.2
1/No. firms, fixd.eff., nace 3	71.4	9.5	14.2	23.8	33.3	1.56	95.2
hh for prod, rand.eff., nace 4	54.6	18.6	26.6	33.3	53.3	1.08	77.3
hh for prod, fixd.eff., nace 4	48.0	10.6	25.3	26.6	46.6	1.98	69.3
dist for prod, rand.eff., nace 4	54.4	16.1	32.3	35.2	55.8	1.04	72.0
dist for prod, fixd.eff., nace 4	48.5	7.3	20.5	26.4	44.1	1.98	66.1
top3 for prod, rand.eff., nace 4	37.3	16.0	29.3	29.3	50.6	2.00	64.0
top3 for prod, fixd.eff., nace 4	29.3	10.6	20.0	22.6	41.3	-0.31	76.0
rel sd for prod, rand.eff., nace 4	44.0	17.3	30.6	34.6	56.0	1.47	74.6
rel sd for prod, fixd.eff., nace 4	37.3	9.3	25.3	29.3	46.6	2.14	70.6
hh for emp, rand.eff., nace 4	58.6	17.3	30.6	22.6	52.0	2.35	74.6
hh for emp, fixd.eff., nace 4	44.0	10.6	26.6	16.0	38.6	0.38	69.3
dist for emp, rand.eff., nace 4	57.3	16.1	29.4	26.4	51.4	0.61	79.4
dist for emp, fixd.eff., nace 4	41.1	8.8	22.0	16.1	35.2	0.14	80.8
hh for exports, rand.eff., nace 4	49.3	21.3	36.0	22.6	50.6	1.92	77.3
hh for exports, fixd.eff., nace 4	42.6	10.6	25.3	22.6	45.3	1.38	74.6
1/No. firms, rand.eff., nace 4	62.6	16.0	30.6	25.3	46.6	1.80	78.6
1/No. firms, fixd.eff., nace 4	53.3	9.3	26.6	24.0	40.0	2.19	72.0

Note: Figures are percentages of tests significant at 5%, except for $\overline{\mu}$ which is the mean of sectoral mark-ups.

Table 5: Estimated markup, varying coefficients, random effects

Nace	constant	dom.priv.	foreign	rel sd of sales	R^2	Wald-test	$\overline{\mu}$
15	0.13 **	-0.06 **	-0.08 **	0.02	0.24	26.82 **	1.13 **
17	0.09 **	-0.09 **	-0.09 **	0.02 **	0.23	24.76 **	1.07 **
18	0.17 **	-0.01	-0.03	-0.02 **	0.16	14.99 **	1.17 **
19	0.01	-0.04	0.03	0.03	0.26	6.42	1.05 **
20	0.22 **	-0.16 **	-0.02	-0.02	0.20	10.31 *	1.24 **
21	0.26 **	0.03	0.17 **	-0.04 *	0.40	27.45 **	1.47 **
22	0.19 **	-0.05	0.08 **	0.01	0.44	13.76 **	1.26 **
24	0.08	-0.03	0.01	0.04 *	0.25	5.91	1.10 **
25	0.74 **	-0.05	-0.01	-0.15 **	0.52	61.46 **	-1.25
26	0.33 **	-0.05 *	0.05	-0.07 **	0.35	45.41 **	1.47 **
27	-0.01	-0.01	0.08	0.05 **	0.27	15.99 **	1.04 **
28	0.25 **	-0.09 **	0.03	-0.03 **	0.29	51.17 **	1.30 **
29	0.21 **	-0.11 **	-0.04	-0.01	0.28	21.62 **	1.22 **
30	0.50 **	-0.67 **	-0.40 **	0.03	0.66	25.16 **	1.48 **
31	0.50 **	-0.05	0.12 **	-0.06 **	0.57	134.16 **	1.88 **
32	-0.31 **	0.15 **	0.22 **	0.10 **	0.65	102.81 **	0.70
33	0.33 *	-0.08 **	0.01	-0.04	0.33	9.53 *	1.44 **
34	0.23 *	-0.22 **	-0.05	0.00	0.35	29.43 **	1.21 **
35	-0.06	0.07	0.21 *	0.04	0.13	6.15	1.01
36	0.04	0.15 **	0.01	0.02	0.38	40.81 **	1.09 **
37	0.53	0.22	-0.34 **	-0.18	0.40	13.66 **	3.01 *

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