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Are the Determinants of Markup Size Industry-Specific? The Case of Slovenian Manufacturing Firms

Summary: The aim of this paper is to identify factors that affect the pricing policy in Slovenian manufacturing firms in terms of the markup size and, most of all, to explicitly account for the possibility of differences in pricing procedures among manufacturing industries. Accordingly, the analysis of the dynamic panel is carried out on an industry-by-industry basis, allowing the coefficients on the markup determinants to vary across industries. We find that the oligopoly theory of markup determination for the most part holds for the manufacturing sector as a whole, although large variability in markup determinants exists across industries within the Slovenian manufacturing. Our main conclusion is that each industry should be investigated separately in detail in order to assess the precise role of markup factors in the markup-determination process.

Key words: Industry, Manufacturing, Markup determinants, Slovenia.

JEL: L11, L60, C33.

A huge volume of theoretical and empirical literature has sought to identify the determinants of firms' and industries' markups that firms add to production costs when setting the prices of their products. In Industrial economics the traditional Structure Conduct Performance approach focuses on industry characteristics, while the more dynamic persistence-of-profit approach examines the time-series behaviour of profitability at the firm level. The strategic management literature emphasises the role of internal resources specific to the firm as determinants of variations in its performance. On the other hand, in non-mainstream Post-Keynesian economics it is argued that the markup size is mainly the outcome of a firm's strategic orientation towards growth.

In spite of the complexity of the pricing decision-making process regarding the markup size, authors largely agree that the factors determining the markup size can be classified in three general groups. First, the characteristics of a firm, usually called firm-specific factors, are connected to the firm's market power (Stephen Martin 2001), its cost efficiency and/or productivity of its production factors and to the technological characteristics of a firm's production process (John Sutton 2001) and are mainly a result of strategies accepted and pursued by the firm in order to achieve its goal, i.e. long-run profit maximisation and growth (Stephen P. Dunn 2002). The second and third groups, i.e. industry-specific and environmental markup determinants, derive from the external environment the firm faces when setting the price.

The power a firm exerts over the price and markup of its products thus depends on the nature of the competition in a particular industry, the competition among industries and groups as well as on the relevant legislation, government regulation and intervention. Industry-specific factors represent characteristics of the industry a particular firm is a member of, with regard to the concentration of firms, entry barriers, product differentiation (Martin 2001; Bernardette Andreosso and David Jacobson 2005) and technological characteristics of the industry's production (Sutton 2001; Lynne Pepall, Dan Richards, and George Norman 2008). Industry factors determine the average power firms within a particular industry exert over the price and the markup of their product(s) and, as such, impact on the average industry markup (Keith Cowling and Michael Waterson 1976). On the other hand, firm-specific factors determine deviations in terms of the performance of a particular firm compared to the industry-average performance. Although according to theory the competitive process should eliminate profit differentials between different firms, industries and countries in the long-run, this does not seem to be observed in the real world. Since the contributions of Dennis C. Mueller (1990), there has been growing literature that confirms the persistence-of-profit hypothesis (see review in Nina Ponikvar 2008). The other group of factors external to the firm are characteristics of the general economic and institutional environment, i.e. environmental and institutional factors. Environmental and institutional factors consist of any governmental antitrust policy, the role of workers' and employers' organisations as well as general economic trends (Massimo Motta 2004).

Recent findings suggest that, even in supposedly more homogenous manufacturing industries, the influence of particular markup determinants differs among different industries within manufacturing (Marcos A. M. Lima and Marcelo Resende 2004; Simon Feeny, Mark Harris, and Mark Rogers 2005). These studies also reveal differences in the sets of factors determining prices and markups and even larger discrepancies among industries in the weights these factors carry for pricing and the markup size. Thus, the estimates of aggregate models might conceal the true relationships between the investigated variables.

The aim of this paper is to provide a deeper understanding of how firm-specific factors, industry-specific factors and characteristics of the general economic and institutional environment affect the pricing policy of Slovenian manufacturing firms in terms of the markup size and, most of all, to explicitly account for the possibility of differences in pricing procedures among manufacturing industries. Because firm-specific factors determine the deviations of a firm's markup from the average industry markup and express the competitive position of a particular firm with regard to its rivals, we hypothesise that across different industries similar factors are important for the size of a firm's markup relative to its rivals. On the other hand, industry-specific factors, i.e. industry characteristics, determine the average industry-level markup. We therefore hypothesise that the importance and thus impact of particular markup factors on the markup size differs across industries.

Accordingly, the analysis is carried out on an industry-by-industry basis, allowing the coefficients on the markup determinants to vary across industries, in order to test the hypothesis that markup determinants and their impact on a firm's markup vary across industries. This represents a departure from most previous studies in which models of markup determination are usually estimated for the whole sample, for all industries in a single joint model, meaning that the coefficients on the determinants of profitability or markup are restricted to be constant across industries. The findings about differences in the relative importance of particular markup determinants across industries are very important from the policy-making point of view.

Another important contribution of this paper is that, unlike most studies on firms' performances and markup size, which restrict the sample to larger firms, it employs a dataset that covers the whole population of manufacturing firms registered in Slovenia. This is particularly important for studying the industry-specific factors' impact on the markup size.

1. Data and Methodology

1.1 Data

The primary data source for our study is the database of firms' financial statements collected by the Agency of the Republic of Slovenia for Public Legal Records and Related Services, which covers the whole population of Slovenian manufacturing firms, and is extended with some internal databases of the Statistical Office of the Republic of Slovenia. The database employed in our analysis after all necessary time lags have been considered contains 20,466 observations for 4,470 manufacturing firms for the 1994-2004 period. A firm's industry membership is defined according to the five-digit Classification of Economic Activities in the European Community (NACE) and all financial data are in fixed prices from the year 2000. The panel nature of the firm-level data allows us to combine inter-temporal as well as inter-firm information efficiently, to control for unobservable firm-specific variables by focusing on differences over time (Richard Schmalensee and Robert D. Willig 1989) and to efficiently overcome the econometric problems. In addition, it enables us to test the time persistence and to study the variability of markups over time.

1.2 Model Specification

A markup of firm i from industry j in year t is determined by general economic trends and the economic environment γ_t, industry-specific factors η_{jt} and firm-specific factors ε_{ijt} as:

$$markup_{ijt} = f(\gamma_t, \eta_{jt}, \varepsilon_{ijt})$$

where subscript i refers to a firm, j to industries according to the 5-digit NACE classification of industries and t to a particular year, respectively. Thus, the markup of firm i from industry j in year t is modelled as a function of firm i's and industry j's contemporaneous characteristics and the characteristics of the economic environment in year t ($\mathbf{X'}_{it}$, $\mathbf{X'}_{jt}$ and $\mathbf{X'}_{t}$, respectively) with unknown weights β, γ and θ and of a lagged dependent variable with an unknown weight δ.

$$y_{it} = \delta y_{it-1} + \mathbf{X}'_{it}\,\boldsymbol{\beta} + \mathbf{X}'_{jt}\,\boldsymbol{\gamma} + \mathbf{X}'_{t}\,\boldsymbol{\theta} + u_{it} \qquad i = 1,...,N;\ j = 1,...,J;\ t = 1,...,T$$

where y_{it} is the observation on the dependent variable for an individual i in time period t, δ is a scalar, $\mathbf{X}'_{it}$, $\mathbf{X}'_{jt}$ and $\mathbf{X}'_{t}$ are 1 x K vectors of explanatory variables with unknown K x 1 coefficient vectors β, γ and θ. Further, a dynamic relationship can be characterised by the presence of a lagged dependent variable among the regressors[1]. u_{it} is composed of $u_{it}=\mu_i+\lambda_t+\nu_{it}$, where μ_i is an unobserved individual-specific time-invariant effect which allows for heterogeneity in the means of the average markup across individual firms, λ_t is a time-specific individual-invariant effect and ν_{it} is a disturbance term.

We apply a firm-level model of markup determination with a specification that includes what theory and empirical evidence propose to be (i) firm-specific factors such as firm's planned growth, the capital intensity of its production, utilisation of its production capacities, its market share and export orientation, the productivity of its labour and input prices; (ii) industry-specific markup determinants such as seller's concentration, penetration of imports, industry's average export orientation, capacity utilisation and its capital intensity of production; and (iii) some characteristics of overall and industry economic dynamics, measured with a set of year dummy variables.

The dependent variable in our model is markup, as proposed by Mihal Kalecki (1954) and defined as the ratio between the price and a unit's direct cost of production, but by using sales, inventories and costs. When multiplied by the quantity produced, the firm's $\mathbf{markup}_{ijt}$ is thus defined as the ratio between a firm's revenues and direct (variable) costs as:

$$markup_{ijt} = \frac{\text{value of sales}_{\text{ijt}} + \Delta\ \text{inventories}_{\text{ijt}}}{\text{payroll}_{\text{ijt}} + \text{cost of material}_{\text{ijt}}}$$

The anticipated relationships of listed factors on the size of firms' markups and the definitions of variables are specified as follows. First of all, it is expected that current markups will be heavily influenced by the past realisation of such. Econometrically, this means the inclusion of a lagged dependent variable in the specification. Next, a simple oligopoly model of firm performance implies a positive relationship between market share and the markup size. The empirical literature shows that the relationship is very likely not linear (see Ponikvar 2008 for a review). Market share $\boldsymbol{MS_{ijt}}$ is defined as the share of a firm's domestic market sales in the 5-digit NACE industry annual sales (the home sales of domestic firms in an industry plus imports in industry j). A firm's growth plans, induced by the expected market demand, are expected to influence the size of the firm's markup since the markup is the source of generating profits to finance growth (see the survey in Glenn Hubbard 1998). Planned growth $\boldsymbol{GR_{ijt}}$ is measured by a one-year lead of asset growth as it is presumed that all the firm's plans are fully carried into effect in the next year.

[1] For the purpose of clarity, the lags and expected values of some variables are not explicitly included in the general model but are considered in detail in the specifications of the empirical model.

Since several arguments speak in favour of the positive capacity utilisation-markup link (Nick Bennenbroek and Richard Ian Harris 1995) on firm and industry levels, firm- and industry-level capacity utilisation $\boldsymbol{CU_{ijt}}$ and $\boldsymbol{indCU_{jt}}$ are also included among regressors and defined as the ratio between the actual and potential volume of sales of a firm[2].

More productive firms are able to charge higher markups due to their lower unit costs at given prices of inputs. We thus measure a firm's labour productivity $\boldsymbol{Lprod_{ijt}}$ as the value added per employee in real terms. On the other hand, in competitive circumstances higher production factor prices on the firm level, leading to both higher production costs and higher unit costs, result in lower markups. Because labour costs are not covered by the markup, a firm with higher labour costs can achieve lower markups at a given product price. Since in our definition of the markup the cost of capital is included among overheads, it is expected that a higher capital price leads to a higher cost of capital and therefore to a higher markup at a given level of sales. The price of labour on the firm level $\boldsymbol{w_{ijt}}$ is calculated by as a ratio between real annual gross wages and the average number of employees for each firm and the price of capital $\boldsymbol{r_{ijt}}$ is defined as the sum of depreciation and the cost of financing relative to the sum of fixed assets and inventory.

The share of exports in total sales is presumably higher in industries that face a more favourable environment in foreign markets, which consequently is also reflected in higher average industry-level markups. Furthermore, firms that sell a larger share of their output in foreign markets compared to their rivals are more likely to be disciplined by foreign competition and thus charge lower markups within their prices compared to the industry average (Martin 2001). A firm's and industry's export orientation $\boldsymbol{EXor_{ijt}}$ and $\boldsymbol{indEXor_{jt}}$ are presented by the share of revenues from exports in total annual sales. Import penetration $\boldsymbol{IMpen_{jt}}$ is defined as the share of industry's import in industry's sales in the domestic market (the home sales of domestic firms plus imports). Import is defined as the value of imported products, which belong to a particular 3-digit NACE industry according to the Statistical classification of products by activity (CPA). Since the import is defined according to the CPA, the availability of imported products is expected to exert downward pressure on markups via the increased number of sellers and lower concentration of sellers (Natalie Chen, Jean Imbs, and Andrew Scott 2007).

The capital intensity of a firm's production $\boldsymbol{KI_{ijt}}$ and the capital intensity of production on industry level $\boldsymbol{indKI_{jt}}$ is calculated as the ratio of total fixed assets to the number of employees. Firms and industries with a higher capital intensity of production are expected to have higher markups due to the higher costs of capital that have to be covered by the (gross) markup. The industry's capital intensity of production acts also as an entry barrier (Henk-Jen Brinkman 1999).

The included sectoral business cycle variable is the index of industrial production $\boldsymbol{indIIP_{jt}}$ at the 2-digit NACE level. To control for other industry-specific effects that are not accounted for by the specified regressors, we include industry dummies

[2] Potential sales of firm i (industry j) are a product of the highest existing ratio between sales and production capacities (fixed assets) in the period 1994 to 2004 and the production capacities of firm i (industry j) in year t.

at the 2-digit NACE level. To account for the time effect, covering changes in the institutional and general economic environment, we add a set of ***year dummy*** variables.

Our model is therefore specified as:

$$markup_{ijt} = \alpha + \beta_1 markup_{ij,t-1} + \beta_2 MS_{it} + \beta_3 MSsq_{it} + \beta_4 EXor_{it} + \beta_5 GRa_{i,t+1} + \beta_6 Lprod_{it} + \beta_7 w_{it} + \\ + \beta_8 r_{it} + \beta_9 KI_{it} + \beta_{10} CU_{it} + \beta_{11} number_{jt} + \beta_{12} H_{jt} + \beta_{13} Hsq_{jt} + \beta_{14} IMpen_{jt} + +\beta_{15} indCU_{jt} + \\ + \beta_{16} indKI_{jt} + \beta_{17} indEXor_{jt} + \sum \beta_{18.jt} local\_cycle_{jt} + \sum \beta_{19.t} aggregate\_cycle + u_{it}$$

where subscript i refers to a firm, j to industries according to the 5-digit NACE industry classification and t to a particular year, respectively.

We estimate the model first on the whole sample of firms, for all manufacturing industries in a single joint model. As mentioned, the estimation on the aggregate level, where the coefficients are assumed to be constant across a wide range of manufacturing industries, may mask the idiosyncrasies of individual industries since a strong negative effect of a particular regressor on the markup in one manufacturing industry may offset a positive effect in another. If the direction and strength of the impacts of markup determinants vary across various manufacturing industries as claimed by Feeny, Harris, and Rogers (2005), it is important to ensure that the analysis is carried out on an industry-by-industry basis. By estimating the model separately for each of the analysed industries we can establish: (a) the array of factors that determine the markup in each of the analysed industries; and (b) whether the coefficients on the determinants of markup vary across industries. Accordingly we estimate the markup model separately for the 2-digit NACE section D Slovenian manufacturing industries with more than 50 firms during the investigated period besides the joint model.

1.3 Methodology

The lagged dependent variable among regressors complicates the application of the markup panel since y_{it} is a function of μ_i and it thus immediately follows that $y_{i,t-1}$ is also a function of μ_i. Therefore, $y_{i,t-1}$, a right-hand side regressor in the model is correlated with the error term and the OLS estimator is thus biased. Further, the usual panel data techniques cannot be used in our case since they are biased and inconsistent as $N \rightarrow \propto$ and finite T in the dynamic setting. In addition, the fact that the specification of models includes firm-specific variables can also imply the possibility of endogeneity arising from individual effects, more precisely from the fact that firm-level variables are likely to be correlated with unobserved firm-specific effects μ_i. Besides, the possibility of simultaneity bias should also be considered as, according to the theoretical origins of the SCP paradigm, some fundamental variables in the model of firm performance (e.g. markup, concentration, product differentiation) are jointly determined (Donald A. Hay and Derek J. Morris 1991) and as such do not satisfy the zero-conditional-mean assumption. In our case, the most apparent possible source of endogeneity among the regressors are sellers' concentration, market share, import penetration, export orientation, etc.

These issues prevent the standard procedures for estimating panel data models being consistent and/or efficient. Manuel Arellano and Stephen Bond (1991) propose the Generalised Method of Moments procedure (hereinafter "AB GMM") which offers a large feasible instrument set by exploring instruments motivated by the moment conditions. Because of the presence of heteroscedasticity in the model, a two-step procedure is used. The consistency of the Arellano Bond GMM estimator hinges heavily on the assumption that the $E(\nu_{it}\nu_{i(t-2)}) = 0$. $E(\nu_{it}\nu_{i(t-1)})$ need not be zero since the ν_{it} are differences of serially uncorrelated errors. Arellano and Bond (1991) therefore propose a test of hypothesis H_0 that there is no second-order serial correlation for disturbances of the first-differenced equation with the test statistic AR(2) for second-order serial correlation based on residuals from the first-differenced equation. Although we cannot test the validity of the instruments directly, we can assess the adequacy of instruments in an overidentified context with a test of overidentifying restrictions.

2. Results

Results of the investigation are presented in Table 1. Technically, the null hypothesis of the Wald test that the estimated coefficients of all regressors are all zero is rejected in all models. The moment conditions in the model are appropriate since the null hypothesis of the test of over-identifying restrictions cannot be rejected.

Table 1 Aggregate Model and Industry Models for Selected Manufacturing Industries in the 1994-2004 Period

Dependent variable: markup	2-digit manufacturing industries of NACE classification (section D)					
	Manufacturing industries (15-37)	15 Food products and beverages	17 Textiles	18 Wearing apparel	19 Leather and leather products	20 Wood products
markup(-1)	0.1315***	0.1402***	0.1264***	0.0691***	0.0243	-0.0039
MS	-0.3439***	0.0206	0.3717***	2.139***	-0.8022	-0.4701
MS^2	0.4697***	0.0899***	-0.1490***	-7.0370***	-3.1192	3.035***
EXor	-0.1209***	-0.0665***	0.1686***	-0.0086***	0.1347	-0.1046***
EXor*MS	-0.0729	0.2993***	-0.2810***	-2.177***	-3.0588	0.2930
GRa	0.0093***	0.0083***	0.0161***	0.0091***	-0.0207**	-0.0108***
Lprod	0.0000031***	0.0000030***	0.0000163***	0.0000075***	0.0000017	0.0000026***
w	-0.000057***	-0.000083***	-0.000130***	-0.000087***	-0.00011***	-0.00013***
r	0.0635	0.2203***	0.1353***	-0.1499***	-0.5995	-0.3215***
KI	0.0000065***	0.0000041***	0.0000013*	0.0000044***	0.000031***	0.000016***
CU	0.0367***	-0.0096**	0.0011	0.1053***	-0.0933	0.0380***
H	0.2377***	0.0674***	0.0481	-1.7450***	-3.6644	-1.1957***
Hsq	-0.3236***	-0.0664***	-0.0626	10.7509***	42.993	3.6629***
IMpen	-0.0834***	-0.2292***	-0.0886***	0.1056***	-0.1233	-0.0820
IndCU	-0.0373***	0.0071**	0.0341***	-0.1655***	0.1274	-0.1654***
IndKI	0.0000019	0.0000019***	0.0000090***	0.0000246***	0.0000014	-0.00001***
IndEXor	0.0102	0.0081	-0.0309*	-0.4176***	0.0980	-0.0395
Indiip	0.00014**	-0.0022***	0.0033***	-0.00023***	0.00051	0.00139***
Year dummies	YES	YES	YES	YES	YES	YES
Constant	0.0113***	0.0052***	0.0125***	-0.0162***	-0.0142	0.0117**
No. of obs.	20466	1413	700	906	246	1367
No. of firms (i)	4470	288	152	232	59	324
(df) Wald $\chi 2$	(30) 541.69***	(29) 1.97e+06***	(29) 2.80e+06***	(29) 1.75e+09***	(30) 1.82e+06***	(30)41077.11***
(df) Sargan $\chi 2$	(175) 181.52	(175) 180.89	175) 132.97	(175) 151.51	(175) 32.10	(175) 173.78
AR(1) z	-15.51***	-4.17***	-2.01**	-3.27***	-1.99**	-5.38***
AR(2) z	0.10	-0.99	-0.92	-0.80	0.51	-0.42

Notes: t-statistics are in parentheses;
***,**,* denote significance at 1%, 5% and 10%, respectively.

Source: Authors' estimations.

Table 1 Aggregate Model and Industry Models for Selected Manufacturing Industries in the 1994-2004 Period (continued)

Dependent variable: markup	21 Pulp, paper and paper products	22 Coke, petroleum products	24 Chemicals and chemical products	25 Rubber and plastic products	26 Other non-metallic mineral products	27 Basic metals	28 Fabricated metal products
	2-digit industries of NACE classification (section D)						
markup(-1)	-0.1268	0.1543***	0.0074***	0.1787***	0.1259***	0.0290	0.1197***
MS	-1.2315	-0.3948***	0.9340***	-0.3772***	0.5014***	0.1997	-0.0204***
MS²	0.4983	0.4182***	-1.8715***	0.5482***	0.4070***	-1.0083*	0.1134*
EXor	-0.4580***	-0.0921***	0.1539***	-0.0640***	-0.0113	-0.1521	-0.1016***
EXor*MS	1.2338	0.2053***	-0.4402**	0.0183	0.5485***	0.7318	0.2608***
GRa	0.0131***	0.01733***	0.0035	0.0227***	0.0226***	0.02891***	0.0121***
Lprod	0.0000085***	0.0000055***	-0.0000053***	0.0000025***	0.0000067***	-0.00000004	0.0000038***
w	-0.00007***	-0.00009***	0.000045***	-0.000027***	-0.0000023	-0.00001	-0.000089***
r	-0.2114	0.1188***	0.3218***	0.9370***	-0.1036*	0.6807*	0.1571***
KI	0.0000063***	0.0000096***	0.00001***	0.00000027*	-0.00000067	0.0000052	0.000012***
CU	0.0744***		0.0953***	0.0447***	0.0042	0.0495	0.0496***
H	0.6593	0.1279***	0.8339***	-0.6653***	0.6182***	-0.3521	0.1284*
Hsq	-7.6265	-0.3131***	0.9389**	1.4700***	-0.5618***	0.7256	-0.2386***
IMpen	-0.0630***	-0.0992***	-0.1194***	-0.1828***	-0.0348*	-0.1528**	0.0300
IndCU	-0.0170	0.0442*	-0.1264***	-0.0338***	-0.0250***	-0.0775	-0.0841***
IndKI	-0.00002***	0.0000016*	-0.0000051***	-0.00000053	0.0000002	-0.00002**	-0.0000014
IndEXor	0.2650***	0.00061	-0.0418	-0.0023	-0.0760	-0.0679	-0.0456**
Indiip	0.0068	0.0005***	0.0008	0.0004***	-0.0010	0.0018	0.00039***
Year dummies	YES	YES	YES	YES	YES	YES	YES
Constant	0.0070	0.0193***	0.0163***	0.0034***	0.0049	0.0151	0.00095
No. of obs.	402	2568	553	1331	691	293	3604
No. of firms	82	585	114	305	150	58	835
(df)Wald $\chi 2$	(28) 12913.07***	(30) 263184.99***	(29) 282124.76***	(29) 2.24e+07***	(29) 832914.76***	(30) 748.51***	(30) 9982.53***
(df)Sargan $\chi 2$	(175) 53.19	(175) 152.49	(175) 77.76	(175) 173.33	(175) 124.51	(175) 32.79	(175) 145.02
AR(1) z	-2.89**	-7.34***	-2.95**	-4.11***	-3.48***	-1.89**	-7.47***
AR(2) z	-1.42	0.53	0.06	1.41	0.30	-1.53	0.24

Dependent variable: markup	29 Machinery and equipment n.e.c.	30 Office machinery and computers	31 Electrical machinery n.e.c.	32 Radio, TV and communication equipment	33 Medical, precision and optical instruments	34 Vehicles and trailers	36 Furniture
	2-digit industries of NACE classification (section D)						
markup(-1)	0.1581***	0.0487*	0.0465***	-0.0694	0.0836***	0.2000**	-0.0384
MS	-0.1890**	0.3173	0.5516***	0.9079	0.8237***	3.8624	1.6182
MS²	-1.0446***	-20.6595	-1.4441***	-2.722	-3.0275***	-3.3457	-1.9296***
EXor	-0.0501**	0.0507	-0.0035	-0.0076	-0.0059	-0.1646	0.0408***
EXor*MS	1.1227***	7.5858*	-0.8866***	-0.1142	-3.5794***	-6.3031	-1.3784***
GRa	0.0081***	-0.0004	0.0040***	0.0034	0.0114***	-0.0133	-0.0044**
Lprod	-0.000000045	0.0000037**	0.0000026***	0.0000074***	0.0000052***	0.0000027**	0.0000013***
W	-0.000019***	-0.00006***	-0.00009***	-0.00004***	-0.0000098***	-0.00010**	-0.000035***
r	-0.1289***	-0.2431***	0.0984***	0.2076***	0.2475***	0.3236	0.0343
KI	0.0000085***	0.00001***	0.0000084***	0.0000022*	0.000007***	0.0000048	0.0000047***
CU	0.0472***	-0.0528***	0.0142***	-0.0658***	0.0315***	-0.1138*	0.0087
H	0.5005***	-32.8940	1.5526***	-1.1071	-0.4881**	1.9356	-0.3931***
Hsq	-2.2976***	/	-5.3162***	-12.126	2.9041***	1.3871	0.9345***
IMpen	-0.0531***	-4.5080	-0.0796***	0.0098***	-0.0632***	-0.1056	-0.0596***
IndCU	-0.0127	2.0411*	0.0211***	0.2231***	-0.1161***	0.1351	-0.0955***
IndKI	0.0000018**	-0.0001	0.000013***	0.00000056	-0.0000009	0.0000031	0.0000009*
IndEXor	0.0471**	-4.0578	-0.1069***	-0.0186	0.0610***	-0.0157	-0.0212**
Indiip	-0.00079***	-0.0004	0.00019***	0.00024***	-0.0015	-0.0033	0.0019***
Year dummies	YES	YES	YES	YES	YES	YES	YES
Constant	0.01463***	0.1992	0.0336***	0.0029	0.0148***	0.0508*	-0.0118
No. of obs.	1611	345	1111	491	817	259	1506
No. of firms	364	76	233	110	183	58	333
(df)Wald$\chi 2$	(29) 236425.81***	(28) 183717.38***	(29) 965636.27***	(29) 1.32e+06***	(29) 7.32e+08***	(29) 2280.43***	(29) 635826.78***
(df)Sargan $\chi 2$	(175) 189.94	(175) 53.98	(175) 183.21	(175) 84.15	(175) 159.47	(175) 31.08	(175) 173.45
AR(1) z	-6.04***	-3.71***	-5.40***	-3.52***	-3.44***	-1.91**	-3.50
AR(2) z	-0.48	-1.17	-0.23	-1.54	-0.01	0.24	0.26

Notes: t-statistics are in parentheses;
***,**,* denote significance at 1%, 5% and 10%, respectively.

Source: Authors' estimations.

Crucial for dynamic models is the confirmed absence of autocorrelation of differenced model residuals of order 2. On the other hand, the null hypothesis that the average autocorrelation in residuals of order 1 is 0 is rejected, which is also in line with the applied technique. In the aggregate model, presented in the second column of Table 1, the determinants of a firm's markup are found to be generally consistent with the theoretical and empirical literature in this field.

The aggregate markup model confirms the majority of the hypothesised relations between the markup size and theoretical markup determinants and shows that the oligopoly theory of markup determination for the most part holds in the Slovenian manufacturing sector. However, we find a large variability in markup determinants across industries within the manufacturing sector. Our model does quite a good job in explaining the markups in industries that produce food and beverages (15), wearing apparel, (18) coke and petroleum products (22), fabricated metal products (28), electrical machinery (31) and medical, precision and optical instruments (33). In some of the analysed industries the hypothesised relationships are confirmed only partially, while in industries that produce leather and leather products (19), pulp, paper and paper products (21), non-metallic mineral products (26), basic metals (27) and vehicles and trailers (34), the assumptions of the basic oligopoly model do not hold. This could indicate that the firms in these industries are too heterogeneous for such a model to be of much use and justifies the decision to estimate the regression on an industry-by-industry basis.

Our results closely relate to the findings of variability in the markup determination process across industries of some other empirical studies. Feeny, Harris, and Rogers (2005), who also carried out their analysis of markup determination on an industry-by-industry basis, conclude that the oligopoly model framework is a useful tool in helping explain price-cost margins for particular industries, but in other cases the heterogeneity of firms within an industry is too large, thus offsetting any information that may be provided by the framework[3].

2.1 Firm-Specific Factors

The chief source of differences in markups among firms within the same industry is a firm's ambition to grow, its market share, the utilisation of its production capacity, the price of labour, labour productivity, the capital intensity of its production and its export orientation.

The firm's planned growth positively impacts the firm's markup size in the aggregate model as well as in 13 out of the 19 separately investigated manufacturing industries, which confirms that the retained profits are an important source of capital for a firm seeking expansion and/or, adequate profitability is likely to be viewed by lenders as an important prerequisite.

[3] John Goddard, Manouche Tavakoli, and John O. S. Wilson (2005) estimate separately models for the service and manufacturing sectors, while others only discriminate between consumer- and producer-goods industries (Ian Domowitz, Robert Glenn Hubbard, and Bruce C. Petersen 1986), durable and non-durable goods industries (Cowling and Waterson 1976) or between differentiated and non-differentiated goods industries (Kostas Oustapassidis and Aspassia Vlachvei 1999). They all report several differences in the sets of firm and industry specific factors, determining prices and markups.

Additionally, when managers have discretion to also pursue their own objectives growth as well as profit may enter the firm's objective function and are thus positively correlated. Similar results are reported by Goddard, Tavakoli, and Wilson (2005) for a panel of manufacturing firms from the EU.

A firm's markup is also higher when its labour is more productive and when the price of its labour is lower according to the aggregate model, as well as in 15 of the 19 2-digit NACE industries. The level of competition among manufacturing firms is obviously strong enough to prevent the complete (or even any) transformation of higher labour costs, caused by higher price of labour or lower productivity, being passed on in the higher prices of final products.

On the other hand, the price of capital measured on the firm level significantly increases firm-level markups in ten and decreases in three industries, while its impact is insignificant in other industries as well as in the aggregate model. Accordingly, the majority of Slovenian manufacturing firms are, on average, not able to transform higher price of capital and therefore higher capital costs into higher markups.

The linear relationship between a firm's market share and its markup is significant and negative while the quadratic link is significantly positive, which is also reported by Fenny, Harris, and Rogers (2005) and Bennenbroek and Harris (1995) and provides evidence of a U-shaped relationship between market share and profitability. In our model the "critical market share size" above which the market share starts to increase markups is surprisingly high and amounts to 37-40 percent of the market, while the mentioned studies for much larger economies compared to Slovenia find this threshold market share to be much smaller[4]. However, the model reveals large differences among the investigated industries. A significant positive linear relationship between the markup and the market share is found in 6 out of 19 industries, while the U-shaped link is found to be statistically significant in 4, with a threshold market share ranging from 9 to 47 percent. In addition, for nine of the analysed industries the influence of the market share on a firm's markup is not found to be significant. These results indicate that there are huge differences among manufacturing industries regarding costly strategies of building excess capacity, advertising and promotion, and innovation in order to gain market share and discourage new competition. Obviously, this is also the case of Slovenian manufacturing industries. Similar differences in market share and measures of performance are also found in studies by Goddard, Tavakoli, and Wilson (2005) for the US economy and in Fenny, Harris, and Rogers (2005) for Australia.

The results show that a firm's export orientation decreases the markup size relative to its less export oriented rivals. Accordingly, a greater exposure to the competition abroad decreases markups[5]. On an industry-by-industry basis, a firm-level

[4] The threshold market shares across industries become smaller, if the market share variable in model's specification is corrected with the share of domestic in total sales in order to get a better indicator of firm's market power. In such case they amount to 20-25 per cent market share (results can be obtained from the authors). However, this is still higher than in other studies and it seems that a firm must have a relatively large market share in the small Slovenian market to obtain enough market power in a general product market to be able to achieve higher prices and increase its markups.

[5] Because the descriptive statistics of the database (Ponikvar 2008) show that large firms are more export-oriented and have smaller markups on average. To control for the interaction between a firm's size

export orientation significantly negatively determines a firm's markups in 8 of the 19 investigated 2-digit NACE industries after the interaction between a firm's relative size and export orientation has been accounted for.

The impact of capital intensity at the firm level on a firm's markup is found to be positive as a consequence of the gross definition of markup which, besides profits, covers capital and other overhead costs. The results are in line with Bennenbroek and Harris (1995) and Feeny, Harris, and Rogers (2005).

2.2 Industry-Specific Factors

According to the results, the intensity of competition, industry-level production capacity utilisation, the strength of entry barriers as well as the average industry price and productivity of labour are the main sources of differences in markup variability observed between manufacturing industries in the Slovenian economy.

In the aggregate model, the quadratic relationship between market concentration, measured with the Herfindahl index, and the markup size is found to be negative with a positive linear link. Such a relationship between markup size and concentration is also reported by other empirical studies (e.g. Stephen Machin and John Van Reenen 1993 for the UK; James Ted McDonald 1999 for Australia; and Lima and Resende 2004 for Brazil). The threshold concentration level in our case is the value of the Herfindahl index of 0.39 on average, meaning that sellers' concentration increases markups in industries with a concentration index less than 0.39, but not in others. One possible explanation is that at this concentration level firms have skimmed all possible profits allowed by the market characteristics (entry conditions, competition from foreign competitors) and the market demand and, with everything else being equal, higher markups cannot be achieved. The other possibility is that this level of concentration is the threshold at which the government's competition policy holders become attentive and start intervention measures to suppress tendencies of markup growth. The industry-by-industry analysis shows that concentration increases markups in 8 of the investigated industries, out of which 6 have a significant threshold concentration level, ranging from 0.11 to 0.55 of the Herfindahl index. This means that concentration, similar to the aggregate model, positively affects markups in a decreasing way only up to this threshold. On the other hand, the U-shaped relationship between sellers' concentration and firm-level markups, which is also reported in Fenny, Harris, and Rogers (2005), is found in 6 other manufacturing industries, where the critical concentration level ranges from 0.08 to 0.26 of the Herfindahl index. The latter is evidently the concentration level, at which collusion behaviour between firms within industry is more likely to occur. In spite of the mixed results across the analysed industries, the results confirm that market concentration positively and nonlinearly affects the markup size, although its influence differs across industries.

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and its export orientation, an interaction term between relative firm size and its export orientation is considered. However, its impact is mostly insignificant, while the impact of the firm's export orientation remains significantly negative even after the effect of the relative firm size on markups is controlled for.

The impact of industry-level export orientation on the markup size is significant in 9 of the investigated industries, while in other industries as well as in the aggregate model, no significant relationship is found between the two variables[6]. The import penetration coefficient is, in line with theoretical expectations, significant and negative in the aggregate model as well as in 13 2-digit NACE industries. Accordingly, the availability of imported products in domestic markets increases the strength of the competition and pushes markups down. The latter is also in line with several empirical studies which confirm a negative link between the two variables (e.g. Machin and Van Reenen 1993 for the UK; McDonald 1999 for Australia; Lima and Resende 2004 for Brazil; Nan Nan Lundin 2004 for Sweden; and Seok Yoon 2004 for Korea). The deficiency of the applied dataset is that it does not allow us to measure the concentration of imports. Namely, the impact of one foreign firm covering a high share of domestic demand cannot be compared to several foreign competitors with small shares of domestic demand. The case of high concentration of imports is also a possible explanation for 6 industries, in which import penetration does not decrease markups.

Similar to Lundin (2004) our results show that the industry-level capital intensity of production acts as an entry barrier and, as theory suggests, allows the markup size to be higher compared to the competitive outcome in the in 7 of the investigated industries. We can infer from the results that when the restriction of the entry barriers variables' coefficients being constant across industries is abolished, entry barriers in the form of the industry's average capital requirements significantly increase the markups of firms within these industries. Obviously, in the case of entry barriers the assumption of the constancy of the regression coefficients is too restrictive for the aggregate model to provide us with significant results.

The higher utilisation of a firm's production capacities means higher production and possible revenues at a given cost of capital. Hence, the achieved markup of a firm can be higher at a given product's price. This is confirmed in the aggregate model. On the other hand, the industry-level capacity utilisation has a negative impact on markups in the aggregate model. Evidently, a positive linkage appears on the firm level within industries by affecting the level of unit costs. The higher utilisation of industry-level production capacities, however, decreases markups. A possible explanation of such a relationship, which was also found by Martha K. Field and Emilio Pagoulatos (1998), is that lower reserve capacities on the industry level make industries more vulnerable to new entries. The lower markups in such a case are a consequence of necessary strategic behaviour aimed at preventing new firms from entering a particular industry when reserve capacities of incumbents become scarce. Another possibility is that increased capacity utilisation on the industry level increases the factor process through increased demand for factors. A positive relationship

[6] In model's specifications, where productivity and factor costs are not accounted for, industry export share positively impacts the markup size (results of the estimates of this model' specification can be obtained from the authors directly; similar findings in Bennenbroek and Harris 1995) but not in models, where productivity and factor prices are listed among regressors. Evidently, a higher average export orientation of an industry has a lot to do with a better competitive position of an industry, deriving from the industry's higher productivity and cost efficiency and results in higher markups, on average, only indirectly.

between firm-level capacity utilisation and firm-level markups is also confirmed for 9 out of the 19 investigated industries. At the same time, in 8 industries the influence of the industry-level capacity utilisation on markups is negative, which is in line with the results of the aggregate model. On the contrary, a positive effect of the industry capacity utilisation on markups is found for 6 industries. Interestingly, these are also the same 6 industries where barriers to entry are found to be effective. In these industries, when the industry-level capacity utilisation moves ever closer to the level of full utilisation of the industry's production capacities due to rising market demand and the entry of new firms is (at least partly) thwarted, the potential for an increase in output prices rises because the market supply is less and less able to meet the demanded quantities. We can therefore conclude that the influence of industry-level capacity utilisation on the markup size depends on the industry's entry conditions.

2.3 Economic Environment

During the investigated 1994-2004 period all main Slovenian economic aggregates were experiencing positive trends: GDP in real terms and the index of industrial production were growing, whereas the aggregate unemployment rate was falling. The estimates show that year dummy variables, measuring the impact of aggregate economic dynamics on the markup size, are mostly negative and significant. The absolute size of the coefficients is larger every year, indicating a decrease in markups throughout the investigated period. Obviously the positive economic dynamics seen in the Slovenian economy have caused markups to fall. Yet the hypothesis of counter-cyclical markups (Julio J. Rotemberg and Michael Woodford 1992) cannot be immediately accepted in the case of Slovenian manufacturing industries since the investigated time period is relatively short and our model does not explicitly take into account the institutional environment changes in Slovenia during the investigated period. The only realistic conclusion that can be drawn is that in manufacturing industries during the investigated period the industry-level markups were decreasing after all other factors have already been accounted for. During the investigated period, industrial production in real terms was increasing in 15 of the 19 industries analysed. The coefficient on the index of industrial production is positive and significant and indicates that firms within industries with growing production were, on average, experiencing higher markups compared to firms from industries with a declining volume of production. The significance of the regression coefficient on index of industrial production also shows that industry-business cycles do not coincide well with the aggregate trends since, although over time markups were decreasing on average, their dynamics differ among different manufacturing industries. The latter is also confirmed in the industry-by-industry analysis where the regression coefficients differ in size and sign among industries.

The time persistence found in the pricing behaviour of the analysed firms means that previous realisations of markups are a relatively strong driving force underlying current markups. The average manufacturing firm in Slovenia responds to an exogenous shock by adjusting its markup size, although within the current year the actually adjusted markup size amounts on average to just 87 percent of the total adjustment needed in pricing behaviour. This percentage is relatively large compared to the results of studies for other economies and is most likely due to the strong export orientation and smallness of the Slovenian market for manufacturing goods. On an industry-by-industry basis the coefficient on the lagged dependent variable is positive and significant in 13 industries. The positive significant coefficients range from 0.007 to 0.2, meaning that the average speed of adjustment of markup levels to shocks differs a lot between firms from different industries, as confirmed by other studies (e.g. Geofrey F. Waring 1996; Goddard, Tavakoli, and Wilson 2005). The adjustment process in all of these 13 industries is monotonic and fast as 80 to almost 100 percent of the adjustment is carried out within one year's time. For six industries a significant relationship between the lagged and current level of the markup was not found. This implies that in these industries firms adopt their markups to the "equilibrium" level within one year.

3. Conclusion

Our study confirms that the estimates of aggregate models, which are based on all manufacturing firms and industries, might conceal the true relationships between the investigated variables because the influence of a particular market and firm characteristics on markups differs among industries and sectors. We can thus conclude that each industry should be investigated separately in detail in order to assess the precise role of industry-level factors in the markup-determination process.

This finding has several policy implications. Namely, we have argued that the markup set by a particular firm is a result of firm characteristics, market structure and technological characteristics of the industry as well as a result of the impact of the general economic environment. While firm-specific characteristics lie almost exclusively in the domain of firms themselves, the industry structure and general economic environment are within reach of economic policy-makers, with deregulation, liberalisation and privatisation being their main weapons for influencing the general economic and competition policy as a tool for influencing market structure characteristics and consequently the competitiveness of industries. Our results, which prove that large differences in the relative importance of different markup factors among manufacturing industries exist, suggest that policy-makers need to examine these industries on their merits when evaluating an industry's characteristics and the competitiveness of its outcomes. We can therefore argue that, although competition policy is needed to stimulate and preserve competition pressures, any automatism in competition policy interventions is not socially desirable since not all markets and industries function in the same way.

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