Market Concentration and Firm Markups: Micro Evidence from an Emerging Market with Inflationary Pressures

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Abstract

This paper presents a comprehensive panorama of the markup-setting behavior of Turkish non-financial firms from 2009 to 2022, using firm-level administrative datasets. The markup indicators, constructed following the methodology of De Loecker and Warzynski (2012), reveal an increasing trend in firm markups, particularly after recent inflationary shocks and deterioration in pricing behavior. The analysis indicates that higher markups are driven by large, foreign trade-oriented, and highly leveraged firms when the overall sample period is considered. Additionally, we observe significant sectoral heterogeneity in markup changes, indicating that sector-level factors play a crucial role in markup formation. We also conduct empirical analyses to examine the effect of sectoral competition on firm markups. Although the overall sample does not reveal a conclusive relationship, our estimations for the high-inflation period (2020-2022) indicate a statistically significant co-existence between the deterioration of sectoral competition and increasing markups under excessive inflation. Our findings are evaluated with respect to alternative competition and markup definitions as well as certain robustness checks. We try to mitigate the potential endogeneity concerns with coarsened exact matching and instrumental variable analyses. Although the results remain intact under most cases, significance is susceptible to the inclusion of sector-specific trends. Our estimations for the high-inflation interval (post-2020) show that the association of market concentration and markups is only relevant for small firms, while the association is higher for firms that have a higher likelihood of receiving state subsidies. Regarding the social externalities, we find that increased markups during inflationary episodes lead to higher investment but lower labor expenses, with a rather limited economic significance.

Keywords: Firm Markups, Market Concentration, Pricing Behavior, Inflationary Shocks

JEL Codes: E31, D40, C55

Non-Technical Summary

Pricing policy represents a strategic cornerstone for firms in the real sector, determining how products and services are priced relative to production costs. From a macroeconomic policymaking perspective, examining firms' pricing behavior—specifically their markups, defined as the ratio of price to marginal cost—provides critical insights into industrial organization and its broader implications for price stability. This study employs detailed micro-level datasets and the well-established methodology of De Loecker and Warzynski (2012) to construct markup indicators for a comprehensive sample of Turkish non-financial corporations. A central policy question addressed is whether structural issues, such as insufficient competitive forces, play a significant role in shaping the markup formation process. Türkiye serves as a compelling case study, given its recent episodes of pronounced inflationary pressures and heightened volatility in inflation expectations.

In the initial phase of our analysis, we compute firm-level markup indicators for the period 2009–2022 and evaluate their trajectory across both time-series and cross-sectional dimensions, incorporating firm-specific characteristics. Our results reveal that a previously stable—or even declining—trend in average markups has reversed into a rising pattern, particularly following episodes of significant inflationary pressures. Markup formation appears predominantly driven by high-markup firms that are large, heavily leveraged, and highly engaged in foreign trade. However, our analysis also uncovers substantial sectoral heterogeneity, suggesting that sector-specific factors exert an important influence on markup dynamics.

In the second phase, we investigate the interaction between sectoral competition—proxied by market concentration—and firm markups through empirical testing. Baseline regressions covering the full sample period do not identify a statistically significant relationship between market concentration and markups. However, our focused analysis of the high-inflation period (2020–2022) indicates a positive and statistically significant association. This result underscores the need for a closer examination of this inflationary episode, which we further corroborate using robustness tests. To address potential endogeneity concerns, we implement coarsened exact matching and instrumental variable techniques. These approaches confirm that the observed positive comovement between

sectoral competition and markup trends during the high-inflation episode is not entirely attributable to confounding factors.

The final segment of our empirical analysis explores heterogeneity in markup-setting behavior and its macroeconomic implications. We find that the relationship between market concentration and markup formation is nonlinear, varying with firm size and the likelihood of receiving state subsidies. Specifically, the positive association between market concentration and markups is more pronounced for smaller firms, while firms with greater access to subsidies display stronger tendencies to adjust markups upward. Additionally, during the high-inflation period, higher markups are associated with reduced labor rent extraction and increased investment activity. However, while these associations are statistically significant, their economic magnitude remains modest.

In conclusion, this study contributes to the literature on firm markups by providing novel evidence from an emerging market characterized by substantial volatility in price dynamics. The findings underscore the intricate interplay between macroeconomic conditions, market structures, and firm-level behavior in shaping pricing strategies and offer valuable implications for policymakers aiming to balance price stability with competitive market forces.

1. Introduction

The relationship between market concentration and firm markups has been widely studied in the prior economics literature. Existing works, such as De Loecker and Warzynski (2012), have consistently demonstrated a positive association between market concentration and firm markups. As a broader concept, market concentration refers to the extent to which a small number of firms dominate a particular market for specific goods and services by usually holding a prominent share of total assets or sales. Firm markups, on the other hand, represent how a firm sets prices above its marginal cost. Higher markups imply that firms are charging more to customers relative to their production (procurement) costs. The relationship between the two is often measured using metrics like concentration ratios such that higher levels of concentration within an industry tend to result in higher markups.

Although academics and policymakers have shown considerable interest in the evolution and dynamics of markups, as well as their macro and microeconomic implications, there are differing findings due to varied definitions and approaches to estimating markups. Consequently, measuring (or estimating) firm-level markups remains an empirical challenge because prices are only observed in a small number of datasets, while marginal costs are not directly observable. Moreover, while market power is crucial to economics, there is limited knowledge of its systematic patterns across the economy and over time, particularly in emerging markets and developing economies (EMDEs).[1] There exists a flourishing literature on the relationship between market concentration and markups in advanced economies such as the US and Europe, whereas the research on the recent developments of markups in EMDEs is rather nascent. Recent studies show that the relationship between market concentration and firm markups can indeed be influenced by the level of inflation, although the specific impact can vary depending on a variety of factors. Therefore, understanding how market structure influences firms' pricing behavior is essential in comprehending market dynamics and the implications for consumers and economic welfare, especially for countries under intense inflationary pressures.

This paper aims to contribute to this debate by providing a comprehensive analysis of the relationship between market concentration and firm markups in the context of a

[1] Recent studies show that markups and market concentration have increased in advanced economies, especially in the US (De Loecker and Eeckhout, 2018; De Locker et al., 2020; Diez et al., 2021).

developing economy, Türkiye, which provides a plausible setting given dynamic and relatively large-scale industrial and trade activities coupled with inflationary shocks of unprecedented intensity during the recent period.

Our paper differs from the existing works in many ways. First, it presents a new set of evidence on the evolution of markups for a large emerging economy over the recent decade. By doing so, we provide new stylized facts on aggregate markups as well as heterogeneity with respect to firm characteristics including size, sector, and foreign trade status. We compute time series for firm-level markups following the method proposed by De Loecker and Warzynski (2012) via employing a comprehensive administrative dataset for Türkiye. Second, an important aspect of our study is that we cover the entire spectrum of firms in the economy, across all sectors and size groups, rather than solely focusing on publicly traded or large firms, as previous studies have frequently done. Third, we investigate how this evolution varies with the degree of market concentration, a topic that has garnered significant attention in recent years. Fourth, the recent literature indicates that excessive inflation realizations (together with elevated inflation expectations) can potentially deteriorate the pricing discipline and allow some firms to set higher markups relative to others. In other words, firms may adjust their pricing tendencies if their inflation expectations change sharply, while such evidence for EMDEs is quite limited (Coibion et al., 2020; Weber et al., 2022). This relationship deserves further attention and investigation, particularly given the concurrent struggle against inflation on a global scale since the occurrence of the recent Covid-19 pandemic.

To the best of our knowledge, this study is one of the first contributions exploring the relationship between market concentration and markups in a country that has both a functioning economic structure embodying a broad range of economic activities and that has also experienced significant inflationary pressures. To perform our analysis, we handle our sample coverage via two categories: an overall (2009-2022) and a high-inflation (2020-2022) sample. Prior to 2020, Türkiye had a relatively stable and low level of inflation, while in the recent period, the country experienced severe inflationary pressures (Figure 1). Finally, we also estimate the impact of markups on several firm-level outcomes including investment and salary expenditures to shed further light on whether firms transmit the elevation in markups to capital formation and increase rents to labor force, measuring the implications for economic welfare.

[Insert Figure 1 Here]

By way of preview, we observe that the firm markups have been rising since 2012 alongside deterioration in the real value of the Turkish Lira. Prior literature also discusses potential channels that might transmit the currency shocks to more profits and market shares as the pass-through between exchange rate movements and export prices may not be complete (Clarida, 1997; Toraganli, 2010; Caselli et al., 2017). In our case, this upward trend in markups has sharpened following the recent inflationary shocks and deterioration in pricing behavior. We show that the early upward trend was driven by large, foreign trade-oriented, and highly leveraged firms. During the recent inflationary shock, we also observe an increasing trend in the markups of small firms. Moreover, there appears to be a prominent degree of sectoral heterogeneity in markup changes, possibly suggesting that sector-level factors are important determinants of markup formation.

Our empirical results, which are robust to several considerations, suggest that there is no evidence of a statistically significant relationship between market concentration and firm-level markups when considering the full sample (2009-2022). However, our estimations for the narrowed sample spanning the high-inflation period (2020-2022) indicate that firm-level markups increase significantly as the sectoral competition worsens, suggesting a positive and significant relationship between market concentration and markups under intense inflationary pressures. Given potential endogeneity concerns, the latter finding is repeated with the help of coarsened exact matching and instrumental variable estimations. In terms of potential moderating channels, we find the association between market concentration and markups is relevant only for small firms and weaker for firms with higher likelihood of receiving state subsidies. We also find that amplified markups during inflationary episodes are observed together with higher investment, albeit at a lower share of value-added created for employees due to decreasing labor expenses. However, the economic significance of these associations is rather limited.

The rest of the paper is organized as follows. Section 2 provides a detailed discussion of related literature. Section 3 describes the dataset and sample formation process. Section 4 gives details of the empirical setting. Section 5 discusses baseline findings, the results pertaining to alternative markup and concentration proxies as well as inferences derived from additional analyses for endogeneity concerns. That section also presents robustness checks,

heterogeneity of results based on firm size and the implications of markup formation on the evolvement of firms' interactions with means of production including capital and labor. Section 6 concludes the paper by outlining findings and discusses potential policy implications.

2. Literature Review

Our work belongs to several strands of literature. First, this paper is related to the literature on aggregate markup estimation. Much of the recent empirical work relies on the pioneering works of Hall (1986, 1988), which introduce the production approach for markup estimation. The production approach employs a flexible input choice to identify the markup as the output elasticity of a variable input divided by its share of revenue while utilizing the first-order condition of cost-minimizing firms for a variable input. Hall (1988) estimates the markup for several industries using aggregate instruments such as military spending and oil prices, while observing a rise in markups for various sectors in the US. The estimator that builds on Hall's ideas has recently been used to estimate firm-level markups by De Loecker and Warzynski (2012), De Loecker et al. (2020) and many others. Using the production function approach, De Loecker and Warzynski (2012) estimate firm-level markups using estimations for the output elasticities of each sector and find that exporting firms tend to have higher markups than non-exporters.

The recent evidence indicates a rise in both the level and the dispersion of markups. De Loecker et al. (2020) estimate firm-level markups over the past 65 years from publicly listed firms and document that markups have significantly increased especially after 1980. Hall (2018) and Barkai (2020) also demonstrate the increase in markups after the 1980s while they point out relatively stable markups before that episode. Moreover, using firm-level data, Weche and Wambach (2021) estimate aggregate markups for EU member states for the 2007-2015 period and show that there was a sharp drop in average market power during the crisis years of 2008 and 2009, which was followed by a post-crisis increase. Unfortunately, most of these studies employ data of aggregate sectors, publicly listed firms or large firms, in turn, possibly underestimating the firm-level heterogeneity and the role of SMEs in aggregate markups in an economy. Moreover, studies such as Diez et al. (2018) suggest that privately held firms have experienced a smaller rise in markups than publicly held firms. Our rich and comprehensive datasets enable us to fully capture the markup dynamics over time and across several firm types regarding the size, sector and foreign trade status.

Second, this paper is associated with the literature on the relationship between market concentration and markups. Brennan (2016) and Gutierrez and Philippon (2017) utilize market concentration as a measure of market power and document the link between rising concentration and profit margins. Gutierrez and Philippon (2017) show that industries with higher market concentration give firms more market power, allowing them to set higher markups without facing significant competitive pressures. Autor et al. (2020) show the growing importance of large firms that dominate the market and lead to higher concentration. On the other hand, Bresnahan (1989) suggests that concentration is not necessarily driven by the market power when products are differentiated.

Third, our paper is tied to the literature suggesting that the potential links between market concentration and firm markups can be contingent on the strategies adopted by firms in response to inflationary pressures. It could be argued that strong inflationary pressures commonly coupled with high search costs, lack of adequate information diffusion of prices (among customers) and low demand elasticity can lead to a concurrent rise in market power and markups (Chirinko and Fazzari, 2000; Janger and Schmidt-Dengler, 2010). Rees and Rungcharoenkitkul (2021) state that a period of higher inflation could bolster firms' pricing power, strengthening the pass-through of costs into prices. Using sector-level data from the UK, Geroski (1992) demonstrates that prices responded more slowly to cost and demand shocks when aggregate inflation was lower. Brauning et al. (2023) examine the differential effect of concentration by documenting muted pass-through of negative cost shocks, whilst presenting larger pass-through of positive cost shocks, especially in more concentrated industries. Furthermore, high and persistent inflationary shocks can temper macroeconomic expectations with visible consequences for pricing decisions. Coibion et al. (2020) utilize data on Italian firms to demonstrate the causal link between inflation expectations and pricing decisions. In this context, inflationary forces de-anchoring firm expectations can further allow firms to revise pricing decisions more frequently and exercise more pricing power (Riggi and Tagliabracci, 2022). Even the ability of monetary policy to tame inflationary trends is subdued when the market structure is composed of high-markup firms (Kouvavas et al., 2021).

Fourth, our paper is also related to the studies regarding the relationship between markups and firm size. De Loecker et al. (2020) suggest that there is a negative relationship between markups and firm size. Moreover, Autor et al. (2020) find that the increase in

markups is mainly driven by the upper tail of the markup distribution, with almost no change in the median markup. Calligaris et al. (2018) confirm that the average markup increased over 2001-2014 for OECD countries while the increase was mainly driven by firms at the top end of markup distribution. This evidence is also confirmed by Caselli et al. (2018) and Diez et al. (2021) in the sense that they argue that markups are lower in larger firms. In contrast to the findings for US firms, firms with high markups in the Euro Area, where markets are less concentrated, are not those with particularly high market shares (McAdam et al., 2019). In this context, we estimate how the relationship between market concentration and markups varies across different firm-size groups. In an overall sense, we find that large Turkish firms display higher markups relative to other counterparts. However, we also find that the positive association between market concentration and markups during inflationary episodes is evident for small firms.

Fifth, we augment the literature on the macroeconomic implications of markups. With the proliferation of firm-level data, recent studies have focused on estimating firm-level markups and their implications for the macroeconomic environment (see De Loecker et al., 2020). For instance, using data of publicly traded firms in 74 economies from 1980-2016, Diez et al. (2018) investigate the relation between markups and investment, innovation, and the labor share at the firm-level. Their findings suggest that there exists a non-monotonic relationship, whereby higher markups are initially associated with increasing investment and innovation rates, but later with decreasing rates. They also document that the relationship between markups and the labor share is generally negative. Moreover, using firm-level data, Duval et al. (2021) show that higher markups reduce the responsiveness of output to monetary policy shocks. In this paper, we particularly focus on the impact of markups on firm investments and the share of labor income on generated firm revenues when inflationary pressures are evident.

Last but not least, our paper interacts with the literature on markup estimations in Türkiye. Several studies have analyzed markups in Türkiye, the majority of which are based on aggregated datasets. Metin-Özcan et al. (2002), considering the 1980-1996 period, find no structural change in market concentration and profit margins for Turkish manufacturing industries. Çulha and Yalçın (2005) calculate price-cost margins only for Turkish manufacturing firms for the period 1995-2003 by also documenting that high market share (being above a

certain threshold compared to industry total) is positively associated with price-cost margins. Erzan et al. (2003) examine the market disciplining role of imports on markups for Turkish manufacturing industries. In their comprehensive study, De Loecker and Eeckhout (2018) find that, similar to other emerging markets, average markups in Türkiye have declined between 1980 and 2016. A strand of other works also depicts the historical trends in markups (Taymaz and Yılmaz, 2015).

More recently, Akçiğit et al. (2020), using firm-level data, emphasize that markups and the profit share of market leaders increased in the Turkish manufacturing sector during the 2013-2016 period. Yılmaz and Kaplan (2022), utilizing the production control method of Ackerberg–Frazer–Caves and the dynamic panel method, focus on market power in the manufacturing sector in Türkiye. Their analyses reveal that a significant heterogeneity among firms and average markup is driven by large firms (a finding shared by our study) while most firms see no increase in markups. As regards the relationship between market concentration and pricing behavior in Türkiye, Torun and Yassa (2023) use sector-level data for the period between 2010 and 2021 to show that firms operating in a low-competition environment increase prices more than those in high-competition sectors. They also demonstrate that when firms are exposed to market competition, their ability to increase producer prices during periods of high exchange-rate volatility is limited. Gürcihan Yüncüler and Sarıkaya (2024) analyze the role of profit margins on import price pass-through at the sectoral level by using data of manufacturing firms. Our study aims to shed further light on the markup dynamics in Türkiye.

3. Data

The firm-level data used in this study are retrieved from the confidential financial reports and customs registry information belonging to the universe of firm operating in Türkiye. We combine two administrative datasets for the analysis. The first dataset includes balance sheets and income statements of non-financial firms. The raw administrative data of financial statements are collected by the Revenue Administration and processed by the Turkish Statistical Institute (TurkStat) and the CBRT on a yearly basis. This comprehensive dataset also includes firm-level employment data that originate from social security records. The second dataset is customs data of all Turkish firms, and it includes information about the amount, destination/home country and product code at the CN 6-digit level for each

transaction of the firms with the rest of the world. This dataset is provided by the Ministry of Trade on a monthly basis. We also collect producer price index (PPI) (at 2-digit NACE level) and headline PPI from TurkStat in yearly frequency and inflation forecasts and expectations data from the first CBRT Inflation Report for a given year and the CBRT Survey of Market Participants.

Our overall sample straddles the period between 2009 and 2022, which is contingent on the availability of administrative data sources regarding financial indicators of firms. Before the sample formation process, the raw dataset included 1.57 million firms with approximately 10 million firm-years. Following the retrieval and merging of individual administrative datasets, we implement a variety of filters and data processing procedures to construct our sample used for the estimations. We omit firms without at least three years of observations to ensure the continuous monitoring of firm pricing behavior. To enhance the validity of market concentration proxies, we also drop firms without available NACE sector information as well as firms belonging to 4-digit NACE sectors with less than 30 firm-years (which brings the remaining number of 4-digit NACE sectors to 457). Furthermore, we discard the firms with missing sales and missing/zero cost of goods sold items. Consequently, our empirical analysis for the overall sample is based on 1.02 million unique entities with more than 6.93 million observations.

4. Empirical Strategy

This section describes the empirical approach used to synthesize markup indicators for a stylized and historical assessment, as well as the empirical framework used to analyze the potential effect of sectoral competitiveness and firm concentration on pricing behavior. The first part of the section provides details on the construction of markup ratios, while the second part summarizes the empirical setting used to associate market concentration with markup formation.

4.1. Estimating Markups

Constructing firm-level markup proxies constitutes the essential part of our methodological approach. We closely follow the commonly used method proposed by De Loecker and Warzynski (2012). Based on the assumption that input markets are competitive and without requiring the specification of a demand function, the theoretical foundation of

the technique emanates from conventional cost minimization conditions. The method intertwines the output elasticity of a specific production input with its share and firm's markup formation. Consequently, the markup of a particular firm is defined as the ratio of price to marginal cost (mostly proxied via variable costs in this line of literature), which is later scaled by the output elasticity of variable inputs (De Loecker and Eeckhout, 2017).[2]

It is conjectured that firms face a production function represented by $Q = \Omega F(x_1, \dots, x_n)$. In this setting, Q represents the units of output, Ω stands for the Hicks-neutral productivity level, whereas x_i refers to the set of inputs utilized in the production of Q. Thus, the first-order condition with respect to the variable input of production, x_i, can be demonstrated as follows:

$$P_{x_i} = \lambda \frac{\partial Q}{\partial x_i} \tag{1}$$

The above equation describes the price of input x_i in the form of P_{x_i}, while λ shows the Lagrange multiplier of the cost minimization problem that defines the marginal cost. Departing from Equation (1), the expression for firm markup, μ, is retrieved from dividing and multiplying by the price of output (P_Q) as shown below:

$$\mu = \frac{\partial lnQ}{\partial lnx_i} \frac{P_Q Q}{P_{x_i} x_i} \tag{2}$$

As outlined in Equation (2), the markup is expressed as the multiplication of the output elasticity of input x_i and the sales to expenditure ratio for the same variable input. It is straightforward to calculate the latter component from firm-level data but the general consensus favors estimating a production function at sectoral level in order to generate the former term (Ackerberg et al., 2015; Díez et al., 2018, 2021; Duval et al., 2021). Assuming a Cobb-Douglas production function, the following empirical specification is considered:

$$q_{it} = \beta_x x_{it} + \beta_k k_{it} + \varphi_t + \varepsilon_{it} \tag{3}$$

[2] A potential criticism might be articulated such that the financial statement-based stream of revenues and profits may not be a perfect proxy for the concept of economic profits due to measurement issues. In fact, this measurement problem may be more pronounced during high-inflation period. However, we follow the approach commonly embraced by the extant literature (to calculate the firm markups), while leaving the related discussion out of the scope of this paper.

where lower-case variables q and x index the natural logarithm of output and variable inputs of firm i at time t, respectively. The substitute series to define these terms are taken as sales and cost of goods sold (COGS), respectively. The lower-case letter k denotes the natural logarithm of firm capital that is measured by the sum of tangible and non-tangible fixed assets. φ_t and ε are time fixed effects (to absorb the underlying sectoral trends such as total-factor productivity) and an error term. We deflate sales, COGS and capital series levels by using producer price index (PPI) (at 2-digit NACE level) when available and headline PPI figures otherwise. Equation (3) is estimated separately for all 4-digit NACE sectors by using panel data of the firms which operate primarily in those sectors. Ultimately, our main variable of interest $Markup\ Ratio$, is determined as follows:

$$\mu_{it} = \hat{\beta}_{it} \frac{Sales_{it}}{COGS_{it}} \tag{4}$$

In addition to the definition given in Equation (4), for the sake of completeness, we also augment our estimations with an alternative outcome variable, $Sales/COGS\ Ratio$, which monitors the markup formation via the ratio of sales to COGS.

4.2. Sectoral Concentration and Markups

In the second stage of our empirical design, we estimate the following specification to investigate the association between market concentration and firm markups:

$$Markup_{ijt} = \beta Concentration_{jt} + \gamma X_{ijt} + \delta_i + \varphi_t + \varepsilon_{ijt} \tag{5}$$

where $Markup_{ijt}$ is the markup formation of firm i operating in sector j at year t. The outcome variable is taken as either $Markup\ Ratio$ or $Sales/COGS\ Ratio$ in different sets of regressions. The main variable of interest is $Concentration_{jt}$ that measures the degree of time-varying competitiveness at 4-digit NACE sector level. This variable is proxied as either the share of the top 4 largest ($CR4$) or the share of top 20 largest ($CR20$) firms' employment in total sectoral employment depending on regressions. We also include time-varying firm controls (X) such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets

($Liquidity$), and the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All continuous variables are winsorized at 2nd and 98th percentile values of univariate distributions to alleviate any concerns due to outliers. Furthermore, Equation (5) is saturated with firm (δ_i) and year (φ_t) fixed effects to account for unobserved time-invariant firm characteristics and firm-invariant macroeconomic factors, respectively. In certain estimations, we also control for 2-digit NACE sector fixed effects. Our inferences are based on standard errors clustered at firm-level. Table A1 of the Appendix provides variable descriptions, data sources and summary statistics.

5. Results

5.1. Stylized Facts on Markups

We delve into our findings by first presenting what micro-data suggests concerning the markup formation and pricing behavior of Turkish non-financial firms.

The left panel of Figure 2 depicts the average firm-level $Markup\ Ratio$ and $Sales/COGS\ Ratio$. During the initial phase of the sample after 2009, markup indicators remained relatively stable. This is mainly the result of the less volatile macroeconomic dynamics in Türkiye during the period of 2010-2017, reflecting contained inflationary pressures, stable growth, flattened currency movements and anchored expectations. Nevertheless, the subsequent period coincided with macroeconomic volatilities, sustained currency depreciation and deteriorating inflation expectations. During this episode, we have observed a noticeable increase in firms' tendency to set prices above their incurred costs. This trend was particularly amplified during the recent period of inflationary shocks since 2021, resulting in an upward trend in markup formations from an overall perspective. Similarly, the right panel of Figure 2 covers the same indicators as an employee number-weighted average instead of a simple average. This adjustment does not structurally alter the conclusions, which still show that firm markups have elevated significantly in the last decade.

[Insert Figure 2 Here]

In addition to reporting the first moment of firm markups, we also analyze the variability of markups in more detail. Figure 3 demonstrates the coefficient of variation measures (calculated as the standard deviation divided by the mean) for each year by using firm-level $Markup\ Ratio$ and $Sales/COGS\ Ratio$. During the examined period, it is evident

that the markup inclination across firms became more volatile and less predictable, despite increasing levels.

[Insert Figure 3 Here]

In the next step, we analyze firm markups through the lens of firm heterogeneity with respect to different markup size groups. Hence, we allocate individual sample firms into three categories corresponding to low, medium and high markups, which are determined based on 25th and 75th percentiles of markup distributions. The iterative process is applied dynamically to the pooled firm observations for each year.[3] Figure 4 shows the decomposition with the help of $Markup\ Ratio$. The data show that low-markup firms experienced a slight decrease in markup formation over the sample period, while medium-sized markup firms remained stable. In contrast, high-markup firms showed an acceleration in markup behavior over time, particularly after extreme inflationary shocks. This shows that the firm groups that operate structurally with high markups tend to increase their markups even more during inflationary episodes, reflecting their relatively high pricing power.

[Insert Figure 4 Here]

Moreover, we implement the decomposition of markup trends by firm size. This is achieved by using the readily available firm size classifications in the administrative datasets.[4] Figure 5 extracts the course of (employee-weighted) $Markup\ Ratio$ contingent on different firm size groups. The first important finding from this representation is that large firms maintained a higher level of markups on average. In contrast, small and medium-sized firms operated with lower margins between charged prices and incurred costs on average. The analysis reveals that the general upward movement in markups was shared by firms of different sizes, especially in the recent period. In detail, we monitor a surge in markup realizations of small and medium-sized enterprises as well.

[Insert Figure 5 Here]

[3] In other words, the categorization based on markup size distribution has been done in each year with different threshold values corresponding to 25th and 75th percentiles of that particular year.

[4] These classifications are provided in four different categories including “micro”, “small”, “medium-sized” and “large” firms. For the purposes of illustration in Figure 5, we combine the first two categories under the title of “small” firms.

We also disaggregate the markups based on the firms' foreign trade status. The markups of the firms engaging in foreign trade might be affected by exchange rate and global prices more than firms operating in domestic markets (Clarida, 1997; Toraganli, 2010; Caselli et al., 2017). Equally, the markups might fluctuate based on the net-export/import status of the firms, as the role of imported inputs or exported outputs may vary among these firms. Figure 6 exhibits (employee-weighted) $Markup\ Ratio$ separately for firms with solely domestic orientation, net exporters, and net importers. Two key findings arise from this analysis. First, firms engaging in foreign trade (either as net importers or net exporters) traditionally make larger markups than the rest of the firm sample characterized by complete focus on domestic sources of revenue creation. This reflects the higher flexibility of firms with international operations in charging their desired level of markups by diversifying their product markets. Second, since 2017, the markups of net importers have risen substantially more than other firms. Additionally, we observe that in the very recent period (since 2020), firms with domestic orientation have also tended to charge higher markups, while the markups of net importers and net exporters are nearly flat.

[Insert Figure 6 Here]

As another component of firm characteristics, we disentangle the sample firms into two groups with high and low financial indebtedness by utilizing the median value of the ratio of short- and long-term financial liabilities to total assets (in each year with an iterative approach). Figure 7 displays the evolution of the weighted-average $Markup\ Ratio$ for the aforementioned groups. It appears that firms with a higher level of financial leverage generally exhibited higher markups, whereas the recent increasing trend in markups has been shared by both groups of firms. The firms charging a larger markup might have a greater access to loans by banks which might lead to a higher financial leverage. Alternatively, the firms with a greater leverage might have raised their markups more to compensate for the higher financial costs stemming from their larger financial debts compared to firms with below-median leverage.

[Insert Figure 7 Here]

More importantly, Figure 8 shows (employee-weighted) markup formation based on a general sectoral classification derived from firms' primary activities. Describing the overview

of embedded trends in $Markup\ Ratio$ (normalized to 2009=100 values), it is seen that industrials (relative to services) operate with higher markup levels and preserved an upward trend, while services firms experienced more stable markups albeit below aggregate level of all main sectors. Other sectors such as agriculture, mining and construction were also able to adjust prices significantly in response to cost increases resulting from the unprecedented inflationary shocks. In the recent inflationary period, average markups in services modestly increased, while those in the industrial sector remained unchanged.

[Insert Figure 8 Here]

It is crucial to investigate firm markups with respect to sectoral heterogeneities, and to that end, we focus on a subset of sample firms that were observed at both the beginning and end of our sample period (Figure 9). The scatterplot in the aforementioned figure shows the average sectoral markups as of 2009 and 2022 for firms aggregated at the 4-digit NACE level. It also demonstrates the scope of operations through sectoral asset sizes. Although a slight majority of individual sectors experienced an increase in markups, the overall markup changes are quite heterogeneous at the sector level, with varying extent of markup level and sector size. These findings collectively imply that the markup behavior of Turkish firms should be investigated by taking sectoral characteristics into consideration (e.g. sectoral competition).

[Insert Figure 9 Here]

The main focus of our empirical analysis is to test how firm markups are related to market concentration and, more specifically, how this relationship is contingent on sizeable inflationary pressures. In this regard, we briefly examine the simple correlation between markup tendencies (aggregated at 4-digit NACE sector level based on weighted-average) and sectoral concentration during 2020-2022 when inflationary forces become relatively more visible. As observed in Figure 10, there exists a positive correlation between concentration measures and markup formation. However, further empirical examination through formal econometric analysis is necessary to control for several confounding factors in order to better understand the relationship between markups and market concentration.

[Insert Figure 10 Here]

Overall, the univariate analysis provides a comprehensive overview of how markup behavior has changed for the universe of Turkish firms over the last decade. The stable course observed in the earlier sample has been replaced by rising trend after 2012 and a sharp increase in markup levels in the recent phase, accompanied by strong inflationary pressures. The increase in levels was observed alongside an exacerbated variation in markup formation. The higher level of markups was driven by firms with larger size, firms focusing on foreign trade and firms carrying a higher level of financial leverage. Albeit that the initial rising trend was firms of those kinds, the recent sharp increase was observed for sample of firms that are domestic, small and operating in sectors other than the industrial sector. It is worth noting that the change in markups varied significantly across individual sectors, which highlights the importance of considering sectoral dynamics when explaining markup movements.

5.2. Baseline Findings for the Relationship between Sectoral Concentration and Markups

We begin discussing the baseline estimation results in Table 1 (derived from the specification given in Equation (5)). Columns (1) to (3) use the continuous dependent variable $Markup\ Ratio$ and attempt to disentangle the impact of competitive conditions through $CR4$ variable to track the market concentration. Column (1) adds firm and year fixed effects to the specification. In column (2), firm-level controls are also taken into account. Finally, in column (3), sector fixed effects are absorbed. The estimates for the main coefficient of interest (β in Equation (5)), which is attached to the market concentration variable, are not robust in terms of statistical significance under different modeling choices and fixed effects. This leads to inconclusive inferences throughout the entire sample period.

[Insert Table 1 Here]

On the other hand, columns (4) to (6) perform the same estimations for a shortened sample period (2020-2022). This period is characterized by a significant increase in inflationary pressures, unanchored inflation expectations, and increased uncertainty regarding the pricing behavior of economic agents. Under these conditions, we find that eclipsed competition implied by higher sectoral concentration co-exists with increasing firm markups given that the β coefficient (demonstrated in Equation (5)) turns out to be positive and statistically significant (at the 5% level). The tendency of firms to charge higher markup premiums, when general inflationary pressures are paramount and when the sector in which they operate is

shaped by declining competition, is consistent against different modeling choices involving firm controls and granular fixed effects.[5]

To rule out the concerns that the detected association between firm markups and competition during high-inflation period is contingent on variable definitions, we repeat the same exercise with alternative markup and concentration proxies. Table 2 keeps the outcome variable unchanged ($Markup\ Ratio$) but replaces the main covariate with $CR20$. Furthermore, Tables 3 and 4 use $Sales/COGS\ Ratio$ as the dependent variable and present the estimates for the concentration ratios; $CR4$ and $CR20$, respectively. All estimations show that firms operating in concentrated sectors tend to charge higher prices compared to cost dynamics when inflationary pressures are considerably excessive.[6]

[Insert Tables 2 to 4 Here]

5.3. Additional Analyses for Endogeneity Concerns

Our baseline estimations may be influenced by potential endogeneity issues driven by factors such as systematic heterogeneity among firm characteristics and possible omitted variables driving firm markups and competition outlook simultaneously. Although we do not completely rule out such concerns, we undertake alternative procedures in order to show that our findings are not entirely driven by observed confounders.

First, we utilize the non-parametric coarsened exact matching (CEM) algorithm to improve the ex-ante balance of observable features between firms being exposed to high and low concentration sectors.[7] In the first step, the CEM algorithm requires the continuous covariates to be allocated into coarsened groups based on pre-determined cut points. The following step entails constructing stratums and placing each (coarsened) observation in a

[5] In this content, it could also be argued that entrepreneurship rents extracted from firm operations may be hiked during high-inflation episode due to amplifying risk and uncertainty surrounding the firm operations. We leave that discussion out of the scope of this paper given the lack of proper empirical proxies in available datasets.

[6] The baseline estimation results are similar when weighted with number of employees.

[7] Initially proposed by Iacus et al. (2009) and Blackwell et al. (2009), CEM provides a variety of advantages over traditional matching methods. It allows one to bound the maximum imbalance concerning the empirical distribution of variables via ex-ante choice of coarsening. In turn, this also limits the level of model dependence experienced in other conventional matching methods, which requires the researcher to decide the extent of matching solution ex-ante and consequently evaluate matching balance ex-post, while following this process iteratively in most cases. Relatedly, CEM insulates the maximum imbalance with respect to a particular variable when the imbalance on any other variable is adjusted. Last but not least, CEM mechanically confines the matched data to common support preventing the possibility of unfounded extrapolations of treatment effect.

unique stratum. In the last step, the aforementioned strata are assigned to original data and any stratum without at least one treated and one control unit is discarded. We use the set of control variables used in main estimations ($Firm\ Size$, $Equity$, $Debt$, ROA, $Liquidity$, $Net\ Exports$) as an input to the matching procedure. In our case, for the estimations covering the high inflation period of 2020-2022, we keep the firm covariate values as of 2019 and disentangle the sample firms into two groups with high (treatment) and low (control) concentrations separated by the median values of sectoral concentration ratios ($CR4$ and $CR20$).[8] The matching regarding $CR4$ yields 354,543 unique treatment firms with the same number of control firms. On the other hand, the matching with respect to $CR20$ produces 356,899 treatment firms associated with same number of control counterparts. Then, we extend the matched sample firm list to the high-inflation period (2020-2022) to repeat the baseline estimations. The findings are presented in Table 5 where estimations are run for each matched sub-sample to investigate the interaction between markup indicators and continuous variables $CR4$ and $CR20$. These results support the idea that a high level of sectoral concentration is associated with increasing markups in a statistically significant way, regardless of the definition of pricing and competition proxies.

[Insert Table 5 Here]

We use the instrumental variable method as a second approach. To this end, two-stage least squares (2SLS) analyses are conducted with time-varying mean values of 4-digit NACE concentration indicators ($CR4$ and $CR20$) at 2-digit NACE level (excluding specific 4-digit NACE sectors in question when calculating mean values in an iterative way) taken as instruments.[9] Finding perfectly valid instruments in empirical economics is often complicated and unfeasible. Arguably, in this case, selected instruments are likely to satisfy the relevance condition in the sense that there is a higher degree of correlation between competitive conditions in aggregated sectors and their disaggregated components. To exemplify, the level of concentration in the basic metals industry (NACE 24) is expected to affect the course of concentration in the precious metal production industry (NACE 24.41). It is also reasonable to assume that the sectoral concentration at the aggregated level should shape firm markup

[8] Additionally, we prefer coarsening firm-level controls in line with 8 equally spaced cut points.

[9] To obtain more reliable calculations concerning the selected instruments, we exclude 2-digit NACE sectors with less than three 4-digit NACE sub-sectors.

dynamics only through its impact on the concentration of the disaggregated sector of a particular firm. Furthermore, it is quite unlikely that concentration at a particular 2-digit NACE sector is entirely determined by the concentration developments observed in a specific 4-digit NACE sector. Overall, these qualitative properties hint that our instruments would satisfy the exogeneity requirement and exclusion restriction.

We report the 2SLS estimation results in Table 6. In column (1), we run the first stage regression of concentration ratio $CR4$ on time-varying sectoral mean of $CR4$ at 2-digit NACE level (that is named as $CR4\ Sector$). As expected, we encounter a positive and significant relationship between disaggregated sectoral concentration dynamics with the chosen instrument.[10] In the second stage, we utilize fitted values of the first stage regression ($CR4\ Fitted$) to estimate the impact of instrumented concentration on firm markups. Columns (2) and (3) show that there are positive and significant effects of $CR4\ Fitted$ on $Markup\ Ratio$ and $Sales/COGS\ Ratio$, respectively. In column (4), we repeat the instrumentation process for concentration ratio $CR20$, whereas columns (5) an (6) check the markup effects of instrumented concentration ratio ($CR20\ Fitted$), which further result in positive and significant coefficients.

[Insert Table 6 Here]

5.4. Robustness Checks

In this sub-section, we discuss the robustness of our results to various considerations. In Table 7, we present robustness checks where columns (1), (2), (3), and (4) of different panels consider the relationship between "$Markup\ Ratio$ and $CR4$", "$Sales/COGS\ Ratio$ and $CR4$", "$Markup\ Ratio$ and $CR20$" and finally "$Sales/COGS\ Ratio$ and $CR20$" for the high-inflation period, respectively. For the sake of brevity, we only report the coefficients on the main variables of interest. Unless stated otherwise, all estimations include firm controls, firm and year fixed effects. It should also be noted that the recent inflationary shock was unprecedented in terms of its destructive impact on pricing behavior and expectations as well

[10] Necessary instrument relevance diagnostics tests are also evaluated. Kleibergen-Paap rk LM test statistic is significant at 1% level, affirming that the null hypothesis of model under-identification can be rejected. Additionally, the Kleibergen-Paap Wald rk F Statistic shows that the hypothesis of weak excluded instruments can be rejected based on the Stock-Yogo critical value.

as market dynamics, thus it inherently limits the generalizability and external validity of our inferences.

[Insert Table 7 Here]

In panel (A), instead of 2-digit NACE sector fixed effects, we control for more granular 4-digit NACE sector fixed effects. In panel (B), we choose to categorize 2019 also as a high inflation period by repeating the estimations for the interval between 2019 and 2022. In panel (C), we depart from the benchmark choice of winsorization at the 2nd and 98th percentiles and follow the winsorization procedure at the 5th and 95th percentiles as an alternative. In panel (D), we augment the baseline specification with the addition of lagged values of concentration ratios. At this point, we further append the firm-level control variables with lagged versions to account for potential simultaneity issues. In panel (E), we abandon the clustered standard errors but utilize the robust ones. In panel (F), we revise the composition of concentration indicators. Instead of $CR4$ and $CR20$ series constructed at sector-level based upon firm-level number of employees, we create $CR4\_Assets$ and $CR20\_Assets$ via the shares of firm-level assets. All these estimations are compatible with the baseline findings and display no prominent divergence in terms of the positive interaction between market concentration and markup formation under inflationary pressures. In panel (G), we consider time-varying sectoral dynamics by using sector-by-year fixed effects where sectoral definition is determined by an aggregated level covering 17 operational areas. This robustness test yields somewhat similar results with loss of statistical significance for CR4 series.[11]

In the next stage of robustness checks, we focus on the composition of Equation (3), which is used to retrieve sectoral output elasticity of inputs (via 4-digit NACE level auxiliary regressions) in order to be used as a key information for $Markup\ Ratio$ calculations. As the first extension, we augment Equation (3) with firm fixed effects (on top of year fixed effects) and re-obtained the output elasticity figures to create $Markup\ Ratio\_FE$ indicator. In the second extension, we append Equation (3) with firm-level total factor productivity variable to

[11] In untabulated results, we also consider time-varying sectoral dynamics by using sector-by-year fixed effects where sectoral definition is 2-digit sectors according to NACE Rev 2. Classification. This robustness test yields insignificant results. However, it should be noted that the sub-sample termed as high-inflation period (2020-2022) is rather short, leading to the lack of variation when higher degree sector-by-year fixed effects are considered. The accumulation of more datapoints in the upcoming period would allow a more precise testing in this context.

compose the output elasticity figures required to create $Markup\ Ratio\_TFP$ indicator. Total factor productivity has been calculated using the revenue-based method outlined by Levinsohn and Petrin (2003). Table A2 of the Appendix illustrates the estimation results for the high inflation period by replacing the outcome variable with newly created markup indicators. Our results suggesting the positive relationship between market concentration and markup behavior during the high inflation era remain unaltered against these adjustments.

Our inferences may be confounded by the drastic shifts in the exchange rate outlook that have been widely observed in the post-2020 period when inflation shocks were also generated. We implement two different analyses to address this issue. First, we return to the original specification described in Equation (5) and drop time-fixed effects in order to saturate the model with time-series variables representing the annual average currency basket calculated from daily data (with equal weights assigned to USDTRY and EURTRY exchange rates). Panel (A) of Table A3 (in the Appendix) show that the positive relationship between markup indicators and concentration ratios does not change visibly. Second, we again revert to the baseline specification, maintain firm and year fixed effects, but extend the model with the addition of a firm-level variable representing the potential FX structure of firms' operations, which is the ratio of foreign sales to total sales. Panel (B) of Table A3 shows that our findings are little changed.[12]

Another potential robustness analysis is to explicitly control the time-persistency aspect of markup formation trend. To do that, we depart from the baseline specification by including a new control variable monitoring the past markup realizations. In panel (C) of Table A3, we repeat the estimations by extending the set of controls with the addition of lagged markup indicators. We observe that the sign and significance of the coefficients attached to concentration ratios do not vary considerably. Furthermore, we adjust the main specification by accounting for relative firm size instead of the original conventional control variable

[12] To further control the possible confounding effect of firm FX indebtedness and the degree of FX-related transactions during high-inflation period characterized by sizeable currency fluctuations, we undertake additional analyses incorporating new control variables. First, we obtain data from the Credit Registry to calculate the ratio of FX credits to total credits as an addition to the list of covariates. Second, we define a binary control variable taking the value of one for firms with net spot FX purchases, otherwise zero. Third, we interact the lagged ratio of foreign sales to total sales with the current annual change in currency basket. Last but not least, we construct the interaction of the lagged ratio of FX credits to total credits with current currency change dynamics. In untabulated results pertaining to these robustness checks, we find that baseline results indicating the positive relationship between market concentration and firm markups remain similar.

describing firm size. To do that, we follow a multi-step approach. In the first step, we calculate the sum of squared shares of individual sample firms concerning asset composition within each sector-year pairs. Then, we calculate the sum of these squared shares for each firm starting from the largest firm in that sector-year pair up to (and including) each firm of interest. Similarly, a cumulative figure is derived by summing the squared shares of other firms contingent on the fact that they are smaller than the firm of interest. In the following step, we calculate a relative firm size proxy by dividing these quantities. The resultant indicator is thought to better represent the relative position of a firm within its sector in terms of size and scope of the operations. We follow this procedure iteratively to construct a new firm-level time-varying covariate. Consequently, we replace the original $Firm\ Size$ control variable with this newly derived relative firm size indicator to repeat the baseline estimations. Panel (D) of Table A3 shows that our findings turn out to be similar when accounting for relative firm size effects.

As the last robustness check, to further alleviate the concern that our results are entirely dependent on the chosen proxies of market concentration, we undertake estimations using an alternative measure of market conditions. In this case, we define a new variable termed HHI, which is the conventional Herfindahl-Hirschman measure of market concentration based on the same inputs used to calculate our original indicators of $CR4$ and $CR20$. Using an HHI indicator as the main independent variable, we re-run the estimations investigating the relationship between market concentration (at sector level) and firm markups following the inflationary pressures. In Table A4 (of the Appendix), we find that this variable assumes a positive and significant coefficient suggesting that the worsening in market concentration co-exists with higher firm markups during the high-inflation episode.

5.5. Extended Estimations

So far, our analyses of micro-level data have concluded that markups of Turkish firms have increased over time with a considerable sectoral heterogeneity. The results also indicate that the shift in competitive forces might have played a role in the rising markups during the recent unprecedented inflationary episode. In this sub-section, we initially delve into the question of whether this finding specific to the high-inflation environment is heterogeneous with respect to firm size. To achieve that aim, we construct a binary variable, $Small\ Firm$, which takes the value of one for micro and SME firms, and zero otherwise. In this regard, we

utilize the readily available regulatory firm classes from administrative datasets to form the categories. Then, we interact $Small\ Firm$ with concentration ratios when predicting markup series, specifically during the high-inflation period (standalone time-invariant $Small\ Firm$ terms are dropped from specification as they are absorbed by firm fixed effects). In Table 8, we find that all interaction terms have positive and significant coefficients, implying that the effect of deteriorated competitive forces on increasing markups is evident for small firms during the very recent high-inflation interval. This finding is economically intuitive. For instance, under a strong inflationary environment, the deterioration in market-wide discipline on pricing (due to potential declines in the level of competition) may allow smaller firms in a specific region (often supplying standardized/generic products and services) to observe other smaller counterparts located nearby increasing the prices and decide to respond by also charging higher prices relative to cost dynamics. Such a behavior might be more common among smaller firms due to standardized products/services and lower operational adjustment costs of altering pricing policy. Consequently, this behavior may result in smaller firms' operations with collectively wider margins.

[Insert Table 8 Here]

As another potential channel moderating the relationship between market competition and firm markups, we analyze the implications of state subsidies. On the one hand, firms might exploit subsidies provided by the government to shield themselves from competition, which might direct markup increases to be realized beyond the level implied by existing competitive conditions (amplifying effect). On the other hand, firms relying heavily on state subsidies to accumulate working capital and investments might be subject to additional layer of scrutiny by policy authorities, which is likely to result in subdued markup increases below the level implied by existing market concentration (mitigating effect). Another potential factor behind the mitigating effect might be that firms can rely on such subsidies and attempt to gain more market share in the short-term by reducing markups. To test this issue empirically, we gather information about the intensity of 4-digit NACE sectors in receiving investment incentives (granted by the Ministry of Industry and Technology). After composing the continuous variable $State\ Subsidies$ in this way, we interact it with concentration measures ($CR4$ and $CR20$) in predicting markup behavior during the high inflation period. In Table 9, we see that the interaction coefficients assume negative and significant coefficients

suggesting that the mitigating effect dominates the amplifying effect regarding the role of external state subsidies in facilitating the association between market competition and markup formation.

[Insert Table 9 Here]

Next, this sub-section also scrutinizes the implications of rising markups on production factors and societal externalities. For this, we investigate whether firms' behavior towards capital and labor, major factors of production, alter as a result of the upward trend in pricing behavior over costs during the recent extreme inflation shock. In other words, we are interested in the question of (if that is the case) which particular factors of production have benefited from widened markups. To do that, we turn our attention to investment behavior and the rent extracted by labor through revenues generated by firm operations. To model gross capital formation at the firm-level, we use the variable $Investments$, which represents the growth rate of long-term tangible fixed assets from the previous year to the current year. To proxy the concept of labor expenses, we use the variable $Salary\ Expenses$, which is calculated as the wage income divided by the number of employees.

We report our estimation results in Table 10, again by focusing only on the high-inflation period. Columns (1) and (2) include $Investments$ as the outcome variable, with different markup ratios as explanatory variables. We reach the conclusion that firms that transmit the elevation in markups into capital formation seem to increase investments significantly in a high-inflation environment. We should note that rising investment in the inflationary period may not be associated with capacity increase or productivity improvement, but simply the choice of firms to accumulate more machines, equipment or real estate due to rising markups (hence eventually rising profits). Whether this rise in capital accumulation leads to larger capacities or productivity improvement is out of scope of this paper. Columns (3) and (4) use $Salary\ Expenses$ as the outcome variable, with the previously defined markup ratios as covariates. Surprisingly, we find that firms with higher markups during the inflationary period have operated with decreasing rents to the labor force, as evidenced by the significant and negative coefficient. In terms of economic significance, based on the estimation results in column (1) of Table 10, we find that one standard deviation increase in $Markup\ Ratio$ results in an increase in investment rate equivalent to 1.59% of the mean value of $Investments$ variable. A similar calculation based on column (3) of Table 10 shows

that one standard deviation increase in $Markup\ Ratio$ is associated with a decline in salary expenses per employee equivalent to 0.35% of the mean value of $Salary\ Expenses$ variable. [13]

[Insert Table 10 Here]

6. Discussion and Conclusion

The markup behavior of firms refers to the ability of firms to charge prices to end-users that exceed the variable costs incurred during production and/or procurement processes. As a prominent emerging market with drastic inflationary pressures and a dynamic business environment, Türkiye provides an ideal laboratory to evaluate how firm markups evolve and which factors are essential determinants of markup formation. Nevertheless, previous studies examining the Turkish case do not use micro-level data that provides richer details on pricing behavior and how it varies based on other factors.

We attempt to fill this void in the literature by synthesizing markup measures for Turkish non-financial firms over the past decade using administrative datasets. The proxies used to measure markup behavior indicate that firm markups have been on the rise, particularly following the recent inflationary shocks. Albeit that the initial rising trend was driven by firms with larger size, firms focusing on foreign trade, and firms carrying a higher level of financial leverage, the recent increase during inflationary shocks was also observed for sample of firms that are domestic, small and operating in sectors other than the industrial sector. It is important to note that the change in markups has not been uniform across different economic sectors and has been influenced by significant sectoral heterogeneity. This descriptive finding further hints that sectoral dynamics might be a major element of markup formation, especially under periods of high inflationary shocks. To test this, we estimate the relationship between sector-level market concentration and firm-level markup measures during the high-inflation period of 2020-2022. Our baseline findings suggest that increasing concentration (decreasing competition) coexists with a higher level of markups. Further

[13] We follow the commonly used methodology mentioned by Mitton (2024) to calculate economic significance. Particularly, the relative response of dependent variable (relative to its mean value) against one standard deviation impulse in a specific explanatory variable is based on the following formula: $\left(\hat{b}\right) * \left(S_x\right)/\bar{y}$ where $\hat{b}$ is the regression coefficient from post-2020 regression, S_x is the post-2020 standard deviation of the explanatory variable, whereas $\bar{y}$ is the post-2020 mean value of the dependent variable.

analysis reveals that this finding is relevant for small firms. This result is robust against endogeneity concerns and additional validity tests. Although the results are robust under the overwhelming share of all specifications, the level of significance is sensitive to the inclusion of sector-by-year fixed effects. Moreover, the extended estimations suggest that, with a rather low economic impact, higher markups during the inflationary episode have been transformed into capital investments, while the share of the labor force has declined.

This paper provides several insights from a policymaking perspective. Specifically, it is one of the few empirical attempts to map out the micro-level markup dynamics over a long period of time for Türkiye, while also considering how markups differ based on firm characteristics. The approach covered in this paper to generate novel markup indicators for Turkish firms can open new research avenues to better understand the determinants and externalities of markup setting behavior in this emerging market setting. Potential questions left for future works to be explored are how credit supply shocks (possibly derived from Credit Registry datasets) affect firm markups and how trade network relationships (possibly derived from micro data on trade receivables/payables) influence firm markups.

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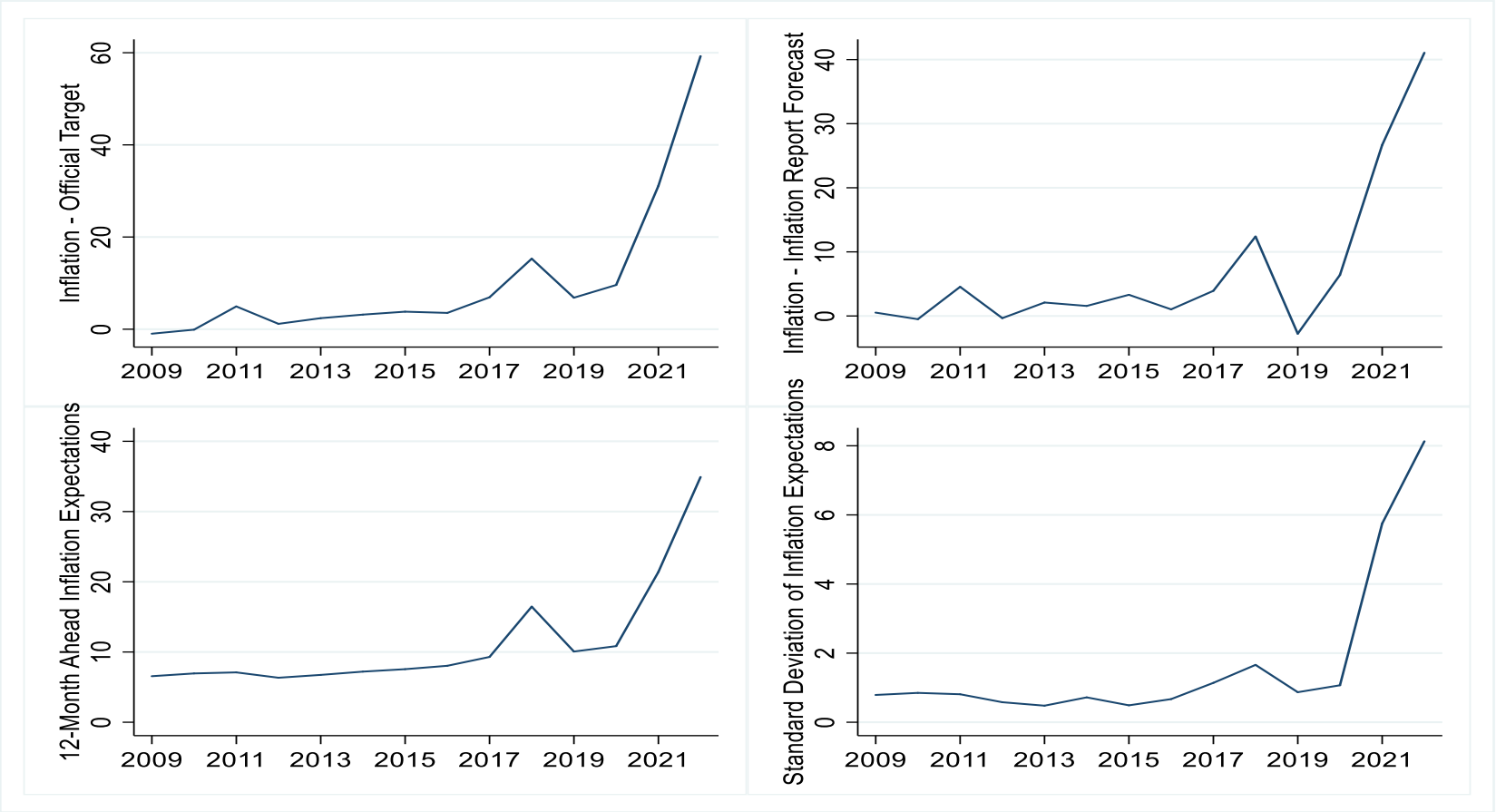
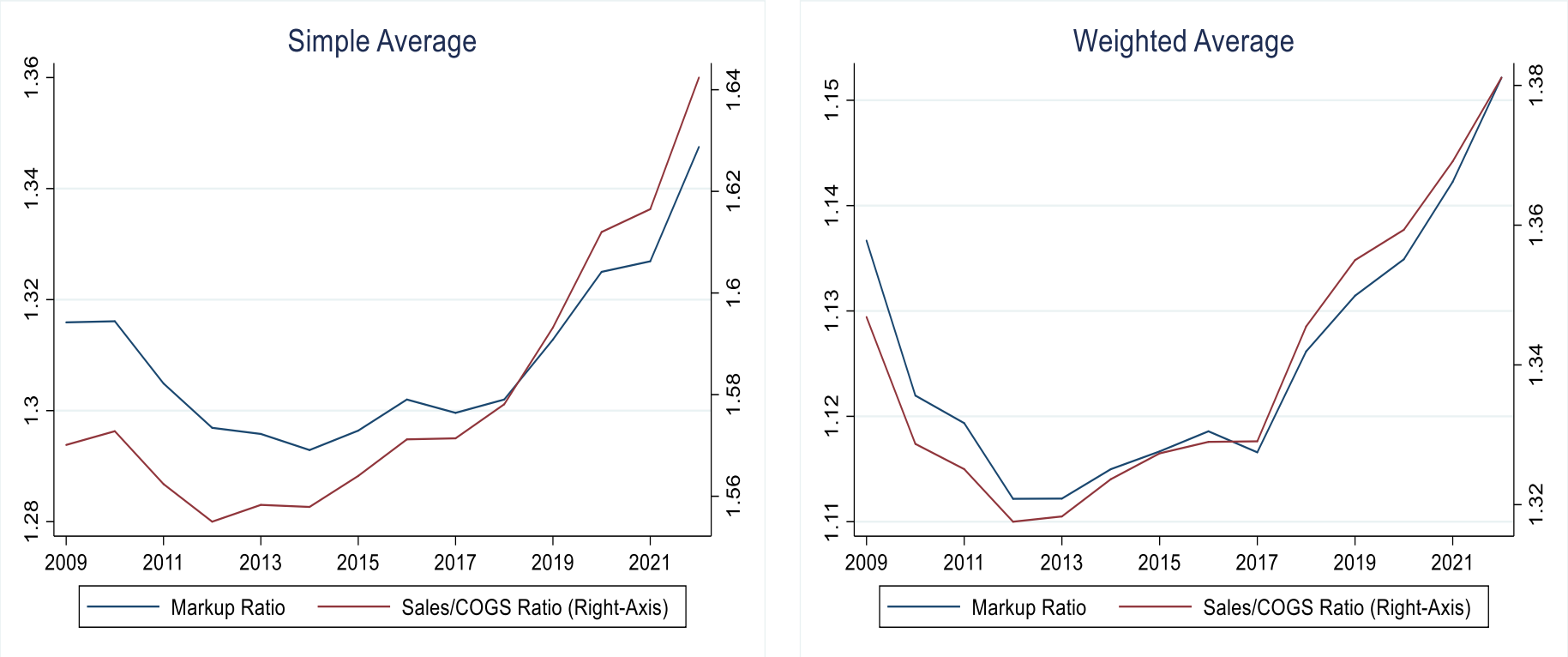
Figure 1: Inflation Developments



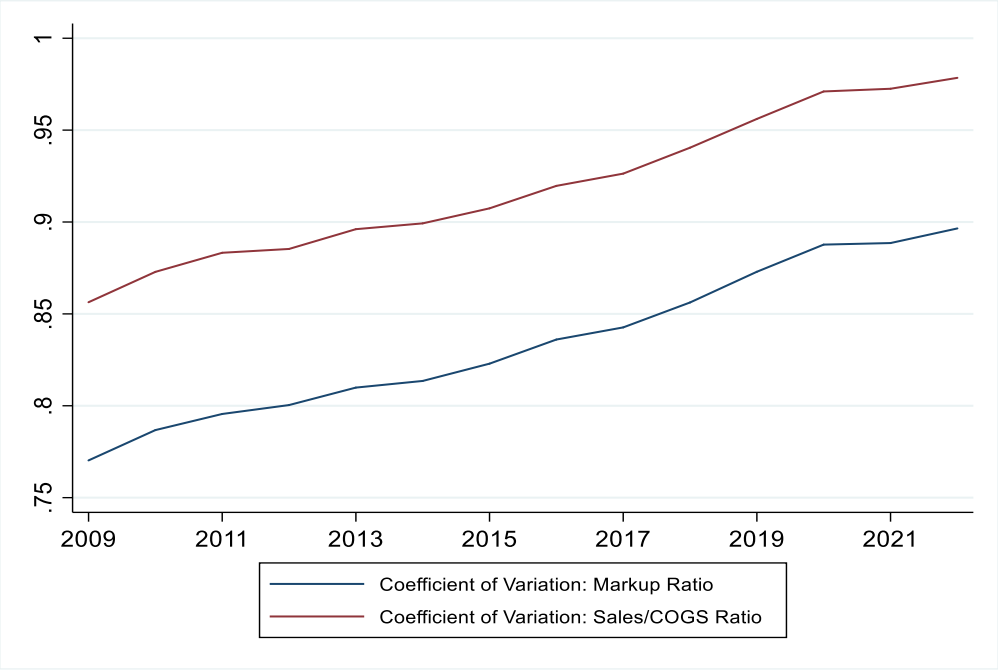
Note: This figure depicts the evolution of inflation outlook and the extent of inflation shocks in Türkiye for the sample period 2009-2022. The top-left chart displays the difference between end-of-year annual inflation rate and the official target rate (5%). The top-right chart displays the difference between end-of-year annual inflation rate and the inflation forecast given at the first CBRT Inflation Report of the same year. The bottom-left chart displays 12-months ahead annual inflation rate expectations. The bottom-right chart displays the standard deviation of inflation expectations for the end-of-year wave of CBRT Survey of Market Participants.

Figure 2: Evolution of Markups



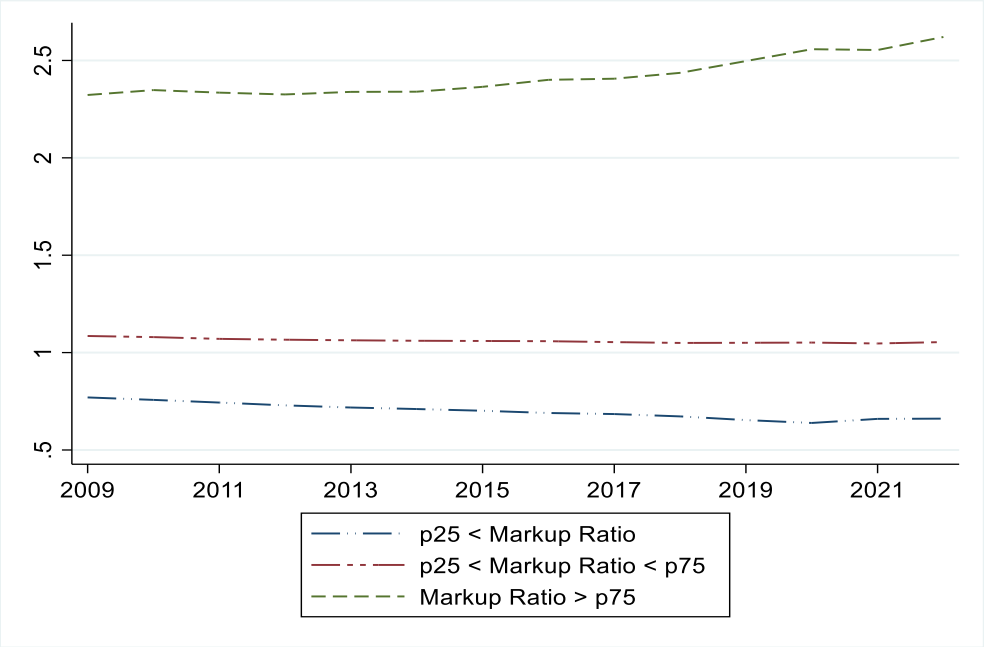
Note: This figure depicts the markup indicators constructed from micro-level administrative datasets in line with the methodology outlined in Section 4.1. The left chart displays time-series average of $Markup\ Ratio$ and $Sales/COGS\ Ratio$ over the sample period 2009-2022. The right chart displays same ratios in a weighted-average form using the share of firm-level number of employees as the input.

Figure 3: Variability of Markups



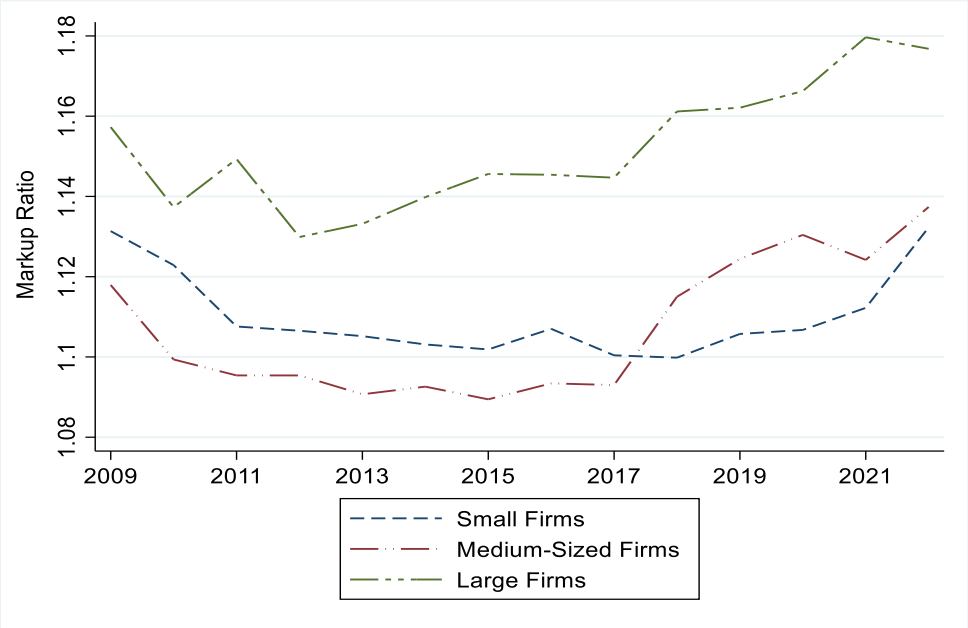
Note: This figure depicts the dispersion in markup setting behavior over the sample period 2009-2022. Particularly, the coefficient of variation measures (standard deviation divided by the sample mean) for $Markup\ Ratio$ and $Sales/COGS\ Ratio$ are created by using firm-level data, in an iterative way for each specific year.

Figure 4: Change in Markups Based on Markup Size



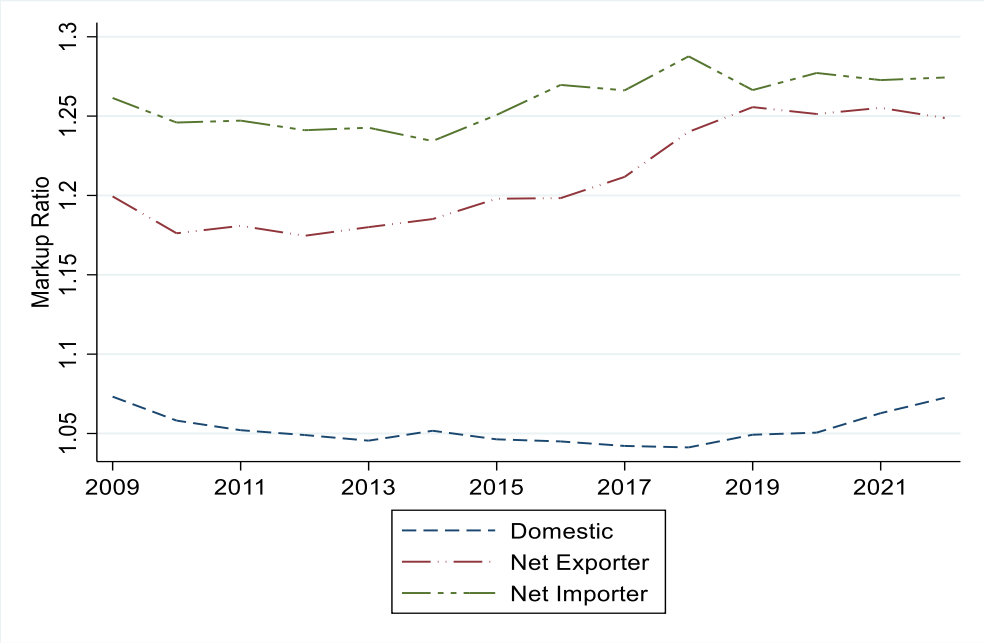
Note: This figure depicts the evolution of markup behavior based upon the markup size. To do that, for each year, we decompose firms into three groups (small, medium and large markups) with respect to 25th and 75th percentiles of univariate distributions of $Markup\ Ratio$.

Figure 5: Change in Markups Based on Firm Size Classifications



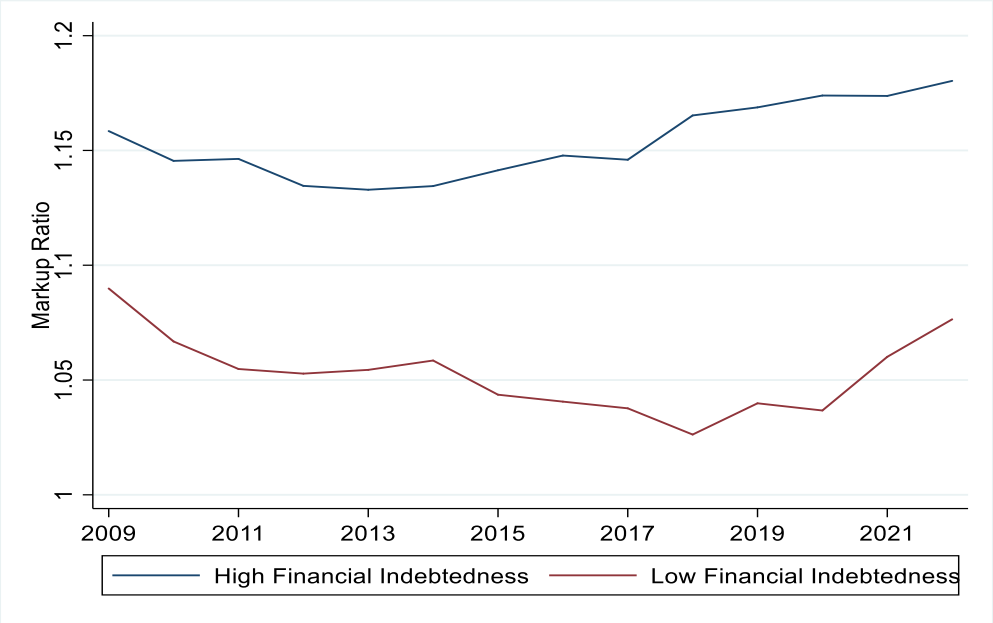
Note: This figure depicts the evolution of (employee-weighted) $Markup\ Ratio$ based upon firm size. To do that, we decompose firms into three groups (small-sized, medium-sized and large-sized firms) with respect to the classification available in the administrative datasets.

Figure 6: Change in Markups Based on Foreign Trade Status



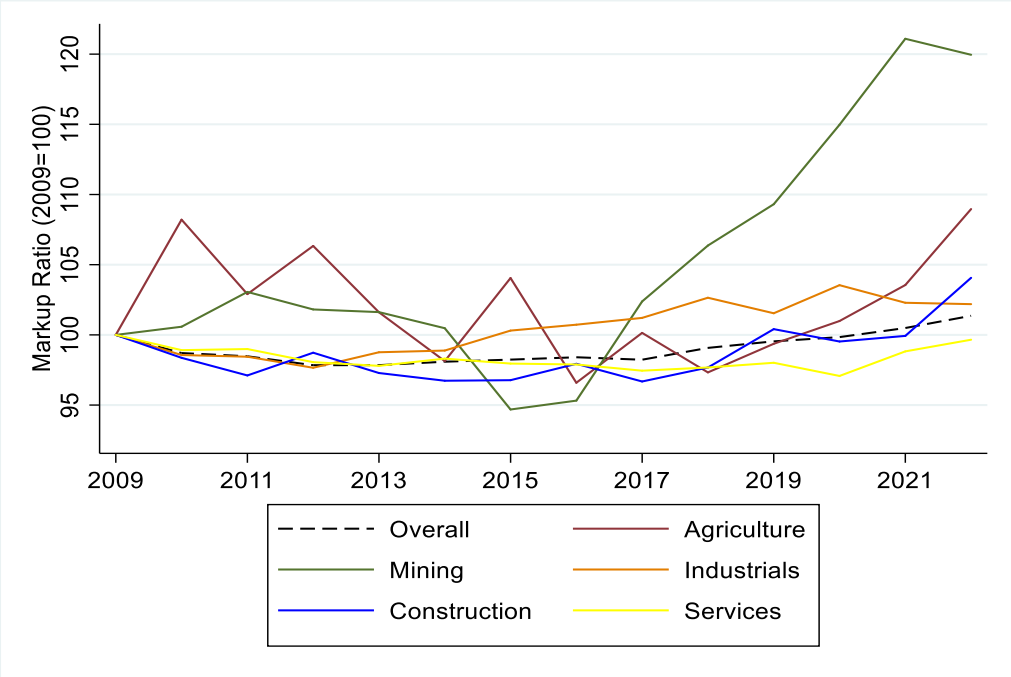
Note: This figure depicts the evolution of (employee-weighted) $Markup\ Ratio$ based upon firms' foreign trade status including only domestically orientated, net exporter and net importer firms.

Figure 7: Change in Markups Based on Financial Indebtedness



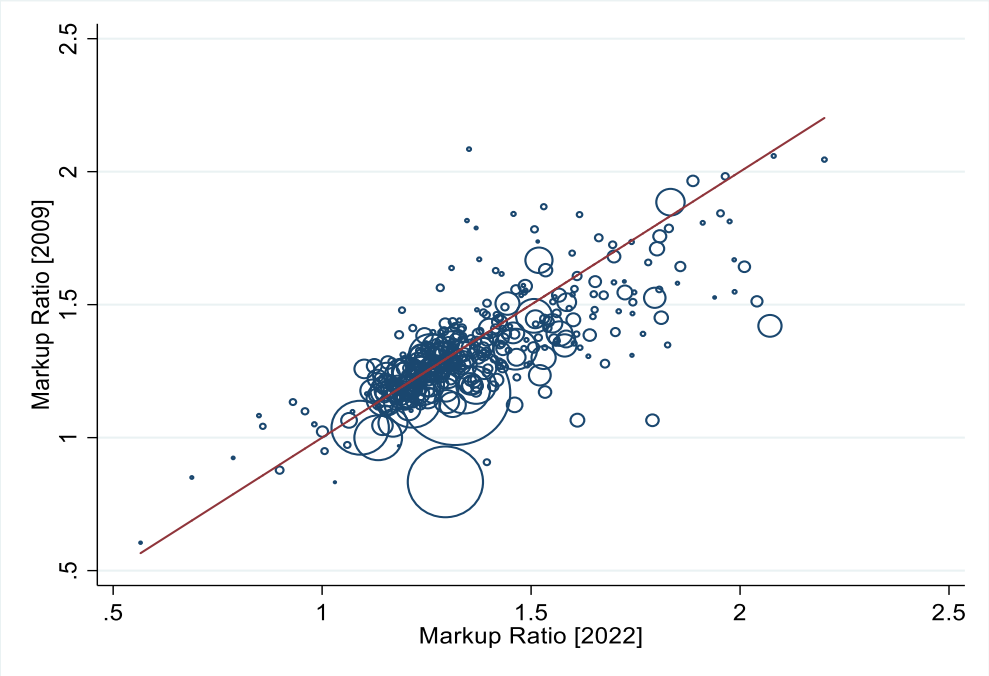
Note: This figure depicts the evolution of (employee-weighted) $Markup\ Ratio$ based upon firms' level of financial debt. To do that, we decompose firms into two groups by using the median value of financial debt to total assets ratio in each year in an iterative way.

Figure 8: Change in Markups Based on Main Sectors



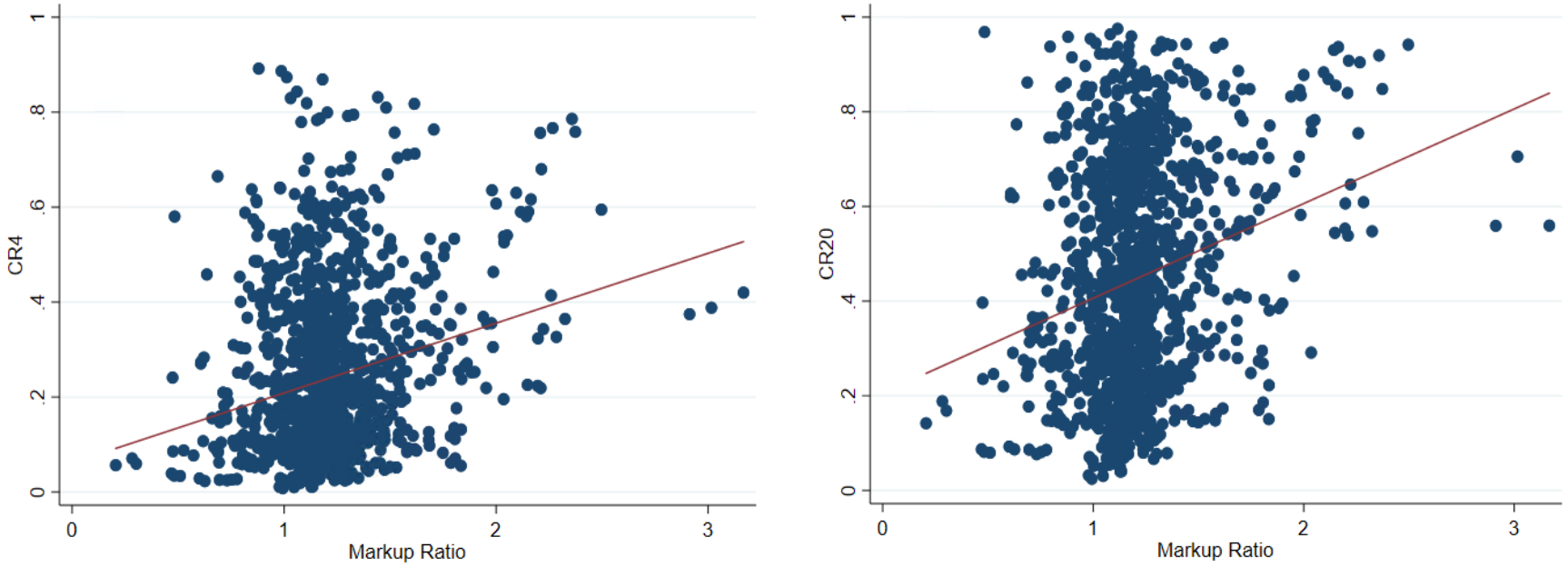
Note: This figure depicts the evolution of (employee-weighted) $Markup\ Ratio$ (normalized to 100 as of the year 2009) based upon firms' main sectors of operations. The dashed black line represents the (employee-weighted) overall $Markup\ Ratio$ for the same period.

Figure 9: Sectoral Heterogeneity in Markup Changes



Note: This figure depicts the evolution of the sectoral change in $Markup\ Ratio$ from the beginning to the end of the sample period at 4-digit NACE classifications. The vertical axis displays the markup behavior as of 2009, whereas the horizontal axis displays the markup behavior as of 2022. The size of the bubbles is constructed based on the average sales of sectors. The red line corresponds to 45^0 line standing for the stability in markup behavior across individual sectors.

Figure 10: Correlation between Sectoral Markups and Market Concentration during High Inflation Period (2020-2022)



Note: This figure depicts the simple correlation between (employee-weighted) $Markup\ Ratio$ aggregated at 4-digit NACE level and concentration ratios $CR4$ and $CR20$ for the high inflation period spanning the interval 2020-2022. Markup indicators are positioned in x-axes, while concentration ratios are depicted in y-axes. The left-panel of the figure measures the market concentration with $CR4$ variable, while the right-panel monitors the concentration tendencies with $CR20$ variable. The solid red lines represent the linear fit.

Table 1: Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Markup Ratio	Markup Ratio	Markup Ratio	Markup Ratio	Markup Ratio	Markup Ratio
CR4	-0.0181	-0.0258**	-0.0238**	0.1107**	0.0921**	0.1059**
	(0.0110)	(0.0109)	(0.0118)	(0.0471)	(0.0465)	(0.0518)
Sample	All	All	All	High Inflation	High Inflation	High Inflation
Obs.	6,871,223	6,871,223	6,871,223	1,682,009	1,682,009	1,682,009
Firm Controls		✓	✓		✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Sector FE			✓			✓
Adj. R^2	0.414	0.424	0.425	0.536	0.545	0.545

Note: This table reports the baseline findings by analyzing the relationship between market concentration and markups in line with the specification presented in Equation (5). Columns (1) to (3) consider the overall sample period (2009-2022) with the dataset of 1,155,019 unique firms, whereas columns (4) to (6) only consider the high-inflation sample period (2020-2022). All columns include dependent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). The main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. All columns include firm and year fixed effects, while columns (3) and (6) involve with 2-digit NACE sector fixed effects. Columns (2), (3), (5) and (6) augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 2: Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Markup Ratio	Markup Ratio	Markup Ratio	Markup Ratio	Markup Ratio	Markup Ratio
CR20	-0.0166**	-0.0199**	-0.0042	0.0966**	0.0856**	0.1323***
	(0.0084)	(0.0084)	(0.0095)	(0.0377)	(0.0371)	(0.0457)
Sample	All	All	All	High Inflation	High Inflation	High Inflation
Obs.	6,871,223	6,871,223	6,871,223	1,682,009	1,682,009	1,682,009
Firm Controls		✓	✓		✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Sector FE			✓			✓
Adj. R^2	0.414	0.424	0.425	0.536	0.545	0.545

Note: This table reports the baseline findings by analyzing the relationship between market concentration and markups in line with the specification presented in Equation (5). Columns (1) to (3) consider the overall sample period (2009-2022) with the dataset of 1,155,019 unique firms, whereas columns (4) to (6) only consider the high-inflation sample period (2020-2022). All columns include dependent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). The main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of employees of 4-digit NACE sectors. All columns include firm and year fixed effects, while columns (3) and (6) involve with 2-digit NACE sector fixed effects. Columns (2), (3), (5) and (6) augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 3: Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio
CR4	-0.0082	-0.0179	-0.0261*	0.1695***	0.1455**	0.1559**
	(0.0141)	(0.0140)	(0.0152)	(0.0616)	(0.0607)	(0.0678)
Sample	All	All	All	High Inflation	High Inflation	High Inflation
Obs.	6,871,223	6,871,223	6,871,223	1,682,009	1,682,009	1,682,009
Firm Controls		✓	✓		✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Sector FE			✓			✓
Adj. R^2	0.437	0.447	0.447	0.557	0.565	0.565

Note: This table reports the baseline findings by analyzing the relationship between market concentration and markups in line with the specification presented in Equation (5). Columns (1) to (3) consider the overall sample period (2009-2022) with the dataset of 1,155,019 unique firms, whereas columns (4) to (6) only consider the high-inflation sample period (2020-2022). All columns include dependent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. The main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. All columns include firm and year fixed effects, while columns (3) and (6) involve with 2-digit NACE sector fixed effects. Columns (2), (3), (5) and (6) augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 4: Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio	Sales/COGS Ratio
CR20	0.0021	-0.0019	-0.0123	0.1595***	0.1456***	0.1856***
	(0.0108)	(0.0108)	(0.0127)	(0.0487)	(0.0480)	(0.0596)
Sample	All	All	All	High Inflation	High Inflation	High Inflation
Obs.	6,871,223	6,871,223	6,871,223	1,682,009	1,682,009	1,682,009
Firm Controls		✓	✓		✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Sector FE			✓			✓
Adj. R^2	0.437	0.447	0.447	0.557	0.565	0.565

Note: This table reports the baseline findings by analyzing the relationship between market concentration and markups in line with the specification presented in Equation (5). Columns (1) to (3) consider the overall sample period (2009-2022) with the dataset of 1,155,019 unique firms, whereas columns (4) to (6) only consider the high-inflation sample period (2020-2022). All columns include dependent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. The main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of employees of 4-digit NACE sectors. All columns include firm and year fixed effects, while columns (3) and (6) involve with 2-digit NACE sector fixed effects. Columns (2), (3), (5) and (6) augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 5: Coarsened Exact Matching

	(1)	(2)	(3)	(4)
	Markup Ratio	Sales/COGS Ratio	Markup Ratio	Sales/COGS Ratio
CR4	0.1565***	0.2247***		
	(0.0551)	(0.0720)		
CR20			0.1701***	0.2425***
			(0.0490)	(0.0640)
Sample	High Inflation	High Inflation	High Inflation	High Inflation
Obs.	1,360,592	1,360,592	1,362,038	1,362,038
Firm Controls	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓
Adj. R^2	0.555	0.574	0.555	0.574

Note: This table reports the coarsened matching analysis to alleviate endogeneity concerns. All columns consider the high-inflation sample period (2020-2022). Columns (1) and (2) perform the matching procedure yielding 354,543 treatment firms (with above the median value of $CR4$ as of 2019) being matched with 354,543 controls firms (with below the median value of $CR4$ as of 2019). Columns (3) and (4) perform the matching procedure yielding 356,899 treatment firms (with above the median value of $CR20$ as of 2019) being matched with 356,899 controls firms (with below the median value of $CR20$ as of 2019). Columns (1) and (3) include dependent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). Columns (2) and (4) include dependent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. In columns (1) and (2), the main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. In columns (3) and (4), the main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of employees of 4-digit NACE sectors. All columns include firm, year and 2-digit NACE sector fixed effects. All columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 6: Instrumental Variable Estimations

	(1)	(2)	(3)	(4)	(5)	(6)
	CR4	Markup Ratio	Sales/COGS Ratio	CR20	Markup Ratio	Sales/COGS Ratio
CR4 Sector	0.2095***					
	(0.0059)					
CR4 Fitted		0.8558***	1.1021***			
		(0.2936)	(0.3819)			
CR20 Sector				0.3932***		
				(0.0076)		
CR20 Fitted					0.4656***	0.6050***
					(0.1203)	(0.1562)
Sample	High Inflation	High Inflation	High Inflation	High Inflation	High Inflation	High Inflation
Estimation	First-Stage	Second-Stage	Second-Stage	First-Stage	Second-Stage	Second-Stage
Obs.	1,511,152	1,511,152	1,511,152	1,511,152	1,511,152	1,511,152
Firm Controls	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓

Note: This table reports the instrumental variable analysis to alleviate endogeneity concerns. All columns consider the high-inflation sample period (2020-2022). Column (1) performs the first-stage of the 2SLS estimation procedure by regressing $CR4$ on the chosen instrument $CR4\ Sector$, which is the time-varying sectoral mean of $CR4$ at 2-digit NACE level (excluding the concentration ratios of specific 4-digit NACE sectors in question when calculating mean values in an iterative way). Columns (2) and (3) perform the second-stage estimations by regressing $Markup\ Ratio$ and $Sales/COGS\ Ratio$ on the fitted values from the first-stage, respectively. Column (4) performs the first-stage of the 2SLS estimation procedure by regressing $CR20$ on the chosen instrument $CR20\ Sector$, which is the time-varying sectoral median of $CR20$ at 2-digit NACE level (excluding the concentration ratios of specific 4-digit NACE sectors in question when calculating mean values in an iterative way). Columns (5) and (6) perform the second-stage estimations by regressing $Markup\ Ratio$ and $Sales/COGS\ Ratio$ on the fitted values from the first-stage, respectively. All columns include firm and year fixed effects. All columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 7: Robustness Checks

Panel A: Controlling for 4-digit NACE Sector FE	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.1244**	0.1825**		
	(0.0587)	(0.0772)		
CR20			0.1504***	0.2148***
			(0.0562)	(0.0736)
Panel B: Alternative High Inflation Sample (2019-2022)	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.0723**	0.1073**		
	(0.0347)	(0.0454)		
CR20			0.0550**	0.0866**
			(0.0273)	(0.0354)
Panel C: Alternative Winsorization (5^{th} and 95^{th} Percentiles)	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.0329	0.0633**		
	(0.0209)	(0.0257)		
CR20			0.0398**	0.0842***
			(0.0169)	(0.0206)
Panel D: Lagged Controls	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.1136**	0.1785***		
	(0.0472)	(0.0616)		
CR20			0.0971***	0.1672***
			(0.0373)	(0.0482)
Panel E: Robust Standard Errors	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.0921**	0.1455**		
	(0.0453)	(0.0592)		
CR20			0.0856**	0.1456***
			(0.0361)	(0.0468)
Panel F: Alternative Concentration Measures	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio

CR4_Assets	0.0552**	0.0744**		
	(0.0258)	(0.0339)		
CR20_Assets			0.0709***	0.1085***
			(0.0252)	(0.0331)
Panel G:	(1)	(2)	(3)	(4)
Sector-by-Year Fixed Effects	Markup Ratio	Sales/COGS Ratio	Markup Ratio	Sales/COGS Ratio
CR4	0.0614	0.0613		
	(0.0469)	(0.0612)		
CR20			0.0951**	0.1043**
			(0.0399)	(0.0518)
Sample	High Inflation	High Inflation	High Inflation	High Inflation
Firm Controls	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

Note: This table reports the robustness analyses for the baseline estimations. All columns cover the high-inflation sample period (2020-2022). For the sake of brevity, robustness analyses are given as rows in the panels. Columns (1) and (3) include dependent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). Columns (2) and (4) include dependent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. In columns (1) and (2), the main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. In columns (3) and (4), the main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of employees of 4-digit NACE sectors. Panel (A) replaces 2-digit NACE sector fixed effects with more granular 4-digit NACE sector fixed effects. Panel (B) utilizes a longer high-inflation sample period spanning the period 2019-2022, instead of the period 2020-2022. Panel (C) follows the winsorization at 5th and 95th percentiles, instead of 2nd and 98th percentiles. Panel (D) uses the one-period lagged firm-level controls in addition to the contemporaneous firm-level controls. Panel (E) constructs robust standard errors, instead of standard errors clustered at firm-level. Panel (F) computes sectoral concentration measures based on total assets ($CR4\_Assets$ and $CR20\_Assets$) and utilizes them to run the estimations. Unless stated otherwise, all columns include firm and year fixed effects. Panel (G) adds sector-by-year fixed effects. Unless stated otherwise, all columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). Unless stated otherwise, all firm-level control variables are winsorized at 2nd and 98th percentiles. Unless stated otherwise, standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 8: Heterogeneity Based on Firm Size

	(1)	(2)	(3)	(4)
	Markup Ratio	Markup Ratio	Sales/COGS Ratio	Sales/COGS Ratio
CR4	-0.0278		-0.0237	
	(0.0649)		(0.0849)	
CR4 x Small Firm	0.1234**		0.1743***	
	(0.0507)		(0.0661)	
CR20		0.0294		0.0652
		(0.0444)		(0.0575)
CR20 x Small Firm		0.0582**		0.0833**
		(0.0278)		(0.0359)
Sample	High Inflation	High Inflation	High Inflation	High Inflation
Obs.	1,682,009	1,682,009	1,682,009	1,682,009
Firm Controls	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Adj. R^2	0.545	0.545	0.565	0.565

Note: This table reports the extended analyses analyzing the moderating role of firm size on the relationship between sectoral competition and markups. All columns cover the high-inflation sample period (2020-2022). Columns (1) and (2) include dependent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). Columns (3) and (4) include dependent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. In columns (1) and (3), the main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. In columns (2) and (4), the main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of employees of 4-digit NACE sectors. Columns (1) and (3) are augmented with the term interacting $CR4$ with $Small\ Firm$, which is a binary variable indicating that the sample firm is small or medium-sized enterprise. Columns (2) and (4) are augmented with the term interacting $CR20$ with $Small\ Firm$, which is a binary variable indicating that the sample firm is small or medium-sized enterprise. The standalone $Small\ Firm$ binary variables are absorbed by firm fixed effects. All columns include firm and year fixed effects. All columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 9: Heterogeneity Based on State Subsidies

	(1)	(2)	(3)	(4)
	Markup Ratio	Markup Ratio	Sales/COGS Ratio	Sales/COGS Ratio
CR4	0.1106**		0.1632***	
	(0.0471)		(0.0615)	
CR4 x State Subsidies	-0.0820***		-0.1037***	
	(0.0183)		(0.0235)	
State Subsidies	0.0063**		0.0084**	
	(0.0031)		(0.0039)	
CR20		0.1177***		0.1808***
		(0.0376)		(0.0484)
CR20 x State Subsidies		-0.0583***		-0.0729***
		(0.0106)		(0.0137)
State Subsidies		0.0129***		0.0165***
		(0.0037)		(0.0048)
Sample	High Inflation	High Inflation	High Inflation	High Inflation
Obs.	1,628,094	1,628,094	1,628,094	1,628,094
Firm Controls	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Adj. R^2	0.543	0.543	0.562	0.562

Note: This table reports the extended analyses analyzing the moderating role of state subsidies on the relationship between sectoral competition and markups. All columns cover the high-inflation sample period (2020-2022). Columns (1) and (2) include dependent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). Columns (3) and (4) include dependent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. In columns (1) and (3), the main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. In columns (2) and (4), the main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of employees of 4-digit NACE sectors. Columns (1) and (3) are augmented with the term interacting $CR4$ with $State\ Subsidies$, which is a continuous variable indicating that the share of a specific firm's 4-digit NACE sector in total investment incentives allocated by Ministry of Industry and Technology. Columns (2) and (4) are augmented with the term interacting $CR20$ with $State\ Subsidies$. All columns include firm and year fixed effects. All columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 10: Effect of Markups on Investments and Salary Expenses

	(1)	(2)	(3)	(4)
	Investments	Investments	Salary Expenses	Salary Expenses
Markup Ratio	0.0113***		-134.23***	
	(0.0039)		(24.92)	
Sales/COGS Ratio		0.0089***		-123.63***
		(0.0029)		(19.25)
Sample	High Inflation	High Inflation	High Inflation	High Inflation
Obs.	1,413,955	1,413,955	1,364,492	1,364,492
Firm Controls	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Sector FE	✓	✓	✓	✓
Adj. R^2	0.137	0.137	0.778	0.778

Note: This table reports the extended analyses analyzing the effect of markups on firm investments and labor expenses. All columns cover the high-inflation sample period (2020-2022). Columns (1) and (2) include dependent variable $Investments$, which is the growth rate of long-term fixed assets, whereas columns (3) and (4) include dependent variable $Salary\ Expenses$, which is the ratio of wage income to the number of employees. Columns (1) and (3) include the main independent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). Columns (2) and (4) include the main independent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. All columns include firm, year and sector fixed effects. All columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

APPENDIX

Table A1: Variable Definitions and Summary Statistics

Panel A: Variable Definitions and Data Sources

Variable	Definition	Source
Markup Ratio	The ratio of gross sales to costs of goods sold by the NACE 4 sector-level output elasticity of variable inputs	CBRT, Authors' Calculations
Sales/COGS Ratio	The ratio of gross sales to costs of goods sold	CBRT, Authors' Calculations
CR4	The share of largest 4 firms' number of employees to total number of employees at NACE 4 sector level	CBRT, Authors' Calculations
CR20	The share of largest 20 firms' number of employees to total number of employees at NACE 4 sector level	CBRT, Authors' Calculations
Firm Size	The natural logarithm of one plus real total assets (realized based on PPI)	CBRT
Equity	The ratio of total equity to total assets (x100)	CBRT
Debt	The ratio of long-term liabilities to total assets (x100)	CBRT
ROA	The ratio of net income to total assets (x100)	CBRT
Liquidity	The ratio of cash and balances to total assets (x100)	CBRT
Net Exports	The difference between total exports and imports (transformed into TL) divided by total assets (x100)	Ministry of Trade
Small Firm	A binary variable taking the value of one for small and medium-sized firms, otherwise zero	CBRT
Investments	The annual growth rate of total long-term tangible assets	CBRT
Salary Expenses	The ratio of total wages paid divided by the number of employees	Social Security Institution

Panel B: Summary Statistics

Variable	Observations	Mean	Standard Deviation	P5	P50	P95
Markup Ratio	6,938,917	1.3106	1.1029	0.5375	1.0451	2.9452
Sales/COGS Ratio	6,938,917	1.5831	1.4667	0.7894	1.1810	3.7274
CR4	6,938,917	0.1132	0.1109	0.0108	0.0820	0.3388
CR20	6,938,917	0.2289	0.1697	0.0307	0.1801	0.5918
Firm Size	6,938,917	7.8300	1.8936	4.7511	7.8541	10.9972
Equity	6,938,917	16.8511	97.2395	-73.8644	26.0384	95.6435
Debt	6,938,917	8.5775	19.5026	0.0000	0.0000	56.3429
ROA	6,938,917	-6.1014	49.5321	-53.9850	1.4339	28.4592
Liquidity	6,938,917	76.1147	25.9381	18.2794	86.3057	100.0000
Net Exports	6,938,917	1.3126	13.9263	-8.0006	0.0000	15.6231
Investments	6,747,194	0.6392	2.4383	-0.7706	0.0000	4.0702
Salary Expenses	6,418,455	25662.78	21898.55	5143.00	18935.00	72859.43

Note: This table reports the variable definitions, data sources and summary statistics of the variables used in the main empirical analysis with the overall sample spanning 6,938,917 observations for the period 2009-2022.

Table A2: Robustness Checks

Panel A: Inclusion of Firm Fixed Effects in Equation (3)	(1) Markup Ratio_FE	(2) Markup Ratio_FE
CR4	0.0911* (0.0515)	
CR20		0.1155** (0.0455)
Panel B: **Inclusion of Firm-Level TFP in Equation (3)**	**(1)** **Markup Ratio_TFP**	**(2)** **Markup Ratio_TFP**
CR4	0.0475** (0.0228)	
CR20		0.0627*** (0.0205)
Sample	High Inflation	High Inflation
Firm Controls	✓	✓
Firm FE	✓	✓
Year FE	✓	✓
Sector FE	✓	✓

Note: This table reports the additional robustness analyses adjusting Equation (3) in calculating the output elasticity of inputs. All columns cover the high-inflation sample period (2020-2022). For the sake of brevity, robustness analyses are given as rows in the panels. Panel (A) includes dependent variable $Markup\ Ratio\_FE$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity obtained from the adjusted version of Equation (3) employing firm fixed effects. Panel (B) includes dependent variable $Markup\ Ratio\_TFP$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity obtained from the adjusted version of Equation (3) employing firm-level total factor productivity. In column (1), the main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. In column (2), the main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of employees of 4-digit NACE sectors. All columns include firm, year and 2-digit NACE sector fixed effects. All columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table A3: Robustness Checks

Panel A: Controlling for Exchange Rate Dynamics	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.0997**	0.1529**		
	(0.0464)	(0.0606)		
CR20			0.0951***	0.1545***
			(0.0369)	(0.0478)
Panel B: Controlling for Foreign Sales/Total Sales Ratio	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.1122**	0.1701***		
	(0.0465)	(0.0607)		
CR20			0.0971***	0.1601***
			(0.0371)	(0.0479)
Panel C: Controlling for Time-Persistent Markup Dynamics	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.0939**	0.1486***		
	(0.0443)	(0.0578)		
CR20			0.0804**	0.1388***
			(0.0351)	(0.0453)
Panel D: Controlling for Relative Firm Size Effects	(1) Markup Ratio	(2) Sales/COGS Ratio	(3) Markup Ratio	(4) Sales/COGS Ratio
CR4	0.1061**	0.1674***		
	(0.0468)	(0.0611)		
CR20			0.0990***	0.1671***
			(0.0375)	(0.0485)
Sample	High Inflation	High Inflation	High Inflation	High Inflation
Firm Controls	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓

Note: This table reports the robustness analyses for the baseline estimations. All columns cover the high-inflation sample period (2020-2022). For the sake of brevity, robustness analyses are given as rows in the panels. Columns (1) and (3) include dependent variable $Markup\ Ratio$ defined as the ratio of sales to COGS adjusted with the sector-level output elasticity following the methodology of De Loecker and Warzynski (2012). Columns (2) and (4) include dependent variable $Sales/COGS\ Ratio$ defined as the ratio of sales to COGS. In columns (1) and (2), the main independent variable is $CR4$ defined as the share of 4 largest firms' number of employees in total number of employees of 4-digit NACE sectors. In columns (3) and (4), the main independent variable is $CR20$ defined as the share of 20 largest firms' number of employees in total number of

employees of 4-digit NACE sectors. Panel (A) drops time fixed effects and augments the model with the change in currency basket as a macro-level control variable. Panel (B) maintains firm and time fixed effects but adds the control variable of the ratio of foreign sales to total sales. Panel (C) includes the lagged values of markup indicators as additional controls to account for time-persistent markup dynamics. Panel (D) replaces $Firm\ Size$ variable with an alternative indicator showing the relative size position of firms in a given sector-year pair. Unless stated otherwise, all columns include firm and year fixed effects. Unless stated otherwise, all columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). Unless stated otherwise, all firm-level control variables are winsorized at 2nd and 98th percentiles. Unless stated otherwise, standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table A4: Robustness Checks

Panel A: Alternative Market Concentration Indicator	(1) Markup Ratio	(2) Sales/COGS Ratio
HHI	0.0038**	0.0049**
	(0.0016)	(0.0020)
Sample	High Inflation	High Inflation
Firm Controls	✓	✓
Firm FE	✓	✓
Year FE	✓	✓

Note: This table reports the additional robustness analyses adjusting Equation (5) by replacing $CR4$ and $CR20$ with HHI variable. All columns cover the high-inflation sample period (2020-2022). For the sake of brevity, robustness analyses are given as rows in the panels. Panel (A) includes HHI which is defined as firms' sum of squared shares of number of employees, which is calculated with respect to the total number of employees of 4-digit NACE sectors that firms belong to. All columns include firm and year fixed effects. All columns augment the specification with the time-varying firm-level controls such as the natural logarithm of deflated total assets ($Firm\ Size$), the ratio of equity capital to total assets ($Equity$), the ratio of long-term liabilities to total assets ($Debt$), the ratio of net income to total assets (ROA), the ratio of cash and balances to total assets ($Liquidity$), the ratio of net exports (exports minus imports) to total assets ($Net\ Exports$). All firm-level control variables are winsorized at 2nd and 98th percentiles. Standard errors clustered at firm-level are given in the parentheses. ***, ** and * denote the statistical significance at 1%, 5% and 10% levels, respectively.

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