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DATA DRIVEN TRADE ANALYSIS PAPER ON

EFFECT OF MARKET STRUCTURE ON MARKUPS IN SLOVENIAN CONSTRUCTION SECTOR

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Table of Contents

INTRODUCTION

The main aim of this paper is to investigate how market structure affects firm-level markups across different sub-branches of the Slovenian construction sector. Markups, defined as the ratio between firm revenues and variable costs, are a key indicator of pricing power and market competitiveness. To estimate them, we rely on a transparent, accounting-based method derived from Kalecki and Domowitz et al. (1986), using detailed financial data from 2006 to 2023. This data includes annual reports submitted to AJPES by companies, cooperatives, and sole proprietors.

Our interest in the construction sector is partially personal. Many of our team members have family members working in the industry, which has made us more aware of its complexities, competitiveness, and long-term challenges. This practical exposure led us to explore the sector more analytically, where we quickly identified patterns in firm behavior that pointed to deeper economic structures. Early descriptive analysis suggested that markups in some NACE-3 construction sub-sectors in Slovenia are closely related to market concentration, entry barriers, and firm size. When researching how markups in Slovenia's construction sector are affected by market structure we are particularly interested in the effects of average firm size, average capital intensity, market concentration and export orientation.

This sector is particularly interesting from a policy and structural perspective. Despite the strong recovery in construction activity after 2015 reflected in the Indices of Construction Production and driven by EU-funded infrastructure projects the market remains highly fragmented, with over 85% of firms classified as micro-enterprises (SURS, 2024). Such fragmentation, combined with high administrative burdens and reliance on public procurement, may inhibit fair competition and limit the ability of firms to scale. At the same time, certain sub-sectors such as civil engineering appear more concentrated and potentially better positioned to sustain higher markups.

In the sections that follow, we first examine and present a description of our data followed by a review of relevant literature on the relationship between market structure and markups, and broader economic determinants of pricing power. We then present descriptive statistics and sector-specific trends and formulate our hypotheses. In the next section we present our methodology and findings along with their interpretation. Finally we conclude the paper by acknowledging the limitations of our analysis.

1. DATA DESCRIPTION

The content with which we tested our research question came in the form of a panel data of Slovenian firms from 2006-2023. The data was supplied by AJPES (the Agency of the republic of Slovenia for public legal records) and includes data on all firms' income statements and balance sheets for the aforementioned years. Additionally, it offers multiple levels of granulation, as the observations can be classified from NACE I to NACE V level.

However, this kind of data suffers from certain deficiencies. One of them is the possibility of inaccurate reporting that might come as a result of masking the income from sales to reduce the tax burden. Moreover, firms are classified based on primary activity, but might also engage in other forms of business. Although these caveats raise serious concerns, there is very little we can do.

On the other hand, the panel data structure offers significant advantages through the application of panel data econometrics. This methodology combines the strengths of cross-sectional and time-series analysis, enabling the observation of multiple entities over time and capturing both intra- and inter-individual variation. As a result, it allows researchers to exploit the rich hierarchical structure of the data using more sophisticated models while effectively controlling for unobserved heterogeneity.

For our analysis, we focus on the construction sector (section F), which, according to the NACE II classification, encompasses all observations falling under codes 41, 42, and 43. We cleaned the data by cutting the upper and lower percentile of the distributions of all variables of interest. Observations that had 0 entries (eg. sales or employees) were also deleted from the data. Lastly, we ended up with 68,106 observations on a firm level.

2. LITERATURE REVIEW

2.1 MARKET STRUCTURE

Lerner (1934) establishes that the level of market structure directly affects markups, as in the perfectly competitive markets, markups are zero, while in the more monopolistic markets, markups are the highest. The general trend of the markups is rising, meaning that markups in the US economy have risen from 21% above marginal costs in the 1980s to 61% above marginal costs. This rise is attributed to an increase in market power, particularly among firms in the upper tail of the markup distribution. The median markup remained unchanged, indicating that the increase is driven by a subset of firms with high markups, often large and dominant in their industries. The rise in markups is accompanied by a reallocation of market share from low-markup to high-markup firms. This reallocation occurs mostly within industries, not between them, suggesting that market structure changes are industry-specific (De Loecker & Eeckhout, 2017; De Loecker et al., 2020). A paper of Marto (2023) finds that the biggest driver of the markup growth has been the reallocation of market shares from non-service firms (manufacturing) to the service producing firms and a faster increase of services' markups.

2.2 FIRM SIZE

Another possible reason that we have to consider, as to why firms charge different markups is firm size. Big firms may benefit or exploit economies of scale and scope, they might be more cost efficient. Big firms may also have cheaper access to key inputs, patents or technology. In industries with strong economies of scale, dominant firms benefit from cost advantages that deter entrants, enabling persistently high markups (Bain, 1956). As the presence of the big firms generally means higher economies of scale and higher barriers of entry, we can say that the market structure is in these cases more oligopolistic or monopolistic.

Companies operating under the NACE code 42 (civil engineering) have on average higher barriers to entry than NACE code 41 (construction of buildings) and NACE code 43 (specialized activities), as civil engineering requires more heavy machinery and specialized labor to be able to undertake large-scale projects (such as building bridges, highways). The pool of available enterprises that are able to undertake infrastructure projects is typically lower than the pool of enterprises of other projects (Finity, 2024). Naturally we would expect that this sector exhibits higher markups on average than the other two sectors.

Altomonte, et al., (2017) find that markups depend on financial capability and productivity. Financially capable companies achieve higher markups by reducing their costs. As larger firms on average have better access to credit and can secure collateral at lower costs, this reduces their marginal costs, which leads to higher markups. This paired with findings of Melitz (2003) that a more productive firm will on average be bigger, can lead to a natural conclusion that bigger firms will also charge higher markups. This is similar to the conclusions of Autor, et al. (2019) which used the US data on manufacturing, retail trade, wholesale trade, services, utilities and transportation, and finance sectors from 1982 to 2012. They find that the “superstar” firms have higher markups. Similar are the findings of Bellone, et al. (2014), which find that markups are positively correlated with firm productivity and negatively related to the toughness of local competition.

Contrary to this, a study from Mertens and Mottironi (2023) finds that not in line with popular theories, bigger firms actually exhibit lower markups. Authors attribute this to larger firms exhibiting higher wage markdowns, big firms paying workers less relative to their productivity. But when controlling for labor market power, the “true” markup then turns positive. De Loecker & Eeckhout (2017) find that larger firms have lower markups economy-wide, but exhibit higher markups than their smaller firms counterparts within narrowly defined industries.

2.3 HERFINDAHL-HIRSCHMAN INDEX

The Herfindahl-Hirschman index (HHI) is a common measure of market concentration of firms in a particular industry. HHI approaches zero when a market in a certain industry is occupied by a large number of firms and grows larger when the number of firms in industry is smaller. The HHI rises as the number of firms in the market declines and as the size differences between them grow (U.S.

Department of Justice, 2024). So if the market concentration is big, we can say that firms have higher market power, as there is a positive relationship between market concentration and average market power (Syverson, 2019).

When it comes to the impact of market concentration on the market structure, a study of Bresnahan & Reiss (1991) found that higher concentration correlates with greater pricing power, especially when the barriers to entry are high. This means that with greater pricing power market structure tends to be more oligopolistic or monopolistic with higher concentration. An increase in concentration also means that the market has become less competitive (Shapiro, 2018).

When it comes to the influence on markups, a study from Ariga et al. (1999) finds that for the Japanese manufacturing companies, impact of market concentration on markups is positive, but the degree is marginally significant and relatively small, suggesting no clear causal relation linking concentration to markups. On the other hand, Lerner (1934) argues that simply counting firms or measuring market share is too simplistic. Even a monopoly does not necessarily have pricing power, it ultimately depends on demand elasticity.

2.4 CAPITAL INTENSITY

The variable Capital intensity of production is the ratio between capital and output ratio. When it comes to the literature review of the impact of this variable on mark ups for firm-level data, conclusions diverge. Below we present some of the rivaling perspectives.

The first study, made by Eichner (1976), proposes that higher markups are a consequence of a firm desire to finance its desired capital growth rate, which in turn is dependent on the capital intensity of the production of the firm. The higher the capital intensity of production, the higher the amount of investment and internal funds needed for a given growth rate, which are accumulated with a higher cost margin. By this spectrum, capital intensity of production has a positive impact on markup estimation.

The second one, proposed by Coelli et al. (1998), presents that a higher capital intensity of production when compared to the average of other firms implies an input-oriented technical inefficiency. This means that for the same amount of output, the capital used is higher than the required, which increases production costs and capital costs per unit of output exceeding competitors making the markup diminish unless offset by higher prices or other productivity gains. By this spectrum, capital intensity of production has a negative impact on markup estimation.

2.5 EXPORT ORIENTATION

The influence of export orientation on the markups has been a debated topic. We wanted to analyze the impact that some specific export-oriented firm has on its markups compared to the markups of

other non-export engaging companies. The question is whether exporters on average have higher markups and if change to exporting also yields higher markups.

While some studies show that engaging in exporting has a positive impact on markups. De Loecker and Warzynski (2012) used data on Slovenia, and found that exporters on average have higher markups and that companies' markups also increase when they enter export markets. This is largely due to the productivity advantage of exporters. Similar research from Bellone, et al. (2009) finds that for French manufacturing firms, exporters have on average higher mark-ups than non-exporters. Bekes, et al. (2016) find positive relationship between markups and export even when controlling for TFP. They also find that firms with affiliates have on average higher markups. Gorg and Warzynski (2003) find that while it is true that on average exporters have higher markups than non-exporters, they also find that only in differentiated goods sectors the distinction between markups of exporters and non-exporters is present, while in homogeneous goods sectors the distinction in markups could not be found.

On the other hand, Hornok and Murakozy (2015) find that exporting proves to be significantly positive only when we do not control for importing. They also find that the export premium is smaller or even negative for those firms that export to the markets where competition is stronger. McQuoid and Rubini (2014), based on Chilean manufacturing firm data, find that after trade agreements, most existing exporters increase their markups, but all of the new exporters reduce their markups, as entering in foreign markets makes them compete harder. This creates a pro-competitive effect. The incumbents benefit more than the new exporters.

2.6 LABOUR PRODUCTIVITY

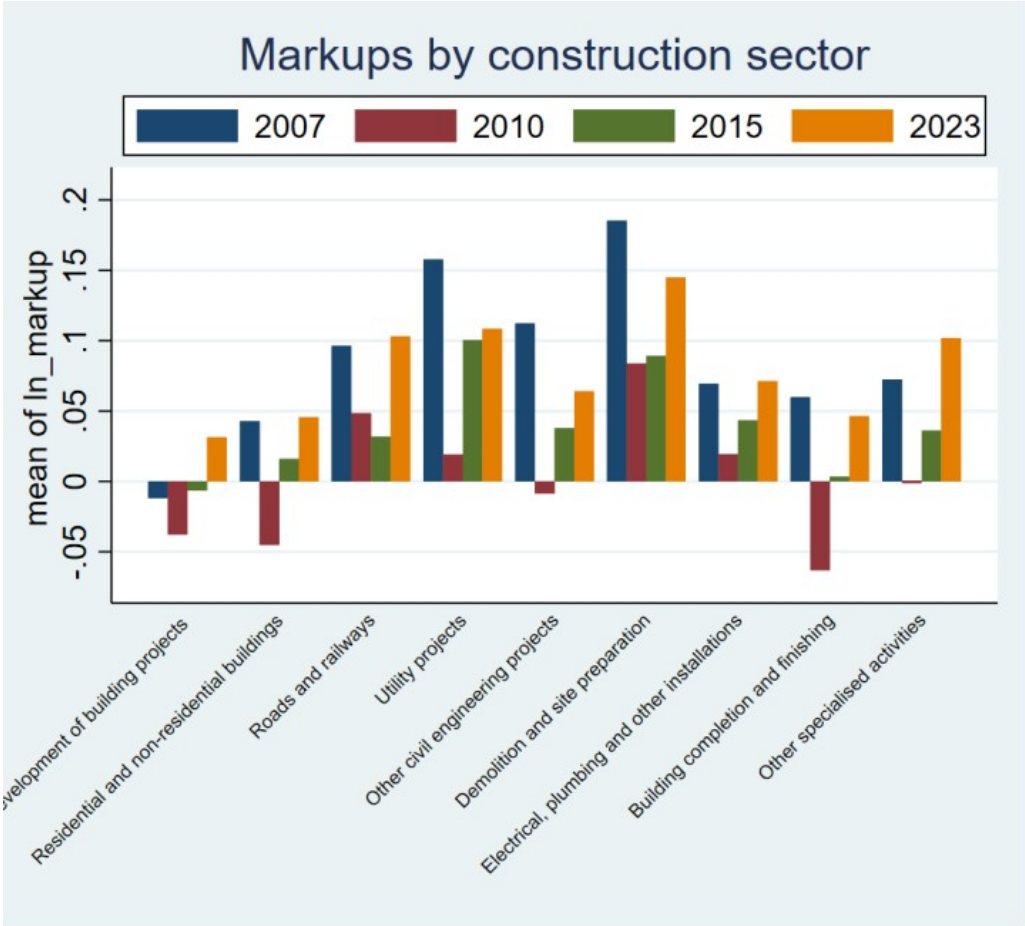
Across the literature the relationship between labor productivity and markups at the firm level has been affirmed as positive. Based on the latest generation of models of international trade (Melitz, 2003) were developed to explain the strong correlations between firm-level characteristics, such as productivity of the firm: the more productive firms are able to have higher mark ups due to their lower costs of production at a given price of inputs. Moreover the correlation between productivity and export status has been proven to be robust and positive. If the export status is positively correlated with mark ups of the firm, the productivity of the firm, and the labor influence contained in it, can be affirmed to have a positive impact on mark ups estimation (De Loecker & Warzynski, 2012).

3. DESCRIPTIVE STATISTICS

Based on the main findings of the literature review, we will now present how the theory holds for the construction firms on our AJPES dataset. To better understand the relation of market structure with the mark ups we started by plotting time-series graphs of the evolution through the years of markups and the proxies for market structure (size, HHI and capital intensity). To do it we used the aggregate averages of firms in the construction sector grouped by NACE3 level and year, which enabled us to understand the behaviour across the 9 NACE3 level sectors. The sum of the number of firms in this

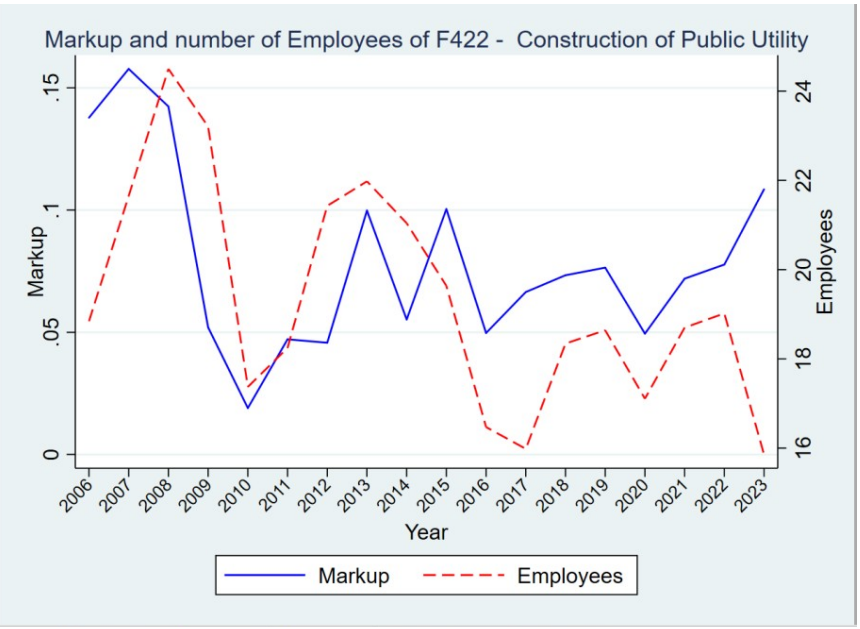
sectors is close to 15000. By comparing the time-series, the sector 422, Construction of Public utility particularly standed out, as it was the sector with the highest loss of the mark up size after the 2008 crisis (Graph 1) . For this reason, we choose it as an example to convey the relation between our proxies for market structure and markups on the graphs that follow.

Graph 1: Markups by construction NACE3 sector.



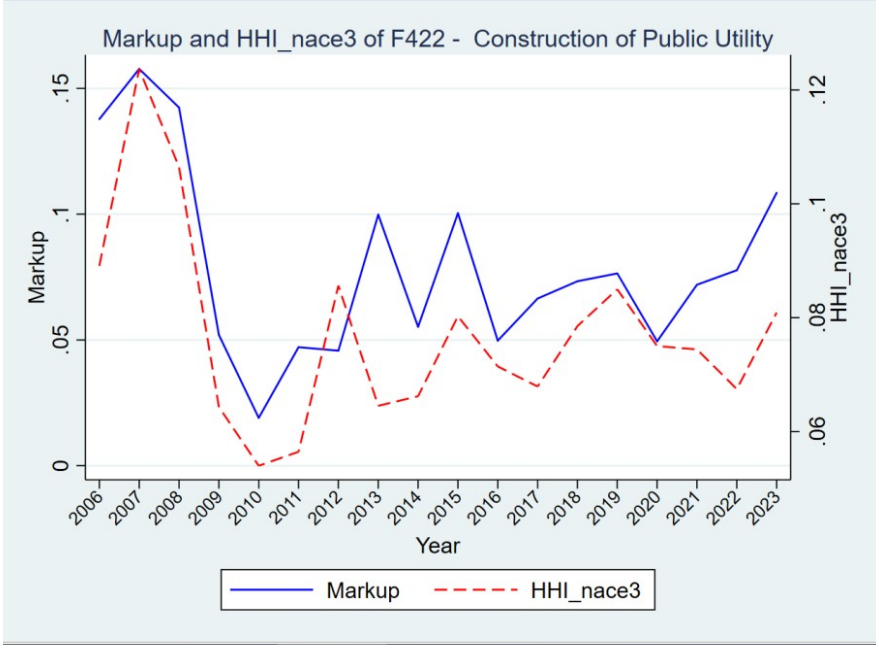
Source: own work

Graph 2: Markups and firm size of sector F422.



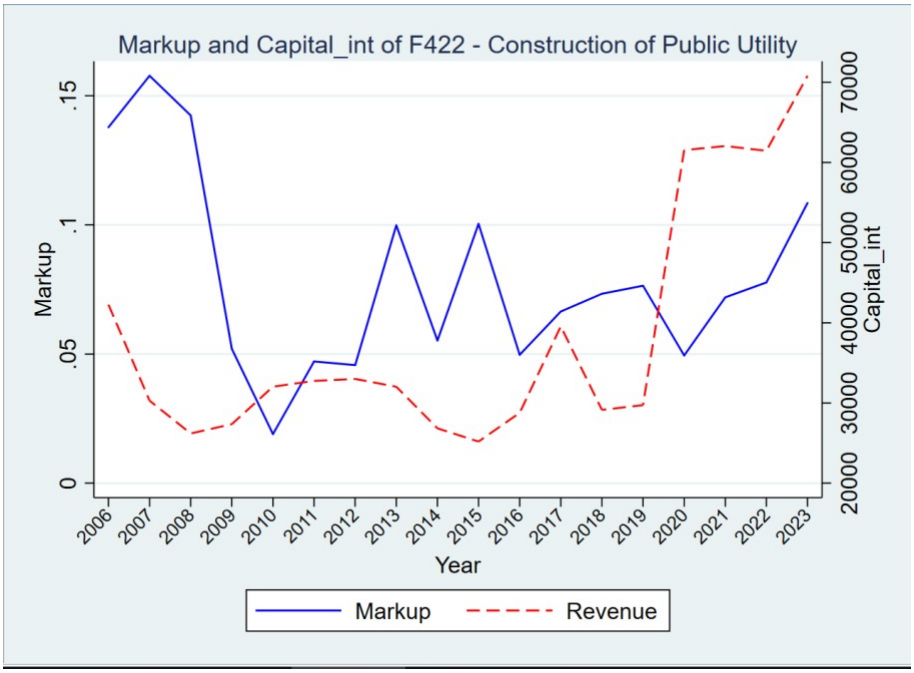
Source: own work

Graph 3: Markups and HHI index of sector F422.



Source: own work

Graph 4: Markups and capital intensity of sector F422.

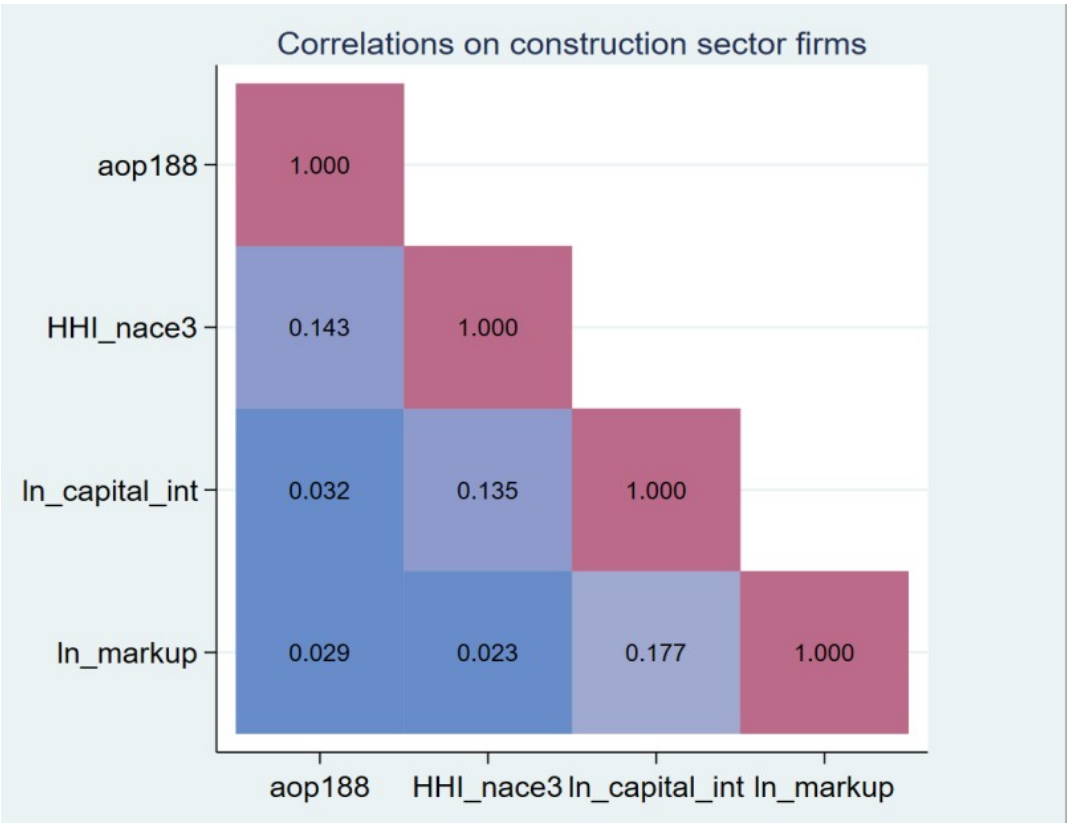


Source: own work

As presented in graph1 and graph 2, the relation between the number of employees and HHI with the markup seems particularly relevant as the trend between the variables is clearly similar for most years. HHI relation is positive as mentioned in the literature (Ariga et al.,1999), but we expect to find a stronger relation with markups. Moreover, on graph 3, capital intensity behaviour supports Eichner (1976) conclusion on the positive effect on the markup of the firm, although we might expect it to be to a smaller degree than size and HHI.

Regarding the nature of the variables, HHI, number of employees, capital intensity and markup follow approximately a normal distribution with high skewness to the right. On graph 5, the correlations between variables are presented. For all correlations, the significance level is marginally significant ($p < 0.1$, "*"), suggesting weak evidence that the correlations are not due to random chance. Capital intensity is mildly correlated with markups and HHI. HHI is mildly correlated with the size of the firm.

Graph 5: Correlation between size, HHI, capital intensity and markup for firms in the construction sector.



Source: own work

Note: $p < 0.10$ (*) for all correlations

4. HYPOTHESIS

Based on our review of the literature and in line with or initial data analysis we have divided our initial research question “how do market structures in Slovenia construction sector impact markups” into hypothesis:

1. Average capital intensity of the NACE-3 sub-sector a firm operates in has a positive impact on its markup.
2. Average firm size of the NACE-3 sub-sector a firm operates in has a positive impact on its markup.
3. Market concentration has a positive impact on markups.
4. Export orientation has a positive impact on markups.

5. METHODOLOGY

5.1 DESCRIPTION OF VARIABLES

To capture the effect of market structure on markups, we computed capital intensity, firm size, and the Herfindahl-Hirschman Index (HHI) as yearly means at the NACE III classification. Given the approximately normal distribution of the data, the mean serves as a reliable measure, equivalent to the median. Each firm-level observation was thus assigned a value for these variables that is constant across all firms within the same year and NACE III category. As a result, the analysis remains at the firm level, while incorporating sector-specific structural characteristics. Other variables serve as control variables and are unique to every observation. Following is a list of the variables and a short description of their computation:

- size was computed as the natural logarithm of the number of employees,
- capital intensity was computed as the natural logarithm of the quotient between long term, fixed assets and the number of employees,
- HHI was computed as the sum of squared market shares,
- labor productivity was computed as A natural logarithm of the quotient between value added and the number of employees,
- export orientation was computed as a ratio between sales abroad and home sales and
- debt to assets ratio was computed as a ratio between all liabilities and all assets.

5.2 MODEL SPECIFICATION

Our model is based on firm level data and includes both the set of industry specific and the set of firm specific variables (as already noted). Given our research question and the format/structure of the data, our model is the following:

$$\textbf{Markup(ijt)} = \alpha + \beta_1\ \text{Size\_NACE3(jt)} + \beta_2\ \text{CapitalIntensity\_NACE3(jt)} + \beta_3\ \text{HHI\_NACE3(jt)} + \beta_4\ \ln(\text{LaborProductivity(ijt)}) + \beta_5\ \text{ExportOrientation(ijt)} + \beta_6\ \text{Age(ijt)} + \beta_7\ \ln(\text{CapitalIntensity(ijt)}) + \beta_8\ \ln(\text{Employees(ijt)}) + \beta_9\ \text{DebtToAssetsRatio(ijt)} + \gamma\_t + \mu\_i + \varepsilon(ijt)$$

where:

- i indexes firms,
- j indexes NACE 3-digit industries,
- t indexes years,
- γ_t are year fixed effects,
- μ_i are firm fixed effects,
- ε(ijt) is the error term.

5.3 METHODOLOGY AND ECONOMETRIC ISSUES

Building on the theoretical foundation, our first step was to address the potential issue of unobserved heterogeneity in the panel data. Anticipating that some unobserved factors might influence our results, we avoided using a simple pooled OLS estimator, as it is known to produce biased estimates when unobserved heterogeneity is correlated with the regressors. If, however, these unobserved effects are uncorrelated with the explanatory variables, pooled OLS remains consistent, though inefficient, leading to weaker inference. In such cases, the random effects (RE) estimator offers both consistency and efficiency. On the other hand, if unobserved heterogeneity is indeed correlated with the regressors, the fixed effects (FE) or the within estimator becomes necessary to obtain unbiased results.

First, to determine whether individual effects are present we conducted the F-test where we were able to confidently reject the null and conclude that individual effects are present. To aid in choosing between a fixed effects and random effects we conducted the Hausman test where under the null both RE and FE are consistent but RE yields more efficient estimates. The alternative hypothesis (RE are inconsistent) turned out to be more likely, as the p-value was below 0.05.

Test	**Value**	**p-value**
F-test	4.79	0.0000
Hausman test	64.48	0.0001

Lastly, we included time fixed effects to control for heterogeneity common to all observations in a given year.

Nevertheless, we recognize several econometric challenges that may affect the validity of our estimates. Specifically, we account for the potential endogeneity arising from the well-known trinity of concerns: omitted variable bias, simultaneity, and measurement error. Omitted variable bias may be present if we have excluded relevant factors that are correlated with our regressors. Simultaneity is a concern because markups, as a proxy for market structure, may themselves influence firm size, capital intensity, and market concentration (HHI), leading to bidirectional causality. Additionally, measurement error could arise due to limitations inherent in financial reporting practices within the panel dataset.

To mitigate these issues, we adopt a strategy of using lagged explanatory variables as instruments. Specifically, we lagged all variables except for the NACE III sectoral identifiers and firm age. The former were excluded because they are constructed as yearly averages by sector, reducing variability and therefore minimizing correlation with the error term. Firm age, on the other hand, was treated as exogenous and unlikely to be influenced by reverse causality, thus not requiring transformation.

6. RESULTS AND INTERPRETATION

Out of our three models the fixed effects model performed the best explaining about 30,7% of the variation observed within markups while pooled OLS explained about 26% and the lagged model explained only around 3%.

We were able to confirm our first hypothesis as the average capital intensity of the NACE-3 sub-sector a firm operates in had a significant positive impact on its markup. This result is in line with existing literature. Our findings are in line with the Eichner study (1976) that expects capital intensity to be a reflection of the desired growth and therefore planned investments. Firms operating in a sub-sector of construction where investment is more necessary could face less competition granting them a better bargaining position and allowing them to charge higher markups to their customers. More investment into specialised machinery can also allow firms to take on large scale projects that can be more challenging but also more profitable. It is important to note that the alternative is also possible. Capital intensity can serve as a steeper entry barrier allowing only firms with a sufficiently high markup to enter a market. In this case our model features an issue of reverse causality.

We found the average firm size of the NACE-3 sub-sector a firm operates in has a significant positive impact on markups, confirming our second hypothesis. We interpret average size as an indicator of the presence of economies of scale. Markets with more prevalent economies of scale should allow for the development of larger firms with more market power and be more oligopolistic. Such markets allow firms to charge higher markups. In Slovenia's construction sector in particular economies of scale can take the form of bulk discounts on materials.

Even though our research confirmed Market concentration has a positive impact on markups, we found its effect was not significant for our dataset. Therefore we can neither confirm nor reject our third hypothesis. Our results not lining up with the Ariga study (1999) for Japanese manufacturing companies is not a very novel result since even the original study only features small and marginally significant effects. It is possible our specification of HHI index on NACE 3 level is too broad and a HHI index on NACE level 4 or 5 could have a more prevalent effect. Alternatively the effects of market concentration could already be accounted for by average firm size and average capital intensity.

Lastly we expected export orientation to have a positive impact on markups. This hypothesis was rejected as we found it had a significant negative effect on markups. This result is surprising and contributes to the ongoing debate around the effects of export orientation. The negative impact could be due to specific characteristics of the construction market where exporting is not very common. Exporters may be more oriented to securing big government projects where they are forced to compete with more international firms and thus forced to reduce their markups. Moreover construction firms in particular may incur very higher transportation costs along with being more exposed to cultural and regulatory barriers when exporting, reducing their markups.

Contrary to our first hypothesis we found a firm's age had a negative impact on its markup. This result is not surprising as the effects of age are often non-linear. Including an additional variable such as aged squared can potentially account for such a relationship.

7. CONCLUSION AND LIMITATIONS

To briefly conclude, we can say that most of our findings were in line with the theory and the literature that we provided. Further research could include estimating the model with the usage of GMM (Generalized methods of moments), as we believe we could obtain even better, less biased and more consistent coefficients (due to endogeneity problems as was already mentioned). Furthermore, as our coefficient of determination was quite low, meaning low explanatory power of the independent variables, we could also try to include some other variables in the model for which we think should provide some more explanation on what determines the markups. As this study takes into account more structural factors when it comes to influence on markups, future research could also potentially include the role of soft powers, such as for example negotiation skills. Similarly, the role of marketing efforts and brand reputation in enabling premium pricing could be investigated, especially in how digital marketing strategies affect demand elasticity in construction services. Managerial practices could also be one potential element where we could also expect to find some relationship with the level of markups. These elements may furthermore provide valuable additional insights into markup determination in the construction sector.

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APPENDIX

Appendix 1

Table 1-relevant NACE classification

NACE-2	SETOR	NACE-3	SECTOR
41	**Construction of buildings**		
		411	Development of building projects
		412	Construction of residential and non-residential buildings
42	**Construction of other civil engineering projects**		
		421	Construction of roads and railways
		422	Construction of public utility
		429	Construction of other structures n.e.c.
43	**Specialized construction works**		
		431	Demolition, site preparation
		432	Building installation
		433	Building completion and finishing works.
		439	Other specialised construction activities

Appendix 2

Regression results and Coefficients

VARIABLES	(1) Pooled OLS (Clustered SE)	(2) FE Model	(3) Lagged Model
const_ind = 1, building_const	-0.0187***	-0.00205	-0.00447
	(0.00463)	(0.00971)	(0.0123)
const_ind = 2, civil_engin	-0.0546***	-0.108***	-0.0970***
	(0.0100)	(0.0173)	(0.0212)
size_lvl_3	0.0129*	0.0340***	0.0342***
	(0.00773)	(0.00794)	(0.00987)
cap_int_lvl_3	-0.0275***	0.0184***	0.0264***
	(0.00489)	(0.00693)	(0.00886)
HHI3	1.118***	0.0310	-0.0984
	(0.105)	(0.0676)	(0.0884)
ln_labor_prod	0.151***	0.194***	
	(0.00335)	(0.00138)	
Export_ori	-0.00634*	-0.00821	
	(0.00385)	(0.00518)	
age	-0.00267***	-0.0109***	-0.00500***
	(0.000150)	(0.000278)	(0.000320)
ln_capital_int	0.00525***	0.00297***	
	(0.000779)	(0.000607)	
lnemply	-0.0128***	-0.00353***	
	(0.00104)	(0.00111)	
debt_to_assets	-0.0521***	-0.0540***	
	(0.00322)	(0.00248)	
year = 2023, omitted		-	-
ln_labor_prod = L,			0.0204***
			(0.00183)
Export_ori = L,			-0.00217
			(0.00663)
ln_capital_int = L,			0.0110***
			(0.000780)
lnemply = L,			-0.00388***
			(0.00142)
debt_to_assets = L,			0.0650***
			(0.00343)
Constant	-0.192***	-0.949***	0.557***
	(0.0427)	(0.0636)	(0.0825)
Observations	68,106	68,106	56,497
R-squared	0.268	0.307	0.039