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Araştırma Makalesi / Research Article

Evolution of Markups in the Manufacturing Industry of Turkiye

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Abstract

In this study, we aim to estimate markups and the evolution of labor and profit shares in the manufacturing industry of Türkiye over 2007-2021 using an administrative firm-level dataset, the Entrepreneurship Information System (EIS), which covers the universe of firms and contains detailed balance sheet information. We employ the production function approach to estimate markups. Until 2016, there was a general decline in markups. Concurrently, the gross profit rate increases slightly, and the labor share of value added remains relatively stable. However, since 2016, which corresponds to the era of high inflation, there has been a notable surge in gross profit rates alongside a significant decrease in the labor share. The primary catalyst for these post-2016 shifts is attributed to firms positioned in the upper percentiles of the markup distribution, which successfully increased their markups and their share in total value-added during this period. As such, it may be fruitful for the competition policy to delve deeper into the root causes of the post-2016 surge in markups among high-markup firms, as well as the changing market composition.

Keywords: *Markup, Market Power, Profits.*

Türkiye İmalat Sanayinde Fiyat-Marjinal Maliyet Oranlarının Gelişimi

Öz

Bu çalışmada, 2007-2021 yılları arasında Türkiye imalat sanayinde fiyat-marjinal maliyet oranları (markup) ile birlikte işgücü ve kâr paylarının gelişiminin tahmin edilmesi amaçlanmaktadır. Bu doğrultuda, Türkiye'de kayıtlı tüm firmaların detaylı bilanço bilgilerini içeren idari veri seti Girişimci Bilgi Sistemi'nden (GBS) faydalanılmaktadır. Markup tahmininde üretim fonksiyonu yaklaşımı kullanılmaktadır. Tahminleriniz, 2016 yılına kadar markup seviyelerinde genel bir düşüşe işaret etmektedir. Aynı dönemde, brüt kâr oranı hafif bir artış gösterirken, katma değerdeki işgücü payı nispeten sabit kalmaktadır. Ancak, yüksek enflasyon dönemine denk gelen 2016 yılından itibaren brüt kâr oranlarında belirgin bir artış ve işgücü payında önemli bir azalma yaşanmıştır. Bu dönemdeki değişimlerin temel itici gücü, markup dağılımının üst yüzdelerinde yer alan firmaların markup'larını ve toplam katma değer içindeki paylarını artırmaları olmuştur. Bu nedenle, rekabet politikasının, 2016 sonrası yüksek markup'lı firmaların marjlarındaki artışın ve değişen piyasa yapısının sepeblerini derinlemesine incelemesi faydalı olabilir.

Anahtar Kelimeler: *Fiyat-Marjinal Maliyet Oranı, Piyasa Gücü, Kâr.*

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INTRODUCTION

Examining the dynamics of markups within a market or industry provides valuable insights into the level of competition and the distribution of economic gains between firms and consumers. The relationship between market power, inflation, and the distribution of economic surplus has gained renewed attention among economists and policymakers, particularly as recent studies highlight rising markups and market concentration across advanced economies. As documented by De Loecker et al. (2020) and Akcigit et al. (2021), many developed countries have experienced significant increases in markups, raising concerns about the macroeconomic implications of these trends. In contrast, Türkiye presents a distinctive case, marked by structural transformation and persistent inflation challenges, with consumer prices rising by 229% between 2017 and 2021, implying an annual inflation rate of 18%. Consequently, we posit that Türkiye's economic context underscores the urgency of understanding how firms adjust their pricing strategies and market power during periods of high inflation.

In the case of Türkiye, a developing economy, understanding markup trends holds particular significance due to the country's unique market structure, which includes a high degree of market concentration alongside firms with differing levels of market power, a significant informal sector, and a history of persistent inflation and currency volatility. These factors create a distinct environment where firms, particularly those in the upper percentiles of the markup distribution, can significantly adjust their pricing strategies in response to macroeconomic shocks.

Understanding markups during periods of inflation is crucial for policymakers, economists, and consumers alike. Inflation erodes the value of money, and markups play a significant role in determining how inflationary pressures are transmitted throughout the economy. By studying how markups change over time during inflation, we can gain insights into whether firms pass on increased costs to consumers through higher prices or absorb some of those costs themselves. This information is critical for designing policies to stabilize prices and protect consumers from the adverse effects of inflation. Moreover, understanding markup dynamics reveals potential sources of market power, giving policymakers tools to identify and address competitive imbalances or anti-competitive practices that could exacerbate inflationary pressures.

From 2010 onwards, Türkiye experienced a period of relatively subdued inflation compared to its historical trends, often aligning with global patterns. During the early 2010s, inflation generally remained within single digits, mirroring trends in many developed economies. However, in recent years, Türkiye has experienced more volatile inflation and interest rates, with sharp spikes driven by factors such as currency depreciation, global commodity price fluctuations, and domestic economic policies. Inflation set a two-decade record high in 2022, with more than 84%, in contrast with many developed economies, which have generally exhibited more moderate inflation levels (Turkish Statistical Institute (TurkStat).

This study examines how markups have changed in the Turkish manufacturing sector between 2007 and 2021—the most recent year for which data were available at the time this paper was written—placing particular emphasis on the distributional and structural consequences of these developments. Understanding markup dynamics in Türkiye is economically significant for several reasons. First, markups are key indicators of firms' pricing power and the degree of market competition, both of which are central to discussions on productivity, inequality, and structural transformation. Second, Türkiye presents a compelling case due to its dual characteristics as a rapidly industrializing economy with strong ties to global value chains and a domestic policy environment marked by economic volatility and shifting industrial strategies. These features make

Türkiye a helpful case study for exploring how markups evolve under conditions of institutional and macroeconomic changes. Third, by analyzing markups alongside labor and profit shares, the study contributes to ongoing debates about declining labor income shares and rising corporate profits in emerging markets. Thus, the findings not only offer empirical insights into Türkiye's manufacturing sector but also add information to broader theoretical discussions on competition, rent distribution, and industrial policy effectiveness in developing economies.

We follow the production function approach pioneered by Hall (1988) and refined by De Loecker and Warzynski (2012). This method uses only input elasticities and observable labor share data to estimate firm-specific markups. To this end, this study leverages a unique administrative, firm-level dataset provided by the Turkish Ministry of Industry and Technology. The Entrepreneurship Information System (EIS) offers rich information on enterprise registers, balance sheets, employee records, and more for 2006-2021. Using a carefully constructed sample, we derive essential metrics, including output, value-added, and capital stock. Our primary markup estimation relies on the flexible translog production function, estimated using the Levinsohn and Petrin (2003) method with Ackerberg et al., (2015) correction. The choice of a translog specification allows us to capture potential non-linearities and generate firm-specific input elasticities crucial for accurate markup calculations. Results derived from a Cobb-Douglas production function serve as a robustness check.

This study reveals the dynamic fluctuations in markups, labor, and profit shares in the Turkish manufacturing sector. Using a data-driven, firm-level approach, we uncover a U-shaped trajectory for firms located in the upper percentiles of the markup distribution: an initial decline followed by a post-2016 surge, which corresponds to the era of high inflation. The remaining firms also experienced a decrease in their markups until 2016, but thereafter, their markups remained relatively stable. As of 2016, the labor share has decreased sharply, and the profit rate has increased significantly. Notably, the expansion and the rise in the markups of high-markup firms fueled these post-2016 changes, highlighting the crucial role of firm heterogeneity.

Related literature. Using markups as a market power metric has gained prominence within industrial organization research. Hall's (1988) methodology for deriving markups from aggregate data and De Loecker and Warzynski's (2012) firm-level adaptation have been foundational to this focus. De Loecker et al. (2020), an influential study on the US economy, spurred extensive research into markups and market power across various economies.

Studies point to a concerning upward trend in average markups worldwide. Several analyses (Akcigit et al., 2021; Calligaris et al., 2018; De Loecker & Eeckhout, 2018; De Loecker et al., 2020; Diez et al., 2018; Diez et al., 2019; Hall, 2018) document significant increases over the past few decades. This escalation in markups appears more pronounced in advanced economies compared to emerging markets (Akcigit et al., 2021; De Loecker & Eeckhout 2018; Diez et al., 2018; Diez et al., 2019). The observed rise in markups is mainly attributable to firms that already have the highest markups (Calligaris et al., 2018; De Loecker et al., 2020).

While research consistently signals upward markup trends, variations in estimation methods exist. Weche and Wambach (2018) report notably higher markup figures for the EU than other literature, e.g., the markup figures of De Loecker et al. (2020) for the US. Additionally, several studies investigate markups at a country-specific level, providing insights specific to Germany, Belgium, Japan, France, Norway, the UK, Italy, and others.

Research specific to Turkey's economic performance often centers on profit metrics, but studies examining markups exist. According to Taymaz and Yilmaz (2015), average markup increases in the Turkish manufacturing sector until 1994, followed by a post-EU Customs Union decline. Unveren and Sunal (2015) show that high markups are a primary factor driving Turkey's low labor share. Akcigit et al. (2020) showed that post-2012 increases in markups observed in Turkey's manufacturing industry, predominantly driven by large firms. Yilmaz and Kaplan (2022) confirm that large firms significantly influence overall markup trends within Turkey's manufacturing sector. Pismaf (2023) works on market power and markups in Turkiye (2006-2021) using a cost approach rather than the production approach we use in this paper. The author finds that markups have tended to rise since 2014. This is driven mainly by the rise in markups of large firms. The author also finds a positive correlation between markups and inflation, but the direction of causality seems unknown. Within the extended literature, this paper suggests similar findings regarding markups in the manufacturing sector employing the production function approach using unique firm-level data for the first time.

Building on a rich body of literature examining markups and market power, our study contributes to the growing understanding of markup trends, particularly in the context of emerging markets like Turkiye. Previous studies, such as those by De Loecker and Eeckhout (2018) and Akcigit et al. (2020), highlight rising markups in advanced economies and large firms, with a focus on the increasing concentration of market power. In Turkey, existing research, including the work by Taymaz and Yilmaz (2015) and Unveren and Sunal (2015), has explored the relationship between high markups and low labor share, but often with a focus on broader trends or using different methodological approaches. Our paper extends this literature by employing the production function approach to estimate labor markups, using firm-level data from the Entrepreneurship Information System (EIS), which covers the universe of firms in Turkey's manufacturing sector.

1. DATA AND METHODOLOGY

The main challenge associated with markup estimation is that the marginal costs (and mostly output prices) are not observable. The so-called accounting approach assumes that the average costs are equal to marginal costs and, therefore, recovers markups by dividing the total revenue by total costs. Whereas recovering markups via the accounting approach is straightforward, this approach rests on solid assumptions such as zero fixed costs and constant returns to scale.

The industrial organization literature, on the other hand, imposes a specific demand system and a competition structure. Markups can then be estimated by utilizing the first-order conditions of firms' profit maximization problem and the price elasticity of demand. See, for example, Berry et al. (1995) among others. Whereas this approach is powerful for estimating the markups of well-defined, specific industries during short periods, it is somewhat restrictive if the purpose is to estimate markups for large industries and over more extended time periods. Furthermore, the demand approach requires prices and quantities of goods sold to be observed, which is again impossible when the interest is on larger sets of firms over several years.

Building upon the insights of Hall (1988), the production function approach developed by De Loecker and Warzynski (2012) avoids these issues by departing from a simple cost minimization problem. Let the cost minimization problem of a firm i, at time t be given by:

$$\min_{L_{i,t},\, K_{i,t},} w_{i,t}L_{i,t} + r_{i,t}K_{i,t} \tag{1}$$

where $w_{i,t}$ and $r_{i,t}$ respectively represent the prices of factor inputs labor, $L_{i,t}$, and capital, $K_{i,t}$. Imposing a value-added quantity constraint[i] $q(\sigma_{i,t}, L_{i,t}, K_{i,t}) \geq \bar{q}$, where $\sigma_{i,t}$ is an unobserved productivity shock, the Lagrangean associated with the cost minimization problem is:

$$\mathcal{L}\left(L_{i,t}, K_{i,t}, \lambda_{i,t}\right) = w_{i,t}L_{i,t} + r_{i,t}K_{i,t} - \lambda_{i,t}\left(q_{i,t}\left(\sigma_{i,t}, L_{i,t}, K_{i,t}\right) - \bar{q}\right). \tag{2}$$

The production function approach builds on the insight that the Lagrange multiplier associated with the value-added constraint, $\lambda_{i,t}$, represents the marginal cost, i.e., the effect of a marginal relaxation of the constraint on the objective function (total costs). First-order-condition with respect to labor supply reads:

$$w_{i,t} = \lambda_{i,t}\frac{\partial q_{i,t}\left(\sigma_{i,t}, L_{i,t}, K_{i,t}\right)}{\partial L_{i,t}}. \tag{3}$$

Multiply both sides of (3) by $l_{i,t}/q_{i,t}\left(\sigma_{i,t}, L_{i,t}, K_{i,t}\right)$ and the right-hand-side by the ratio of value-added price to itself, $P_{i,t}/P_{i,t}$, to get:

$$\frac{w_{i,t}L_{i,t}}{q_{i,t}\left(\sigma_{i,t}, L_{i,t}, K_{i,t}\right)} = \frac{P_{i,t}}{P_{i,t}}\lambda_{i,t}\frac{\partial q_{i,t}\left(\sigma_{i,t}, L_{i,t}, K_{i,t}\right)}{\partial L_{i,t}}\frac{L_{i,t}}{q_{i,t}\left(\sigma_{i,t}, L_{i,t}, K_{i,t}\right)}. \tag{4}$$

Recognizing that markup is the price-marginal cost ratio, $\frac{P_{i,t}}{\lambda_{i,t}} = \mu_{i,t}$, and rearranging equation (4) yields:

$$\mu_{i,t} = \delta_{i,t}^{q,L}\frac{P_{i,t}q_{i,t}\left(\sigma_{i,t}, L_{i,t}, K_{i,t}\right)}{w_{i,t}L_{i,t}} \tag{5}$$

where the first term $\delta_{i,t}^{q,L} = \frac{\partial q_{i,t}(\sigma_{i,t}, L_{i,t}, K_{i,t})}{\partial L_{i,t}}\frac{L_{i,t}}{q_{i,t}(\sigma_{i,t}, L_{i,t}, K_{i,t})}$ represents the elasticity of value added with respect to labor supply and the second term is the inverted share of labor in value-added.[ii] Since the latter term is directly observable in many firm-level datasets and the former term can be estimated via the well-known production function estimation techniques, firm-specific markups can be recovered at any year.

Table 1: Descriptive Statistics Per Firm (In Million TL, Annual)

Year	Output	Input	Value-added	Labor Cost	Depre-ciation	Gross Profit	Sample Size
2007	5.12	4.11	1.01	0.42	0.21	0.38	71.392
2008	5.68	4.54	1.14	0.45	0.20	0.49	75.395
2009	5.12	4.02	1.10	0.47	0.21	0.42	75.054
2010	6.11	4.92	1.20	0.54	0.21	0.44	77.925
2011	7.75	6.26	1.49	0.61	0.24	0.64	82.148
2012	7.88	6.43	1.46	0.69	0.24	0.53	87.069
2013	8.35	6.67	1.68	0.75	0.27	0.66	93.102
2014	9.16	7.31	1.85	0.85	0.29	0.72	98.902
2015	9.73	7.56	2.17	0.98	0.31	0.88	104.418
2016	10.36	7.90	2.46	1.16	0.34	0.96	108.286
2017	13.10	10.06	3.04	1.30	0.38	1.36	110.815
2018	16.71	12.79	3.92	1.48	0.47	1.97	116.534
2019	18.40	14.52	3.88	1.63	0.53	1.71	117.656
2020	20.59	15.82	4.77	1.69	0.57	2.51	123.462
2021	37.09	27.65	9.45	2.46	1.86	5.13	121.649

Notes: Construction of the variables is described in Appendix Section A. Figures represent per firm (total divided by the number of firms), annual values in million TL.

We utilize an administrative, firm-level, employee-employer-integrated dataset provided by Turkiye's Ministry of Industry and Technology's Entrepreneurship Information System (EIS). EIS covers the universe of registered firms over 2006-21 and provides detailed information on enterprise registers, balance sheets, employee registers, and between-firm sales, among other firm-specific aspects. Although the first year of the dataset is 2006, our markup series begins in 2007 because stock adjustments and depreciation calculations require information from the prior year.

Utilizing mainly enterprise registers, balance sheets, and employee registers, we construct output, input, value-added, labor cost, annual hours worked, depreciation, gross profit, and capital stock variables. Our sample size of the manufacturing industry starts at approximately 70.000 in 2007 and exceeds 120.000 in 2021. Table 1 provides additional descriptive statistics for our sample. Gross profit rates are calculated by dividing gross profits by output. Thus, gross profit share and gross profit rate are used interchangeably throughout this study. Labor share indicates the ratio of labor costs to value added. See Appendix Section A for further details on data preparation and variable construction.

Table 2: Translog Production Function Estimation Results

NACE Code	Market Share	Labor Elasticity	Capital Elasticity	Returns-to-scale
Avg.	-	*0.828*	*0.159*	*0.986*
10	0.142	0.749	0.149	0.898
24	0.120	0.882	0.176	1.058
29	0.091	0.772	0.150	0.922
13	0.085	0.798	0.153	0.951
25	0.059	0.850	0.186	1.036
20	0.056	0.968	0.137	1.105
27	0.056	0.774	0.135	0.909
22	0.054	0.946	0.145	1.091
14	0.054	0.760	0.110	0.870
28	0.049	0.829	0.164	0.993
23	0.048	0.822	0.250	1.072
19	0.043	0.964	0.178	1.141
17	0.027	0.848	0.167	1.015
31	0.018	0.784	0.131	0.916
26	0.014	0.869	0.144	1.012
32	0.014	0.715	0.136	0.850
16	0.013	0.793	0.146	0.940
21	0.013	0.872	0.183	1.055
33	0.012	0.763	0.163	0.926
30	0.011	0.904	0.153	1.057
15	0.008	0.750	0.124	0.873
11	0.007	0.927	0.226	1.154
18	0.007	0.698	0.142	0.840

Notes: Sectors are ranked based on their market share within the manufacturing industry. Sector definitions can be found in Table 3 of the Appendix. As explained in the text, the translog production function produces elasticity estimates at the firm level. Firm-level estimates are averaged within industries, across firms, and years to produce the figures reported in the table. The first row presents the average elasticities and returns-to-scale across manufacturing industries.

EIS provides us with the inverted share of labor in value-added, i.e., the second term in equation (5), for each firm every year. Recovering the first term, i.e., elasticities of factor inputs requires estimating a production function. We separately estimate a translog and a Cobb-Douglas production function by employing the Levinsohn and Petrin (2003) method combined with Ackerberg, Caves and Frazer (2015) correction. See Appendix Section B for a detailed account of our production function estimation procedure. We prefer the translog production function as our main specification due to its flexibility, i.e., it produces firm-specific input elasticities and performs better in capturing nonlinearities in input-output relationships. See Table 2 for the elasticities estimated from the translog production function. The elasticities reported in Table 2 represent firm-specific elasticities averaged across firms and years. The results of the Cobb-Douglas production, which fundamentally produces the same implications as the translog function, are reported in Appendix Section C.

2. RESULTS

Using the EIS data and production function approach, we find that labor shares in Turkiye have a tendency to fluctuate but have a decreasing trend after 2016, with a slight increase in 2019 and a sharp fall from 2019 to 2021. Meanwhile, Figure 1 also shows that gross profit share in output only slightly increased from 2012 to 2016. After 2016, however, it sharply increased, accompanying the decline in the labor share. Although the labor share fluctuates between 0.4 and 0.45, Turkiye experienced a sharp decline to around 0.25 in 2021. The decreasing trend in labor share and increasing trend in gross profit share in Turkiye, especially after 2016, could come from the fact that firms are exercising greater market power. Prices might rise beyond marginal costs, generating extra profits beyond workers' share, hinting at a fall in competition. The second explanation could be the change in the production composition towards high markup firms. Our analyses below suggest that both explanations play some part.

Figure 1: Labor and Profit Shares

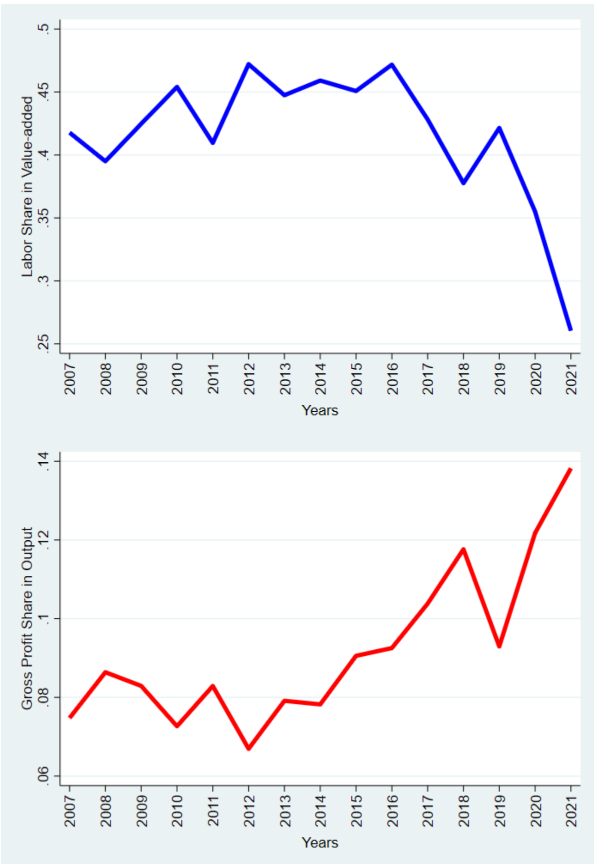


Figure 2 illustrates the evolution of markups for the firms located at different percentiles of the markup distribution within the manufacturing industry.[iii] It should be noted that we opted to keep outliers of the markup distribution in our dataset and, therefore, focus on different percentiles of the markup distribution. See Appendix Section D for the change in average markups throughout the period of interest. As evident from Figure 2, markups fall for all percentiles from 2007 to 2016. At the same time, markups have a tendency to rise starting from 2016 for the firms located at the 90th percentile of the markup distribution. While remaining firms could not witness a similar surge, they achieved stabilizing their markups.

Figure 2: Evolution of Markups Assuming Translog Production Function and CPI

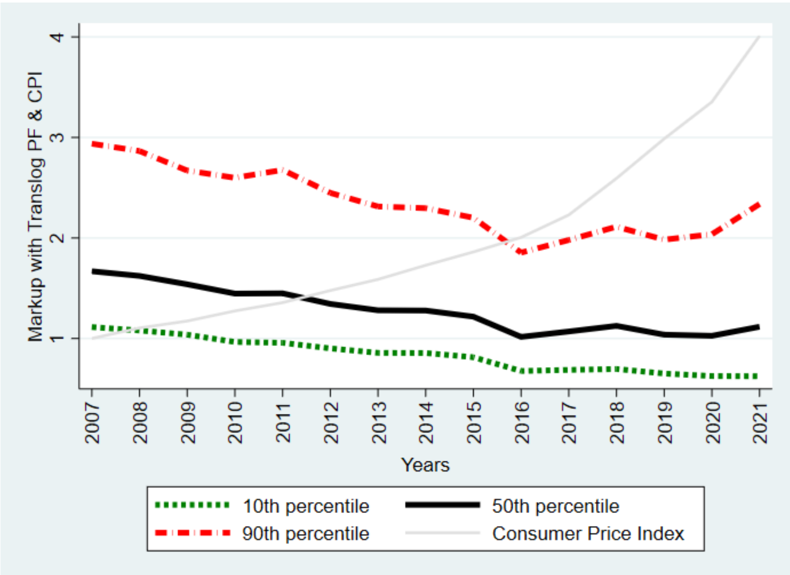
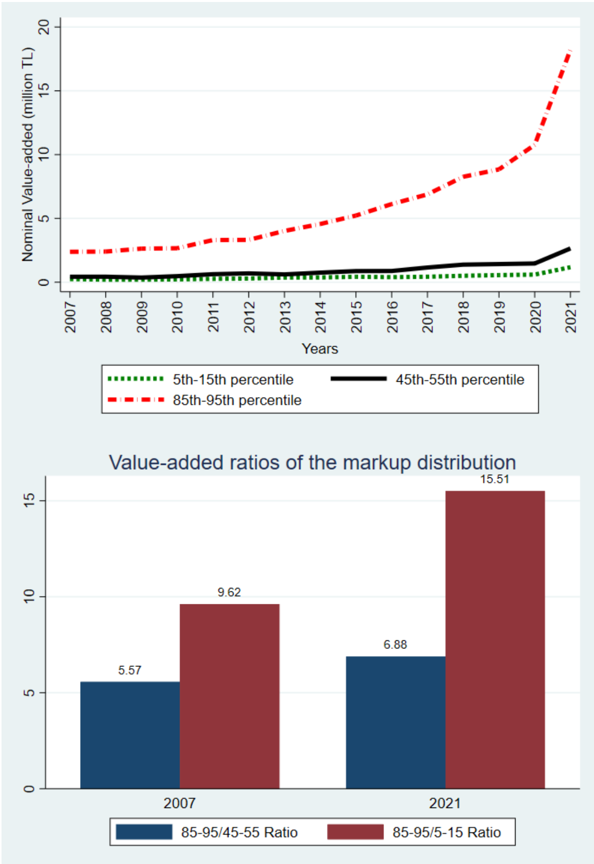


Figure 2 provides one possible reason for the post-2016 developments in profit and labor share: the rise in the markups of the high markup firms. On the other hand, comparing 2021 with 2007 reveals that profit rate increased and labor share decreased despite an overall reduction in markups across the board. As such, the rise in the markups of high-markup firms alone does not account for the general evolution of profit rate and labor share.

To delve into the evolution of market composition, Figure 3's left panel illustrates shifts in average nominal value added across the markup distribution. Evidently, firms with high markups experienced a significant increase in their value-added during the observed period. However, it's important to acknowledge the influence of high inflation, particularly in the post-2016 era, which complicates the interpretation of relative changes in nominal value added across the markup distribution.

To address concerns regarding graph legibility, the right panel of Figure 3 presents a comparison of value-added ratios among different markup distribution percentiles in 2021 versus 2007. It becomes apparent that firms with high markups achieved a notably greater increase in their value added. Specifically, the ratio of the average nominal value added across the 85th-95th percentiles to the 5th-15th percentiles has more than doubled, surging from 6.88 to 15.51.

Figure 3: Evolution of Value-Added Across The Markup Distribution



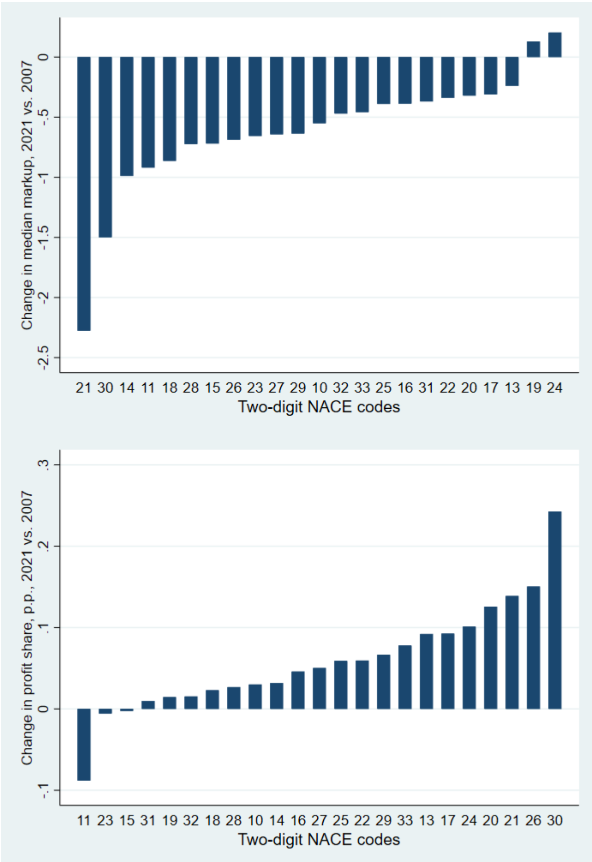
Notes: The first panel illustrates the evolution of mean nominal value added (in million TL) across the firms in the indicated percentage of the markup distribution. The second panel shows the mean nominal value-added ratios of the exact markup percentiles in 2007 and 2021. The use of nominal values in the first may reduce legibility. However, the second panel is unaffected by inflation, as it shows ratios of value added across markup percentiles, which would remain unchanged when both numerator and denominator are scaled with inflation.

Overall, our descriptive analyses suggest that changing production composition in favor of high markup firms is a prominent feature of the Turkish manufacturing industry over the period of investigation. This compositional change does contribute to the overall rise in profit rate and the decline in labor share. However, there is another factor influencing the pronounced changes in profit rate and labor share, particularly noticeable in the post-2016 period of high inflation. During this time, firms with already higher markups relative to others experience a further markup increase, while other firms, at the very least, manage to stabilize their markups. Coupled with the ongoing change in production composition, the post-2016 years witness a sharp ascent in the overall profit rate along with a drastic decline in labor share.

The distribution of various manufacturing subindustries across the markup spectrum is not necessarily uniform. Consequently, there is a potential concern that our findings might be influenced by a few dominant industries capable of significantly impacting the overall results for manufacturing. To mitigate this concern, we examine the outcomes specific to different manufacturing subindustries.

The left and right panels of Figure 4 respectively show changes in markups and profit rates across different industries using two-digit NACE codes. We see that the median markup falls in 2021 compared to 2007 in nearly all industries except (19 and 24, Coke and refined petroleum products, and basic metals) and the profit share increases for the majority of the subindustries with the highest spike in 30 (Other transport equipment), consistent with the results of the overall manufacturing industry. Thus, we conclude that the rise in profit rates and the fall in median markups are not due to changes in a few large industries, but instead hold across almost all industries. Nonetheless, it is worthwhile to note that the extent of aforementioned developments exhibits remarkable heterogeneity across subindustries, as evident from Figure 4.

Figure 4: Changes in Markups and Profit Shares Within Industries



Notes: Industry definitions are provided in Table 3 of the Appendix. The panels illustrate the changes in the median markup (left panel) and the profit share of total output (right panel) in 2021 relative to 2007.

Appendix Section D presents the evolution of labor shares, profit rates, and markups as in Figure 1 and Figure 2, but for the largest (in terms of market share) four subindustries. Results indicate that manufacturing sector-wide developments persist within subindustries. After 2016, high-markup firms generally exhibit increasing momentum in their markup levels, while median markups remain relatively stable. At the same time, profit rates within industries rise sharply. This suggests that the post-2016 surge in markups among high-markup firms—alongside their growing value-added shares (not shown)—contributes to the rise in profit rates and the decline in labor shares during the same period.

We now turn to the nature of the relationship between markups, profits and inflation—a topic that has attracted considerable attention in both policy and academic circles in Europe and the United States, particularly in light of the inflationary pressures that emerged in the post-pandemic period. Researchers and practitioners alike have devoted substantial effort to understanding this relationship (see, for example, Bouras et al., 2023; Hansen et al., 2023, Leduc et al., 2024). However, the international evidence on the contribution of markups to inflation remains mixed.

A key challenge in addressing this question lies in the scarcity of credible exogenous variation in either markups or inflation, which complicates efforts to identify a causal relationship. This limitation applies to our context as well. As such, we do not attempt to establish causality between the two variables. Nevertheless, we offer some interpretive insights into their potential relationship based on descriptive patterns in the data.

To this end, the patterns in markups and consumer price inflation observed in Figure 2 offer an important insight. The resurgence of markups in the upper percentiles coincides with a notable change in the slope of the CPI, both occurring around 2016. As discussed above, it is difficult to establish a causal relationship between these trends or to determine whether a third factor is driving both the increase in markups at the top of the distribution and the acceleration of inflation. Nevertheless, drawing on anecdotal evidence, it can be argued that the initial rise in inflation in Türkiye was relatively independent from the increase in markups.

Starting in 2016, Türkiye faced a series of internal and external shocks, including the failed coup attempt, the diplomatic crisis with the United States over the detention of Pastor Andrew Brunson, and heightened global uncertainty stemming from anticipated interest rate hikes by the U.S. Federal Reserve. These shocks interacted with several structural vulnerabilities in the Turkish economy—such as persistent trade deficits and import dependence of domestic production. In addition, growing concerns over the independence of the judiciary and the central bank, coupled with delayed or insufficient monetary and fiscal responses, further eroded investor confidence. Together, these factors triggered a sharp depreciation of the Turkish lira and a sustained rise in inflation.

It is apparent that the era of rising inflation coincided with a divergence in markups between firms in the upper percentiles of the markup distribution and the rest of the firm population. Table 5 in Appendix D presents the attributes of these firms, showing that they are significantly larger in terms of labor, capital, output, value added, and productivity measured by value added per day worked. These characteristics suggest that such firms may have had a greater capacity to adjust prices and sustain higher markups compared to smaller firms.

Building on this pattern, we interpret that while the rise in markups among these upper-percentile firms may not have been a major driver of the initial inflationary surge, the high-inflation environment may have provided them with an opportunity to reverse previously declining markups and expand their market shares. Their size and productivity advantages could have made it easier to pass through costs or leverage pricing power. This, in turn, may have contributed to the persistence and further acceleration of inflation. We emphasize that this interpretation is descriptive in nature; establishing the direction and magnitude of these relationships would require more detailed empirical analysis, which falls outside the scope of this paper.

3. CONCLUSION

This paper investigates the evolution of markups in the Turkish manufacturing industry between 2007 and 2021 using the administrative EIS data from the Republic of Turkiye Ministry of Industry and Technology that provides detailed information on enterprise registers, balance sheets, employee registers, and between-firm sales, among another firm-specific aspects. We utilize the production function approach to estimate firm-level markups. Our findings reveal several key insights:

- In the manufacturing industry of Turkiye, the share of labor in value-added remained relatively unaltered until 2016 but exhibited a dramatic decline thereafter, in the period associated with a high level of inflation. At the same time, the slight increase in the gross profit rate observed until 2016 intensified in this inflationary era.

- The analysis of markup distribution reveals that the upper percentiles of the markup distribution in the Turkish manufacturing industry exhibit a U-shaped trend, decreasing initially and then increasing after 2016. Markups of the remaining firms exhibit an initial decline until 2016, and they are stabilized thereafter.

- Throughout the investigation period, two primary factors underlie the increase in profit rates and the decrease in labor share. Firstly, there is a notable shift in the value-added composition of the manufacturing industry towards high markup firms, which typically feature lower labor shares. Secondly, starting from 2016, high markup firms succeeded in elevating their markups, albeit without fully reaching the levels observed in 2007. This suggests that firm heterogeneity plays a crucial role in understanding the overall trend of markups. Using aggregate measures can mask significant underlying trends and variations.

- The findings underscore that shifts in labor shares, profit rates, and markups are not isolated to a handful of manufacturing subindustries; rather, they are observed across numerous subsectors within the industry.

The trends we uncover have important distributional and welfare implications. The labor share of an economy reflects the portion of total output allocated to wages. In contrast, firm ownership is typically concentrated among a relatively affluent segment of the population. Consequently, a rising profit share alongside a declining labor share may exacerbate disposable income inequality through the non-labor income channel. The existing empirical literature investigating the links between rising markups, profit shares, and income inequality supports this view (Ennis et al., 2019; Han & Pyun, 2021).

At the same time, evidence points to increasing assortative matching in labor markets—that is, high-paying firms are increasingly matched with high-ability individuals, and vice versa (Card et al., 2013; Song et al., 2019). If this pattern also characterizes the labor market in Türkiye, rising markup inequality may further amplify wage inequality via the labor income channel. Finally, if high-markup firms continue to expand their share of value added and crowd out competitors, this could lead to a decline in overall labor demand and a consequent rise in unemployment.

Thus, monitoring markup trends and understanding the factors driving them can inform policy decisions to promote competition and protect consumer welfare. The standard competition policy, e.g., strengthening anti-trust enforcement specifically in sectors showing signs of excessive market power and profit rates, reducing market entry barriers, monitoring mergers and acquisitions can help preserve both competition and employment, and act as an indirect redistribution mechanism. On the other hand, our findings also reveal that the competition policy might benefit from exploring the underlying factors driving the increase in markups among high markup firms after 2016, as well as the changing market composition in favor of high markup firms over the last decade. This approach could facilitate the development of targeted interventions tailored to specific types of firms.

Beyond competition policy, a growing body of recent literature explores the role of fiscal policy in addressing the adverse consequences of rising profit rates in settings where firms are heterogeneous in their markups. For instance, Eeckhout et al. (2024) argue that the optimal policy response to declining competition involves raising profit taxes while lowering labor income taxes. In a more counterintuitive finding, Boar and Midrigan (2024) suggest that policies which further increase product market concentration may be optimal. However, as highlighted in the previous paragraph, country-specific dynamics—such as Türkiye’s evolving market structure—must be carefully considered when formulating specific policy recommendations.

Appendix

A. Data Preparation

We drop firms that do not report balance sheets or employee registers. Firms that remain inactive for at least three consecutive years in the sample period are also excluded. We also dropped observations lacking the balance sheet information necessary to compute key variables such as output, inputs, gross profit, and capital stock. Net sales and capital stock (book values of capital) data are directly observable in the balance sheets. Employee registers in EIS report hours worked and monthly gross salaries for one month of each quarter until 2019 but for every month in 2020 and 2021. We calculate the sum of hours worked and gross wages for every firm and multiply them by four for every year until 2020 to arrive at annual figures for labor costs and total hours worked. Gross salaries are adjusted for severance allowances and social security premiums.

Table 3: Industry Definitions and Sample Sizes

NACE Code	Industry Definition	Sample Size
10	Food products	170.400
11	Beverages	4.421
13	Textiles	107.734
14	Wearing apparel	151.694
15	Leather and related products	35.046
16	Wood and cork, except furniture	41.568
17	Paper and paper products	24.110
18	Printing and reproduction of recorded media	54.794
19	Coke and refined petroleum products	2.031
20	Chemicals and chemical products	40.795
21	Basic pharmaceutical products	3.335
22	Rubber and plastic products	95.230
23	Other non-metallic mineral products	72.170
24	Basic metals	35.468
25	Fabricated metal products, except machinery and equipment	197.699
26	Computer, electronic, and optical products	9.718
27	Electrical equipment	46.947
28	Machinery and equipment n.e.c.	112.093
29	Motor vehicles, trailers and semi-trailers	32.964
30	Other transport equipment	6.460
31	Furniture	94.104
32	Other manufacturing	52.428
33	Repair and installation of machinery and equipment	72.310

Balance sheets incorporate information on accumulated depreciations. Depreciation in each year is recovered by first-differencing this variable. Suppose a firm was inactive in the previous year(s). In that case, the yearly depreciation variable is adjusted accordingly, i.e., by dividing the first-differenced variable by two if a firm was inactive for one year. We replace the flow variables, such as depreciation and net sales, with zero if they are negative. Output is constructed by adding net sales to income from other sources and adjusting for output stock differences. In order to compute the inputs of the firms, we sum the cost of goods sold and other expenditures, adjust for input stock differences, and deduct labor costs and depreciation of capital. Value added can be calculated as the difference between output and input. Gross profit is computed by deducting the labor costs and depreciation from value added.

Table 3 provides the definitions of each manufacturing subindustry along with their total sample sizes across 2007-2021. Note that the tobacco sector (NACE code: 12) is excluded from the analyses due to the low sample size.

B. Production Function Estimation

Following De Loecker and Warzynski (2012), let value-added be produced according to:

$$q_{i,t} = F\left(L_{i,t}, K_{i,t}; \beta\right)\exp(\sigma_{i,t}) \tag{6}$$

where $\sigma_{i,t}$ represents the productivity known by the managers of the firm but unobserved by the econometrician and β represents a set of coefficients that relate inputs to value-added. The expression in (6) encompasses both Cobb-Douglas and translog production functions. Remaining explanations and derivations are presented with a translog value-added production function because it is our preferred specification.

Let $\tilde{q}_{i,t} = lnq_{i,t} + \varepsilon_{i,t}$ where $\varepsilon_{i,t}$ represent an i.i.d. error term unobserved both by the managers and the econometrician. The production function reads:

$$\tilde{q}_{i,t} = \beta_l l_{i,t} + \beta_k k_{i,t} + \beta_{ll} l_{i,t}^2 + \beta_{kk} k_{i,t}^2 + \beta_{lk} l_{i,t} k_{i,t} + \sigma_{i,t} + \varepsilon_{i,t} \tag{7}$$

with $l_{i,t} = lnL_{i,t}$ and $k_{i,t} = lnK_{i,t}$.

It is a well-known feature that simple OLS regressions of the logarithm of output on the logarithms of factor inputs yield biased estimations of input elasticities due to the simultaneity and selection biases caused by the firm-specific productivity parameter $\sigma_{i,t}$. A vast literature is developed to eliminate these biases. Building on Olley and Pakes (1996), Levinsohn and Petrin (2003) proposes that the level of material inputs, $m_{i,t}$, can be considered as a function of the firm-specific productivity $\sigma_{i,t}$ and the state variable $k_{i,t}$, that is $m_{i,t}\left(k_{i,t}, \sigma_{i,t}\right)$. This idea rests on the assumption that, for any given level of the state variable (decision about whose level is made prior to the realization of the productivity shock), the level of material inputs, which can be adjusted instantaneously, increases in $\sigma_{i,t}$. Thus, inverted $m_{i,t}$ can be used as a proxy for $\sigma_{i,t}$, i.e., $\sigma_{i,t} = {m_{i,t}}^{-1}\left(k_{i,t}, \sigma_{i,t}\right) = d_{i,t}(m_{i,t}, k_{i,t})$.

Ackerberg, Caves and Frazer (2015) points out that, as long as labor input is associated with adjustment costs (e.g., hiring, firing costs), it should be an argument in function $d_{i,t}(.)$, i.e., $\sigma_{i,t} = d_{i,t}(m_{i,t}, k_{i,t}, l_{i,t})$. In the empirical applications, $d_{i,t}(.)$ is usually approximated by a second or a third order polynomial. Plugging $d_{i,t}(.)$ into (7) yields a function of the form:

$$\tilde{q}_{i,t} = \varphi(m_{i,t}, k_{i,t}, l_{i,t}) + \varepsilon_{i,t} \tag{8}$$

where $\varphi(m_{i,t}, k_{i,t}, l_{i,t}) = \beta_l l_{i,t} + \beta_k k_{i,t} + \beta_{ll} l_{i,t}^2 + \beta_{kk} k_{i,t}^2 + \beta_{lk} l_{i,t} k_{i,t} + d_{i,t}(m_{i,t}, k_{i,t}, l_{i,t})$. The first stage estimation yields the estimates of planned output, $\hat{\varphi}_{i,t}$, and the error term, $\varepsilon_{i,t}$. Following the first stage, it is possible to obtain the firm-specific productivity shocks for any β via: $\hat{\sigma}_{i,t} = \hat{\varphi}_{i,t} - \beta_l l_{i,t} + \beta_k k_{i,t} + \beta_{ll} l_{i,t}^2 + \beta_{kk} k_{i,t}^2 + \beta_{lk} l_{i,t} k_{i,t}$.

The estimates of coefficients β can be searched for in a second stage assuming a Markov chain process for the firm-specific productivity shock, $\sigma_{i,t} = g(\sigma_{i,t-1}) + \xi_{i,t}$, utilizing a set of moment conditions, $E(\xi_{i,t} x) = 0$ where $x \in \{l_{i,t-1}, k_{i,t}, l_{i,t-1}^2, k_{i,t}^2, l_{i,t-1 k_{i,t}}\}$ and by employing standard GMM techniques. In a next step, firm-specific labor and capital elasticities can be calculated as:

$$\delta_{i,t}^{q,L} = \hat{\beta}_l + 2\hat{\beta}_{ll} l_{i,t} + \hat{\beta}_{lk} k_{i,t}, \tag{9}$$

$$\delta_{i,t}^{q,K} = \hat{\beta}_k + 2\hat{\beta}_{kk} k_{i,t} + \hat{\beta}_{lk} l_{i,t}. \tag{10}$$

It should be noted that this study utilizes the "prodest" command developed in Rovigatti and Mollisi (2018). In particular, we run the "prodest" command with 30 repetitions, a tolerance level of 10^{-6} and the Nelder-Mead optimizer. A well-known feature of Levinsohn and Petrin (2003) algorithm and Ackerberg, Caves and Frazer (2015) correction is that the results of the second stage optimization may be sensitive to initial values, especially under low sample sizes (see Rovigatti and Mollisi (2018)). While our sample sizes are generally sufficiently large, we nevertheless estimate the production functions of each manufacturing sub-industry with five different seeds and average the resulting coefficients.

As standard in the literature on production estimation, we use deflated monetary values of value-added, capital stock, and material inputs, since quantities are not available. In particular, we deflate value-added by producer price indices (PPI) of three-digit NACE industries taken from the Turkish Statistical Institute (TUIK) whenever possible. If the producer prices of a three-digit industry are unavailable, we utilize two-digit NACE industry PPI, letter NACE industry PPI, or general PPI in this order, depending on availability. Our capital input is the book value of capital deflated with the capital goods price index provided by TUIK.

EIS allows us to observe the difference between firm sales. Thus, we construct firm-specific material input price indices based on the composition of inputs from different three-digit NACE industries. Once again, we use lower-digit price indices of an industry if producer prices are not available at the three-digit level. EIS also allows us to observe imported inputs. For the imported inputs, we construct a specific price index by multiplying the EUR/TRY exchange rate with the PPI of the EU. Finally, total hours worked are employed as the labor input into the production function. It should be noted that while using deflated monetary values can lead to well-known biases in the estimation results, there is a high correlation between biased and true markup estimates (De Ridder et al., 2022). Therefore, trends over time and across industries can be conveniently investigated.

Finally, the total monetary value of value-added observed in the dataset is $\tilde{q}_{i,t} = lnq_{i,t} + \varepsilon_{i,t}$, that is, it includes the idiosyncratic error term $\varepsilon_{i,t}$. Utilizing the error term estimated in the first-stage of the production function estimation, we convert realized value-added into planned value-added. Specifically, our final markup estimates read:

$$\mu_{i,t} = \delta_{i,t}^{q,L} \frac{P_{i,t}\,\tilde{q}_{i,t}(\sigma_{i,t}, L_{i,t}, K_{i,t})/\exp(\varepsilon_{i,t})}{w_{i,t}L_{i,t}}. \quad (11)$$

C. Results with Cobb-Douglas Production Function

Table 4 and Figure 5 report the equivalents Table 1 and Figure 2 when the underlying production function is assumed Cobb-Douglas instead of translog. The estimation of Cobb-Douglas production function virtually follows the same steps mentioned in the previous section with the exception that equation (7) is replaced by:

$$\tilde{q}_{i,t} = \beta_l l_{i,t} + \beta_k k_{i,t} + \varepsilon_{i,t} \quad (12)$$

Equations (9) and (10) also become redundant since coefficients β_l and β_k directly imply labor and capital elasticities. In this case, elasticities do not differ across firms as opposed to the elasticities that result from the estimation of a translog production function.

The average labor elasticity, which is the crucial component of markup calculation, is similar to that of translog production function estimation. Similarly, trends across the markup distribution are very similar in comparison to the markup estimations with the translog production function.

Figure 5: Evolution of markups assuming Cobb-Douglas Production Function

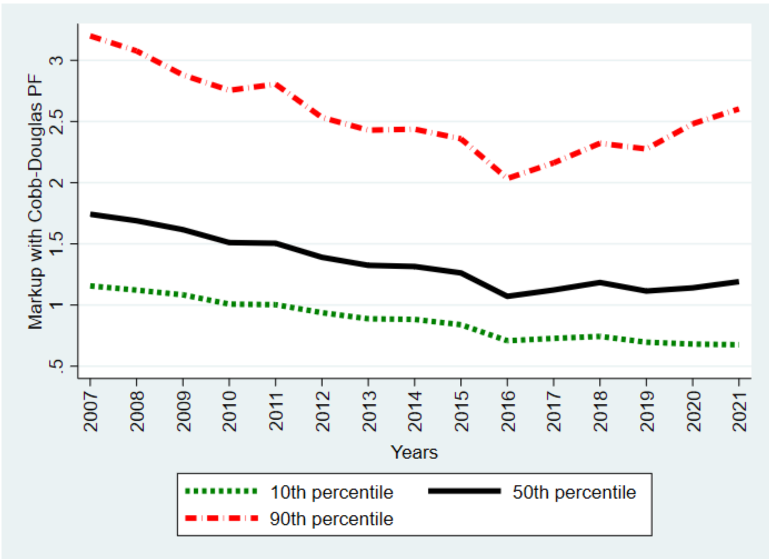


Table 4: Cobb-Douglas Production Function Estimation Results

NACE Code	Market Share	Labor Elasticity	Capital Elasticity	Returns-to-scale
Avg.	-	*0.854*	*0.037*	*0.891*
10	0.142	0.856	0.051	0.907
24	0.120	0.852	0.023	0.875
29	0.091	1.000	0.030	1.030
13	0.085	0.831	0.056	0.887
25	0.059	0.811	0.055	0.866
20	0.056	0.876	-0.029	0.847
27	0.056	0.945	0.022	0.966
22	0.054	0.852	0.030	0.882
14	0.054	0.832	0.054	0.886
28	0.049	0.844	0.033	0.877
23	0.048	0.807	0.042	0.849
19	0.043	0.886	0.120	1.005
17	0.027	0.864	0.000	0.863
31	0.018	0.833	0.066	0.899
26	0.014	0.907	0.042	0.949
32	0.014	0.808	0.054	0.862
16	0.013	0.802	0.063	0.865
21	0.013	0.894	-0.079	0.814
33	0.012	0.755	0.044	0.799
30	0.011	0.784	0.068	0.852
15	0.008	0.816	0.074	0.890
11	0.007	1.010	0.025	1.035
18	0.007	0.770	0.017	0.787

Notes: Sectors are ranked based on their market share within the manufacturing industry. Sector definitions can be found in the Table 3 of the Appendix. The first row presents the average elasticities and returns-to-scale across manufacturing industries.

D. Further Results

Figure 6 presents the changes in simple average markups and average markups weighted with firms' market shares. Weighted average markups appear relatively high. This is because we opted not to drop the outliers. Thus, the main text focuses on the evolution of markups at the specific markup percentiles. Nonetheless, the U-shaped trend of weighted average markups is consistent with the narrative in the main text, i.e., firm composition shifts in favor of high markup firms over the sample period and, simultaneously, high markup firms achieve an increase in their markups as of 2016.

Figure 7, Figure 8, and Figure 9 figures, respectively, demonstrate the evolution of labor shares, profit shares, and markups of the largest four industries, which, in total, constitute approximately 45% of the manufacturing industry market. Table 5 presents the firm characteristics by translog markup percentiles.

Figure 6: Evolution of Average Markups Assuming Translog Production Function

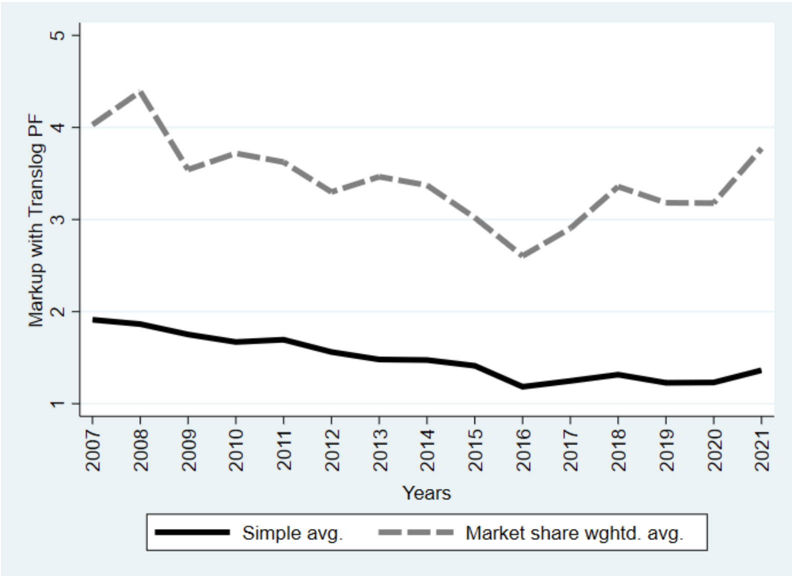


Figure 7: Labor Shares of the Largest Four Industries

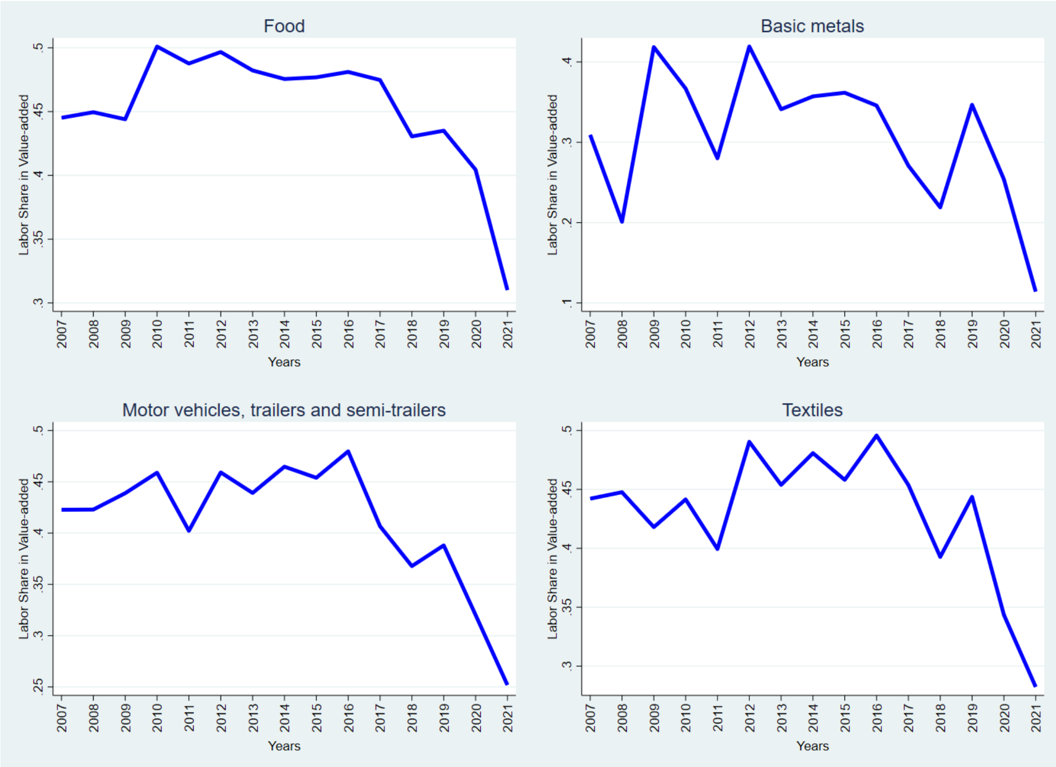


Figure 8: Profit Shares of The Largest Four Industries

Figure 9: Markups of The Largest Four Industries

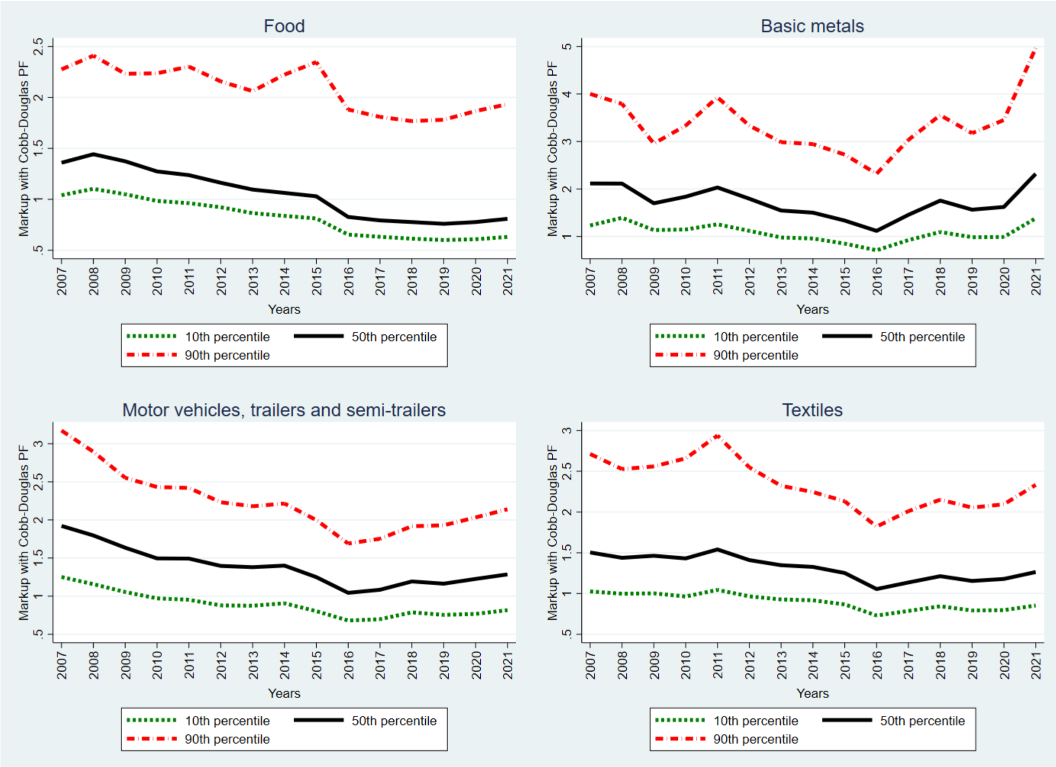


Table 5: Firm Attributes By Translog Markup Percentile

Year	Markup Percentiles	Days Worked	Capital Stock	Output	VA	VA per Day
2007	5th-15th	3.47	0.17	0.76	0.25	52
2007	45th-55th	5.96	0.36	1.63	0.43	62
2007	85th-95th	21.04	3.35	11.48	2.39	108
2014	5th-15th	2.97	0.20	0.99	0.37	95
2014	45th-55th	6.40	0.59	2.68	0.75	103
2014	85th-95th	22.33	5.36	21.00	4.56	174
2021	5th-15th	4.30	0.44	2.76	1.17	288
2021	45th-55th	5.58	1.83	9.52	2.65	380
2021	85th-95th	19.42	14.16	68.68	18.22	700

Notes: Values represent averages for firms with markups above the specified percentile range. Days Worked denotes the total number of days worked by all employees in a firm. Capital Stock, Output, and VA (Value Added) are in nominal million TL. VA per Day is calculated by first dividing each firm's value added by its total days worked, and then averaging across firms; thus, it does not equal total VA divided by total Days Worked.

NOTES

[1] The production function approach can also be utilized by incorporating intermediate goods into the production function and assuming that q represents output instead of the value-added. Because our focus is on estimating labor markups, which we simply refer as markups throughout the paper, employing a value-added production function with labor and capital as factor inputs is sufficient.

[2] As in De Loecker and Warzynski (2012), the monetary value of total value added is adjusted for the error term to reflect planned value-added. See Appendix for further details.

[3] High-markup firms are defined as those in the top percentile of markups each year, permitting entry and exit over time, consistent with the earlier literature. This rank-based approach helps identify whether aggregate markup trends are driven by changes in a typical firm's markup or by broader shifts in the dispersion of markups.

YAZAR BEYANI

Araştırma ve Yayın Etiği Beyanı

Bu çalışma bilimsel araştırma ve yayın etiği kurallarına uygun olarak hazırlanmıştır.

Etik Kurul Onayı Gerekli değildir.

Yazar Katkıları

Yazarlar çalışmaya eşit oranda katkıda bulunmuştur.

Çıkar Çatışması

Yazarlar açısından ya da üçüncü taraflar açısından çalışmadan kaynaklı çıkar çatışması bulunmamaktadır.

Destek Beyanı

Bulunmamaktadır.

Teşekkür

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