STOCKHOLM SCHOOL OF ECONOMICS
Department of Economics
BE551 Degree project in economics
Spring 2024

Do Mergers and Acquisitions Explain the Rise of Markups?

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Abstract: I analyse how mergers and acquisitions (M&A) have influenced the increase in markups in Sweden from 1998 to 2021. Economic theory suggests that M&A may increase market power, leading to higher markups. Utilising the Serrano database, which contains comprehensive balance sheet data for Swedish companies, I calculate markup dynamics in Sweden's manufacturing sector using the production approach to estimate markups. My findings indicate that although markups have risen during the examined period, there is no substantial evidence linking M&A activities to this increase. Surprisingly, the data reveals that while the markups of merging firms do increase post-merger, they do so at a rate slower than that of non-merging firms.

Keywords: Market Power, Markups, Mergers and Acquisitions

JEL: G34, L16, K21

Date submitted: May 13, 2024
Date examined: May 31, 2024
Discussants: Mondrita Rashid
Examiner: Magnus Johannesson

Acknowledgements

I extend my deepest gratitude to Sampreet Goraya from SSE and Timo Boppart from HSG/IIES, who have been instrumental in shaping my academic journey. Sampreet introduced me to the macroeconomic study of firm dynamics during his master's course, sparking my interest and inspiring this thesis. Timo further deepened my understanding of growth theory, prompting critical reflection on long-run macroeconomic developments. His guidance, particularly while I worked as his research assistant on a project concerning Swedish markups, was invaluable in the preparation of this thesis. I am also thankful to my former colleagues at IFN, especially Melinda Suveg, Lars Persson, and Pehr-Johan Norbäck, who were the first to encourage my initial markup estimations. My friend and flatmate in St. Gallen, Gösta Nils Ian Lycke, provided critical insights and comments that enriched this work. Finally, my heartfelt appreciation goes to my family and Valeriia, whose relentless support and encouragement have been my cornerstone throughout my studies and the development of this thesis.

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1 Introduction

Rising aggregate markups – the difference between the price of firms' output and their marginal cost of production – represent a recent puzzling development in macroeconomics and industrial organisation (De Loecker, Eeckhout, and Unger 2020). The cause and effect of rising markups have important implications for economic welfare, it may reflect a structural change to the economic environment where firms have attained higher aggregate market power. Such shifts could increase producer surplus (economic profits) at the expense of falling consumer surplus, as firms with higher market power might produce less goods and services, while charging more. Moreover, rising market power reduces aggregate labour demand, potentially explaining the recent decline in labour's share of output (Autor et al. 2020).

Several theories have been proposed to explain the rise in markups. Autor et al. 2020 suggest that changes in the economic environment have facilitated the emergence of 'superstar firms'—highly productive firms with significant market power. These firms achieve high markups and low labour shares, out-competing less efficient ones. The authors attribute this shift to increased product market competition, hypothesising that it stems from greater consumer price sensitivity, enhanced access to price comparison technologies, and globalisation. An alternative hypothesis by De Loecker et al. 2016 suggests that reductions in import tariffs might lower production costs, and if these savings are not passed on to consumers, markups could increase.

Another compelling hypothesis is that Mergers and Acquisitions (M&A) contribute to industry consolidation, thereby increasing market power and markups. There are four primary mechanisms through which this may occur. First, in imperfectly competitive markets, merged entities may raise prices while maintaining or reducing marginal costs (due to efficiency gains), thus increasing markups. Second, market structure might allow even non-merging firms within the industry to enhance their market power as a result of competitors merging[1]. Third, if a high-markup firm merges with a low-markup firm and the resultant entity adopts the higher markup level, the disappearance of the lower-markup firm could 'arithmetically' raise the average markup. Finally, high market concentration reduces barriers for firms to collude, either explicitly or tacitly, enabling them to set prices above competitive levels.

My paper focuses on the first of these channels, whether, in aggregate, merging firms' markups increase more post-merger compared to non-merging firms. The purpose of this study is *not* to show if mergers can result in higher markups – a well-documented theoretical and empirical fact. Rather, I explore the extent to which M&A activities contribute to broader economy-wide markup increases. This remains an open question; it is possible that only a small proportion of mergers result in significant markup increases, or that such mergers occur in industries too small to impact the economic aggregates significantly.

Using the method of De Loecker and Warzynski 2012 and De Loecker, Eeckhout, and Unger 2020, I structurally estimate markups for Swedish manufacturing firms. My data is from the Serrano database (Weidenman 2024), which includes the universe of balance sheet data for Swedish limited liability firms

1. Intuitively, consolidation from five to three competitors in a market can increase market power for remaining firms, even those not involved in mergers. See Motta 2004 for theoretical underpinnings.

('aktiebolag') between 1998-2021 and all domestic mergers. Although I find that aggregate markups in Sweden have increased, broadly consistent with findings by De Loecker, Eeckhout, and Unger 2020 for American publicly listed firms, the increase in Sweden begins from a higher baseline. Comparing the markup dynamics of merging and non-merging firms reveals that while markups do increase post-merger, they do not rise more than those of non-merging firms. In fact, post-merger, non-merging firms' markups tend to increase more rapidly. Consequently, the rise in Swedish markups during 1998-2021 cannot be attributed primarily to mergers and acquisitions.

I present a number of explanations for why I fail to find any role of M&A in driving the rise of markups. Despite potential individual increases in market power from specific mergers, these effects do not manifest significantly at the aggregate level, likely due to Sweden's characteristics as a small, open economy with intense international competition. Effective regulatory oversight by Swedish and EU authorities might also mitigate the influence of mergers on market power. Moreover, efficiency gains from mergers could lead to reduced prices, counteracting increases in markups and reflecting the competitive pressures within the market. It is important to note that this analysis does not include cross-border mergers, which might exhibit different impacts on markups, potentially underestimating the effects of global M&A activity.

As there are growing concerns over market concentration and its economic ramifications within both academic and policymaking circles, this study provides a unique examination of how mergers and acquisitions affect market markups. While numerous studies have investigated the impact of mergers on prices, few have explored their influence on markups, particularly in response to the recent findings of rising markups from De Loecker, Eeckhout, and Unger 2020. To the best of my knowledge, this is the first paper to employ the production approach to markup estimation in the context of M&A and stands as one of the few studies specifically focusing on markups in Sweden.

The rest of this paper is presented as follows: Section 2 reviews the literature on aggregate markups and the impact of M&A on market power. Section 3 details the production approach to markup estimation used in this study. Section 4 describes the dataset. Section 5 presents the empirical findings, and Section 6 discusses these results, their implications, and potential drivers. Finally, Section 7 concludes the paper and suggests directions for future research.

2 Literature Review

The study of rising markups has gained prominence with the work of De Loecker, Eeckhout, and Unger 2020, which outlines several broad facts about the dynamics of markups in the United States. Firstly, the aggregate markup increased significantly, from 21% above marginal cost in 1980 to 61% in 2016. The authors identify that this rise is driven by the right tail of the markup distribution — in fact, the median markup remained static. The increase in market share by high-markup firms relative to their lower-markup counterparts is the critical driver of this trend. De Loecker, Eeckhout, and Unger 2020 also establish that this rise in markups aligns with increases in profits rather than being a function of escalating fixed or overhead costs[2]. The authors argue that rising markups explain macroeconomic shifts such as declines in labour and capital shares in production. While the paper does not attempt to explain the underlying reasons that markups increase, it speculates that it is due to 'technological change and the change in the market structure'.

There are a handful of papers that have followed up De Loecker, Eeckhout, and Unger 2020 by estimating markups in a non-US setting. I will summarise the most important of these papers that compute markups in Sweden. In an NBER working paper, Eeckhout and De Loecker 2018 use the same method as in De Loecker, Eeckhout, and Unger 2020 to estimate markups in 134 countries. Using Worldscope data from Thomson Reuters, find that Swedish sales-weighted markups increased from 0.94 in 1980 to 1.31 in 2016[3]. Koppenberg and Hirsch 2022 compute markups for the food retailing industry in five European countries using the production approach[4]. Within this industry, the average (not sales weighted) markup using the production function method is 1.26, but the authors do show the evolution of markups over time and this number is not comparable to my study, since the food retailing industry is not included in manufacturing. In a working paper, Agrawal, Gaurav, and Suveg 2021, estimate Swedish manufacturing industry markups, and while they do not show the dynamics of the markup, they do state that the mean[5] markup is between 1.63 and 1.83 depending on the specification. Broadly consistent with this result, one of the authors has a separate working paper (Suveg 2023) where she estimates that sales-weighted markups in Sweden rose from 0.9 in 1997 to 1.6 in 2016. Sandström 2020 estimates markups on Swedish non-financial firms in a working paper and finds that sales-weighted markups have been low and stable, in the range of 1.06 and 1.10 in the period of 1998-2016. Forsbacka 2023 finds that sales-weighted markups for non-financial firms have risen from 1.3 in 1998 to 1.5 in 2019.

2. If fixed costs increase, even in perfectly competitive markets, this should be reflected in higher markups, since firms need to charge higher prices to recuperate the fixed cost. While De Loecker, Eeckhout, and Unger 2020 find that fixed costs do increase, they find the rise in markups is more than what can be explained by rising fixed costs.

3. I am sceptical about the validity of this result, since it is difficult to believe that over a five-year period from 1980-1985, most Swedish firms had negative markups, meaning they were loss-making.

4. The purpose of the study is to compare the Production Function approach to markup estimation to the stochastic frontier approach of Kumbhakar, Baardsen, and Lien 2012 (a lesser known and utilised method in the literature).

5. Arithmetic mean, instead of sales-weighted markup, which is likely to be smaller than the sales-weighted markup, since the latter usually places a larger weight on high-markup firms.

2.1 Mergers and Markups

The theoretical link between mergers and markups is well-established. Arguably, the first economic model with relevance for merger analysis was Cournot 1838, where two non-colluding oligopolistic firms choosing quantities would charge prices above the marginal cost and receive positive economic profits. However, Cournot competition alone will not generate profitable mergers, unless the merger involves at least 80% of firms in the relevant industry or large efficiency gains ('synergies') (Salant, Switzer, and Reynolds 1983). There are a number of models that show profitable mergers (with positive effects on markups) under alternative assumptions, such as Perry and Porter 1985 who assume that both firms produce a homogeneous good but are endowed with different production capacities and Farrell and Shapiro 1990 who give general conditions for when horizontal mergers in industries with quantity competition raise prices. Deneckere and Davidson 1985 show the equivalent in the case of price (Bertrand) competition. The theoretical implications of M&A on macroeconomic aggregates has been less studied in economic theory. In a novel approach, David 2021 incorporates mergers in a search and matching model, though without addressing their impact on markups.

Empirical inquiries into the 'merger channel' are nascent but growing[6]. Cao and Zhu 2021 take a very different approach from me to examine the impact of mergers and acquisitions on markups in a working paper motivated by De Loecker, Eeckhout, and Unger 2020. They integrate markups to the above-mentioned search and matching model (David 2021) and use the resulting 'dynamic general equilibrium model with heterogeneous firms and endogenous M&As' to estimate that markups increased by 5 percentage points between the period of 1981-85 to 2011-15. Further to this, their model indicates that laxer antitrust laws starting in the late 1970s account for 73% of this increase. While this working paper is examining a similar question to my paper, it differs in its methodology (calibrated DSGE model versus production approach) and its setting (US versus Sweden).

In another working paper Alviarez, Head, and Mayer 2021 study how global M&A in the alcoholic beverage industry impacts markups. The main difference compared to my analysis is that the authors rely on the 'IO-approach' to computing markups, introduced in Berry 1994 and Berry, Levinsohn, and Pakes 1995 (briefly outlined in section 3 below). Alviarez, Head, and Mayer 2021 find that mergers, through increasing firm market shares, do increase markups. My paper also differs in focus, by examining mergers within all of manufacturing for one small, open economy (Sweden) rather than one industry (alcoholic beverages) within a global context (36 countries).

Using the same underlying Swedish data as this study, Forsbacka 2023 examines a tangential question to this study: Does the production approach of De Loecker and Warzynski 2012 and De Loecker, Eeckhout, and Unger 2020 match the 'stylised fact' that more concentrated industries exhibit higher markups. She restricts the main part of her study to the four industries of hairdressers, grocery

6. There are a multitude of studies of the dynamics of prices after a merger, with most, but not all studies, finding support for falling prices after a merger (see for instance surveys of the literature by Ashenfelter, Hosken, and Weinberg 2014 and Kwoka 2014). However, it is not possible to draw conclusions about markups from these studies without making assumptions about the dynamics of marginal costs.

stores, driving schools and taxis and finds significant effects of concentration on markups in the latter three[7].

2.2 Criticisms of the Production Approach

While the production approach has revolutionised markup estimation, particularly due to its relative simplicity, applicability on an economy-wide scale and minimal data needs, it faces criticisms regarding its assumptions. Some of the main criticisms involve there being meaningful differences in final markup depending on the use of intermediate input[8], which is attributed to the use of a single, Hicks-neutral, productivity term (Raval 2023). Researchers have also identified problems associated with using revenue data in markup estimation (Kirov, Mengano, and Traina 2023) and with the assumptions regarding the structure of input markets (Bond et al. 2021; Hashemi, Kirov, and Traina 2022). These criticisms remain disputed[9] and I do not attempt to address them in this paper. Instead, to maximise the comparability between my paper and De Loecker, Eeckhout, and Unger 2020, I follow the original method as closely as possible in a Swedish context.

One criticism of De Loecker, Eeckhout, and Unger 2020 that I do address in this paper is that the authors only use data from publicly traded firms (Traina 2018; Ciapanna et al. 2022). My database, Serrano (Weidenman 2024), includes all Swedish limited-liability companies, unlike Compustat, which only includes publicly traded firms in the United States.

7. In the case of hairdressers Forsbacka argues that the (lack of) result is likely due to tax evasion.

8. See section 3.1.2

9. See for instance De Loecker, Eeckhout, and Unger 2020; De Loecker 2021; De Ridder, Grassi, and Morzenti 2021 for a defence of using the original production approach

3 Method

I construct markups using the production approach as outlined in De Loecker and Warzynski 2012 and further developed in De Loecker, Eeckhout, and Unger 2020, which structurally estimates a firm's markup under the assumption of cost minimization. Define the markup for firm i at time t, μ_{it}, as the ratio of the price of the firm's output to its marginal cost of production:

$$\mu_{it} = \frac{p_{it}}{mc_{it}} \tag{1}$$

While the price is readily observable in some firm-level datasets, the marginal cost mc_{it} is not directly measurable[10]. Various econometric approaches have been proposed to circumvent this problem. The most popular alternative approach, pioneered in the IO-literature, involves demand function estimation (see Berry 1994 and Berry, Levinsohn, and Pakes 1995). Since this method requires the (discretionary) subdivision of firms into markets where products are substitutes within the market but not between markets, as well as detailed data on the characteristics of outputs, it works well for studying an individual market but is not feasible when conducting research over the entire economy.

The production approach to estimate markups offers several advantages for this research. First, it eliminates the need to assume specific returns to scale for any firm or industry. Second, it does not require the researcher to segment the dataset into distinct markets. Third, it is compatible with conventional firm-level accounting data, such as that found in the Serrano and Compustat databases, facilitating broader applicability across various industries.

Consider[11] a firm i at time t producing output $Y_i t$ with the production technology

$$Y_{it} = Y(\omega_{it}, X_{it}^{(1)}, ..., X_{it}^{(V)}, K_{it}) \tag{2}$$

where ω_{it} represents a firm's (Hicks-neutral) productivity, X_{it}^{n} for $n \in (1, V)$ various flexible inputs and K_{it} a dynamic input[12] The associated cost-minimisation problem becomes

$$\min \sum_{j=1}^{V} P_{it}^{(j)} \cdot X_{it}^{(j)} + r_k \cdot K_{it}$$

subject to

$$Y_{it} \leq Y_{it}(\omega_{it}, X_{it}^{(1)}, ..., X_{it}^{(V)}, K_{it}). \tag{3}$$

The Lagrangian for this cost minimisation problem is

$$\mathscr{L}(X_{it}^{1}, ..., X_{it}^{V}, K_{it}, \lambda_{it}) = \sum_{v=1}^{V} P_{it}^{X^v} X_{it}^{v} + r_{it} K_{it} + \lambda_{it}(Y_{it} - Y_{it}(\cdot))$$

10. One common simplification is to equate marginal cost to average variable cost, though this is imprecise when dealing with nonconstant returns to scale.

11. I have adapted this section from two presentations I have given, one at IFN, one at the University of St Gallen for a course

12. This could for instance be capital that takes time to build.

Assuming no adjustment costs to the flexible inputs and solving for their associated first order condition I get

$$\frac{\partial \mathscr{L}}{\partial X_{it}^{v}} = P_{it}^{X^{v}} - \lambda_{it} \frac{\partial Y_{it}(\cdot)}{\partial X_{it}^{v}} = 0.$$

which I rearrange to

$$\frac{\partial Y_{it}(\cdot)}{\partial X_{it}^{v}} = \frac{P_{it}^{X^{v}}}{\lambda_{it}}.$$

I multiply by $\frac{X_{it}}{Y_{it}}$ and get

$$\frac{\partial Y_{it}(\cdot)}{\partial X_{it}^{v}} \frac{X_{it}}{Y_{it}} = \frac{1}{\lambda_{it}} \frac{P_{it}^{X^{v}} X_{it}}{Y_{it}}.$$

Note that the left hand side is an expression for the output elasticity of variable input v, that is θ_{it}^{X}. Thus, the above equation becomes

$$\begin{aligned} \theta_{it}^{X} &= \frac{1}{\lambda_{it}} \frac{P_{it}^{X^{v}} X_{it}}{Y_{it}} \\ &= \frac{P_{it}}{\lambda_{it}} \frac{P_{it}^{X^{v}} X_{it}}{P_{it} Y_{it}} \end{aligned}$$

where P_{it} is the output price. Due to the envelope theorem, the Lagrange multiplier λ_{it} is an expression for the firm's marginal cost mc_{it}. I can therefore substitute the markup μ_{it} into the equation. Rearranging, I get the expression for the markup, namely

$$\mu_{it} = \frac{\theta_{it}^{X}}{\frac{P_{it}^{X^{v}} X_{it}}{P_{it} Y_{it}}}.$$

That is, the firm's markup can be expressed as the output elasticity of variable imput v divided by the cost share of v relative to the firm's total sales. The latter is easily observable in most firm-level datasets, including Serrano, but in order to apply this method I am required to estimate the output elasticity of variable good v.

3.1 Production Function Estimation

In order to estimate the output elasticity, I structurally estimate the production function for each firm using the method proposed in Ackerberg, Caves, and Frazer 2015[13]. I assume the functional form of the production function is Cobb-Douglas[14] with respect to capital and labour

$$Y_{it} = \exp(\omega_{it}) K_{it}^{\theta_K} L_{it}^{\theta_L} \exp(\epsilon_{it})$$

13. This method builds on the insights of Olley and Pakes 1996 and of Levinsohn and Petrin 2003

14. There are two main assumptions in the literature, either a Cobb-Douglas production function or a translog production function (which is more flexible and nests the Cobb-Douglas production function, but requires more moment conditions in its estimation procedure). While there are tradeoffs to each assumption, I have opted for the former, both to increase the comparability of the Swedish markups I calculate to US markups in De Loecker, Eeckhout, and Unger 2020 and since it requires fewer assumptions.

or letting lowercase letters represent having taken the natural logaritm,

$$y_{it} = \omega_{it} + \theta_K k_{it} + \theta_L l_{it} + \epsilon_{it}$$

where $\theta_{K_{it}}$ is the output elasticity with respect to capital, $\theta_{L_{it}}$ is the output elasticity with respect to labour and ϵ_{it} is measurement error. The coefficients correspond to the elasticities as, using the definition of an elasticity, for example with respect to labour

$$\frac{\partial Y_{it}}{\partial L_{it}} \frac{L_{it}}{Y_{it}} = \frac{\partial log(Y_{it})}{\partial log(L_{it})} = \frac{\partial y_{it}}{\partial l_{it}} = \theta_{it}^{L}.$$

I assume that capital is an inflexible input into the production function, with time to build, meaning that it accumulates dynamically according to the law of motion

$$K_{it+1} = (1 - \delta)K_{it} + I_{it}$$

where δ represents the coefficient of depreciation[15]. Unlike capital, labour is assumed to be a fully flexible that firms can instantly adjust depending on their production needs[16]. Finally, I assume there is a third, intermediate input, M_{it} that, like labour, is fully flexible, but is not a direct input into the production function but is fully determined by a firm's level of productivity, capital and labour. In other words, I assume the intermediate input can be described by the function

$$M_{it} = F(\omega_{it}, K_{it}, L_{it}).$$

Ackerberg, Caves, and Frazer 2015 show that, assuming that the intermediate input is monotonic in productivity[17] the above function can be inverted to arrive at an expression for the productivity

$$\omega_{it} = F^{-1}(M_{it}, K_{it}, L_{it}).$$

Since I have measures for capital, labour and materials, I exploit above property to purge the data of measurement error and estimate the production function, described in the first step of the ACF procedure belows.

Productivity is a dynamic process which I model as an AR(1) function

$$\omega_{it+1} = \rho\omega_{it} + \eta_{it}$$

where η_{it} is a white-noise process. With these underlying assumptions established, I describe the estimation procedure below.

15. Which I have set to 7%

16. One can disagree about how realistic this assumption is in the Swedish context compared to the US context used in Ackerberg, Caves, and Frazer 2015 and De Loecker, Eeckhout, and Unger 2020. Swedish labour laws are undoubedly less flexible than American labour laws, meaning that it is easier to 'flexibly adjust' (hire and fire) labour in the US. I believe the assumption that over a one-year horizon, the assumption is still realistic in the Swedish context, since employers are allowed to reduce headcount if there are a 'lack of tasks' according to the Swedish Employment Protection Act (Lagen om anställningsskydd) with a probation period between one and six months depending on the circumstances.

17. A reasonable assumption, as more productive firms will usually produce more and require more intermediate inputs to produce this output.

3.1.1 First stage

The purpose of the first stage of the estimation procedure is to purge the data of measurement error. Without doing this, I am unable to separate productivity from measurement error when calculating the former as a residual. Using the inverted function to express productivity, I can write my production function as

$$y_{it} = \omega_{it} + \theta_K k_{it} + \theta_L l_{it} + \epsilon_{it} \tag{4}$$
$$= F^{-1}(M_{it}, K_{it}, L_{it}) + \theta_K k_{it} + \theta_L l_{it} + \epsilon_{it} \tag{5}$$
$$= \Phi_{it}(M_{it}, K_{it}, L_{it}) + \epsilon_{it} \tag{6}$$

I non-parametrically approximate Φ_{it} through a second degree polynomial of M_{it}, K_{it} and L_{it}. The output purged of measurement error Φ_{it} I use both as an input in the second stage, and in the denominator of the markup calculation (see below).

3.1.2 Second Stage

From the first stage, I have an estimate of the output purged of estimation error

$$\hat{\phi_{it}} = \omega_{it} + \theta_K k_{it} + \theta_L l_{it}. \tag{7}$$

I use Generalised Method of Moments (GMM, Hansen 1982) to estimate δ, θ_K and θ_L[18]. Broadly in line with De Loecker, Eeckhout, and Unger 2020[19] I use the moment conditions

$$\mathbb{E}\left[\xi_{it}\begin{pmatrix} k_{it} \\ k_{it-1} \\ l_{it-1} \end{pmatrix}\right] = 0$$
$$\iff \mathbb{E}\left[(\omega_{it} - \rho\omega_{it-1})\begin{pmatrix} k_{it} \\ k_{it-1} \\ l_{it-1} \end{pmatrix}\right] = 0$$
$$\iff \mathbb{E}\left[\left((\hat{\phi_{it}} - (\theta_K k_{it} + \theta_L l_{it\cdot})) - \rho(\hat{\phi}_{it-1} - (\theta_K k_{it-1} + \theta_L l_{it-1\cdot}))\right)\begin{pmatrix} k_{it} \\ k_{it-1} \\ l_{it-1} \end{pmatrix}\right] = 0$$

to exactly identify the model[20].

18. As stated above, OLS is inappropriate since there is likely to be endogeneity – more productive firms are likely to use more inputs

19. I say 'broadly' since De Loecker, Eeckhout, and Unger 2020 only use two moment conditions, k_{it} and l_{it-1}. I find this strange, as the model has three unknowns and therefore, it appears that De Loecker, Eeckhout, and Unger 2020 have an under-identified model, which implies that they should not receive any outputs. Unfortunately, the replication files of De Loecker, Eeckhout, and Unger 2020 do not include the elasticity estimating procedure, instead the outputs are included as a separate dataset, meaning that I cannot interrogate their model specification further.

20. The procedure requires an initial guess to run the GMM algoritm. I simply run OLS and use the outputs as my initial guess.

3.1.3 Final Markup Calculation

Recall that I showed that the markup can be expressed as

$$\mu_{it} = \frac{\theta_{it}^{X}}{\frac{P_{it}^{X^v} X_{it}}{P_{it} Y_{it}}}. \tag{8}$$

For consistency, the cost share should be purged of measurement error. Thus, the final markup is actually calculated as

$$\mu_{it} = \frac{\theta_{it}^{X}}{\frac{P_{it}^{X^v} X_{it}}{P_{it} \frac{Y_{it}}{\exp(\epsilon_{it})}}}. \tag{9}$$

The method developed in Ackerberg, Caves, and Frazer 2015 only outputs a single elasticity when it is run. In order to have technology vary over time, I run a +/- 3 year rolling-window estimation procedure for each years, setting the elasticity in the beginning and end to the closest estimated elasticity[21]. I also run the estimation procedure separately for each industry, as defined by the 2-digit SNI[22]. One of the downsides of the production approach to markup estimation is that it is prone to being driven by outliers. For this reason, I follow the convention of winsorizing the inputs and the cost share and final markup at the 1% and 99% level.

3.2 'Monte Carlo' Simulation of Non-Merging Firms

Since the purpose of this study is to examine to what extent merging firms contribute to the economy-wide rise in markups, it is necessary to benchmark firms that merge against firms that do not merge. Without comparing merged firms to non-merged ones, one might incorrectly conclude that mergers are driving markup increases, when the rise in markup in merging firms is normal when benchmarked against non-merging firms.

In my main result, I opt for a 'Monte-Carlo-like' simulation in order to conduct this comparison. By doing this, I can use the fact that I have calculated markups for both merging and non-merging firms[23]. The main benefit of this approach that it allows me to only use each non-merging firm once in each simulation[24]. The other approach, described below, is regression based, but uses the full dataset, meaning that the same non-merging firm will occur multiple times but with different intervals.

For the simulation, I randomly choose 851 unique firms that either have not merged, or alternatively have merged but more than three years before or after the year I select (I henceforth refer to these as 'non-merging firms)[25]. Of the

21. While this is not ideal, it is preferable to assuming one fixed elasticity for all years in my study. Furthermore, De Loecker, Eeckhout, and Unger 2020 show that it is the cost share, the denominator of the markup expression (9), which is also holds true in my dataset.

22. For the few industries with less than 1000 firm-year observations, I do not run the rolling window procedure

23. My dataset is ultimately smaller than the universe as all LLC's, since all the observations in Serrano do not include the data necessary to compute markups, see below.

24. If I have data for a non-merging firm between 2010-2020, the question becomes how to select the six-year period to benchmark against

25. I select 851 firms, since these are the number of observations of firms that merge only once that I have, see below.

observations in each firm, I randomly pick a year that has complete markup data between two years pre-merger and three years post-merger. I calculate the average percentage change in markup relative to the markup two years prior to the merger for year prior to the merger, until three years after the merger. I repeat this exercise 10000 times, using different random seeds. Following this, I identify the lowest and highest average markup change for each year, as well at the 10% and 90% percentiles. By benchmarking against these percentiles, I can identify if the behaviour of the aggregate markups for the merging firms are outliers from the perspective of non-merging firms.

3.3 Regression Approach to Comparing Merging and Non-Merging Firms

I also estimate a simple regression model as an alternative, more conventional, analysis to the method above. I estimate two models

$$\Delta\mu_{it} = c + \beta_M M_i + \beta_{-1} Y_{-1} + \beta_0 Y_0 + \beta_1 Y_1 + \beta_2 Y_2 + \beta_3 Y_3 \tag{10}$$

$$\Delta\mu_t = c + \beta_M M_i + \beta_{-1} Y_{-1} + \beta_0 Y_0 + \beta_1 Y_1 + \beta_2 Y_2 + \beta_3 Y_3 + \beta_{1M} Y_1 \cdot M_i + \beta_{2M} Y_2 \cdot M_i + \beta_{3M} Y_3 \cdot M_i \tag{11}$$

where $\Delta\mu_{it} = \frac{\mu_{it}}{\mu_{i,-2}} - 1$ is the markup of firm i at time t, standardised by dividing the markup two years before the merger[26]. Thus, $\Delta\mu_{it}$ represents the same variable we have been using above. M_i is a dummy variable that is 1 firm i during year 0 of the six-year interval Y_j is a dummy varible that is 1 if $t = j$ and c is an intercept. Thus, model 1 (10) captures if there is any difference in markups between merging firms and non-merging firms controlling for the year relative to the merger. Through the interaction terms, Model 2 (11) on the other hand also captures if the difference is entirely due to the post-merger years.

26. Note that, from a notation-standpoint, Δ does not correspond to the traditional definition of first difference for which it is usually used except in the case of$t = -1$

4 Data

4.1 Serrano

The primary dataset for this thesis is Serrano, a comprehensive firm-level database containing financial statement data from Swedish firms, beginning in 1997 and updated through 2022 (Weidenman 2024). This dataset aggregates balance and income statement data sourced from the Swedish Companies Registration Office (Bolagsverket), enriched with additional data from Statistics Sweden (Statistiska Centralbyrån) and Dun and Bradstreet. Serrano has full coverage of limited-liability companies (aktiebolag), the focus of this study. On top of its broad coverage, it standardises financial statements to account for discrepancies such as varying fiscal year lengths, missing data, and firm discontinuities due to events like liquidation or mergers and acquisitions. Consequently, each firm is represented annually by a corrected financial statement as of December 31st.

Additionally, Serrano provides detailed information on mergers and acquisitions, identified by the unique organisation numbers (organisationsnummer) of the entities involved. A key limitation however is that it only includes Swedish mergers and acquisitions.

For the purposes of this analysis, the utilised balance sheet variables include Net Sales (nettoomsättning) as a measure of output, personnel expenses (comprising salaries, compensations, and employee social security contributions) as the labour input, production costs (mainly raw materials and consumables, but it also includes the small items of goods for resale and other external costs) as the 'flexible' intermediate input[27], and tangible fixed assets (including buildings, land, machinery, equipment, and other tangible assets) as capital. These capital figures are adjusted using the perpetual inventory method.

4.2 Deflators

To ensure accuracy in the production function estimation, it is necessary to convert the nominal balance sheet and income statement data into real terms using price deflators. I develop these deflators based on the Swedish national accounts data provided by Statistics Sweden, which is detailed according to the two-digit Swedish Standard Industrial Classification (SNI)[28]. I download both nominal and real series for gross output, intermediate inputs, and gross fixed capital formation to create the corresponding deflators. For labor costs, I calculate labor deflators by dividing the 'Wages and salaries' series by the 'hours worked' series. However, there are gaps in the data for gross fixed capital formation for some SNI codes in 2014 and 2015, which I address through linear interpolation using the values from 2013 and 2016. Since, at the time of writing, the detaiked national account data from SCB is available only up to 2021, I am unable to adjust the 2022 data from Serrano for inflation. Consequently, I exclude the observations from 2022 from my analysis.

27. This is, in my opinion, the best proxy variable available in Serrano. Arguably, firms can very flexibly adjust this costs, more so than other costs such as labour and capital, which makes it the most appropriate choice. In some firm-level datasets, it is possible to choose other proxy variables such as Cost of Goods Sold (COGS) or raw material costs without the other items, but these are not in the main Serrano database

28. I am grateful to Melinda Suveg of IFN who first introduced me to the method of constructing deflators using SCB data

4.3 Variable Choices and Summary statistics

There are in total 9304661 limited liability firm-year pairs in Serrano. I exclude observations that are not classified according to SNI, observations with zero or negative values for sales, labour, intermediate input and capital and firms with zero or one employee(s)[29]. I restrict myself to manufacturing firms (two digit SNI-code between 5 and 33) as production function estimation on services will be more prone to measurement error[30].

After filtering for firms that are classified as manufacturing firms, and where I have the available data to construct markups, I am left with 143 905 unique firm-year combinations (15106 unique firms). Of these, 2452 firm-year combinations have a registered merger taking place (2006 unique firms merged at least once in the 1998-2021 period). Some of these observations represent firms with multiple mergers over many years, which complicates my analysis, but there are 851 unique observations of a firm that mergers only once in the time period I study. I document the evolution of markups in the appendix below, but the broad fact of De Loecker, Eeckhout, and Unger 2020, that markups have been rising, holds true for Sweden.

29. I exclude single-employee firms since it is likely that the employee owns all the equity in the firm and thus does not exclusively pays herself through wages. This would lead to a biased labour coefficient in the production function estimation and also would overestimate the markup as the associated cost share would be 'artificially' small

30. The definition of 'output' in services is less concrete, more difficult to compare between firms and challenging to deflate. Furthermore, service firms can have a very small capital share in production, which is difficult to reconcile with my assumption of a Cobb-Douglas production function. Since service firms likely have a larger labour share of output, which goes into the denominator of the markup calculation, the aggregate output including these firms is likely smaller. I believe this is one reason my markups in Sweden are larger than other studies.

5 Results

Figure 1 and table 1 displays the headline result of my analysis. I standardise the markup two years prior to the merger, so that subsequent years show the percentage increase relative to the markup two years before the merger. The solid black line shows the average markup increase for firms that merge only once[31]. The dark blue area corresponds to the 10% and 90% percentiles from a my Monte-Carlo-like simulation of the evolution of markups of non-merging firms. One year before the merger, the average firm's markup increased by 2.5% on average, above the lowest 10% of non-merging firms. Similarly, the year of the merger, merging firms' markups had increased by an average of 4.6%, close to the lower bound (but still above) the lowest 10% of non-merging firms. Thus, prior to the merger, the evolution of markups is consistent with non-merging firms.

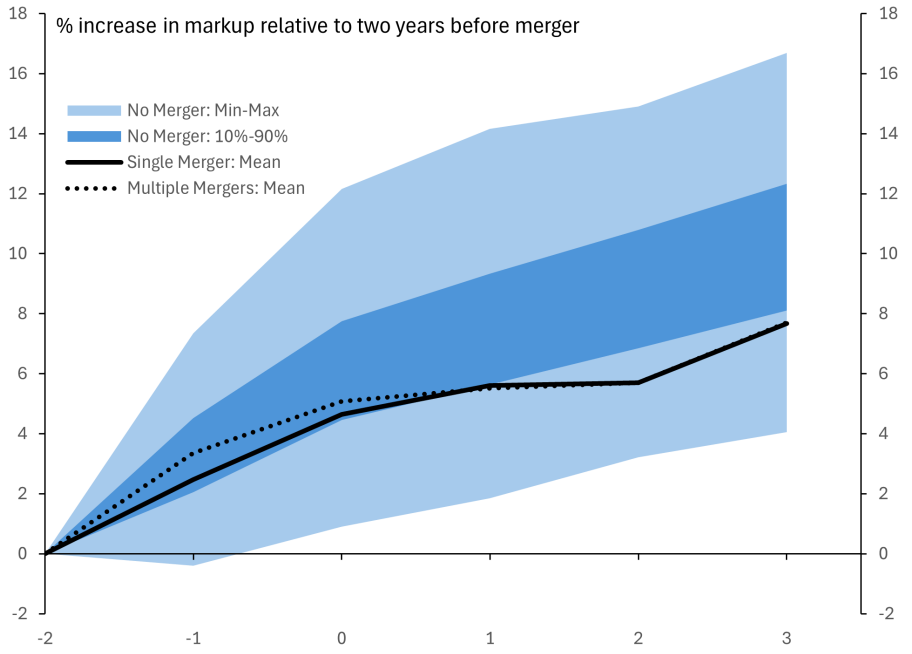


Figure 1: *The evolution of markups in firms that merge, relative to non-merging firms.*

The year after the merger was completed, I fail to find evidence for merging firm's markups increasing more than firms that do not merge. In fact, the average markup in merging firms increases *less* than the 10% percentile of non-merging firms. After one year, the average merging firm's markup has increased 5.6%, in line with the average of the 10% percentile (which is slightly higher, which cannot be seen due to rounding). This pattern holds for two years after the merger is completed (the average merging firm's markup has risen by 5.6%, lower than the 10% percentile firm which rose by 6.8%) and three years (the

31. I include firms that merge many times in one year, but neither before nor after.

Table 1: Evolution of Mean Markup in Merging and Random Sample of Non-Merging Firms

	Year Relative to Merger					
	-2	-1	0	1	2	3
Single Merger: Mean	0	2.5	4.6	5.6	5.7	7.7
All Mergers: Mean	0	3.4	5.1	5.5	5.7	7.7
Non-Merging: Min	0	-0.4	0.9	1.9	3.2	4
Non-Merging: 10%	0	2.1	4.5	5.6	6.8	8.1
Non-Merging: 90%	0	4.5	7.8	9.3	10.8	12.3
Non-Merging: Max	0	7.3	12.2	14.2	14.9	16.7

average merging firm's markup has risen by 7.7%, lower than the 10% percentile firm which rose by 8.1%).

My headline result is only for firms that merge *once*, in order to avoid double-counting firms. An objection to this is that firms that merge only once may be firms that are 'unproductive at mergers and aquisitions'. Plausibly, firms that successfully merge and can raise their markup, and thus profits, are more likely to merge again to keep capturing market power. As a robustness check, the dotted line in figure 1 is the average markup for all merging firms, including those that merge more than once[32]. Nevertheless, the same dynamics emerge as in the headline result with firms that merge once. Compared to the headline result, the percentage change in markup the year before the merger and the year of the merger is somewhat higher (but still within the 10%-90% range of non-merging firms), but for the years following the merger, the percentage change in markup is very similar and squarely below the 10% percentile of non-merging firms. If firms that merge more than once saw a markups rising faster, one would expect to see higher results relative to the headline result – compounded by the double counting[33].

The results from estimating the two models using OLS, is presented in table 5 below. The first result of note is that for both models, all the year dummies are individually significant at the 1% level and broadly in line to the result in Figure 1 and Table 1. That is, markups tend to increase over time, both for merging and non-merging firms[34]. The second result is that, like in my 'Monte-Carlo-like' analysis above, there is no evidence for merging firms markups rising faster than non-merging firms. As above, merging firms are associated with a smaller growth in markups. In model 1, we would expect β_M to have a (statistically significant) positive sign if firms that merge had a faster markup growth. In fact, it has a statistically significant negative sign.

If we add the interaction effects with the three post-merger years, β_M is both economically and statistically insignificant, which (like in the analysis above)

32. Thus, this result will double count firms, but also double count years in case the mergers are close. For instance, if a merger occurs in 2002 and in 2005, the markup for the year 2004 will be aggregated both in the 'two years after the merger' average, and in the 'one year before the merger' average

33. Another possible objection is that very productive firms will keep merging until the 'marginal return on markups' from merging gets small enough, at which point the firm ceases to aquire more firms. This would suggest only including the first merger is more appropriate. When I only include the first merger, this produces similar results as in figure 1

34. This pattern of rising markups holds true for the merging firms, although two of three variables are not individually significant at the 10% level

Table 2: Comparison of Regression Models

	Dependent variable: $\Delta\mu$	
	Model 1	Model 2
	(1)	(2)
β_M	-0.843**	0.054
	(0.401)	(0.567)
β_{-1}	2.942***	2.942***
	(0.136)	(0.136)
β_0	5.330***	5.330***
	(0.136)	(0.136)
β_1	6.719***	6.731***
	(0.136)	(0.137)
β_2	7.906***	7.928***
	(0.136)	(0.137)
β_3	9.460***	9.478***
	(0.136)	(0.137)
β_{1M}		-1.266
		(1.135)
β_{2M}		-2.287**
		(1.135)
β_{3M}		-1.826
		(1.135)
c	0.008	-0.001
	(0.096)	(0.096)
Observations	863,430	863,430
R^2	0.007	0.007
Adjusted R^2	0.007	0.007
Residual Std. Error	36.500 (df = 863423)	36.500 (df = 863420)
F Statistic	1,075.677*** (df = 6; 863423)	717.735*** (df = 9; 863420)
Note:		*p<0.1; **p<0.05; ***p<0.01

indicates that it is the post-merger years that are driving the difference between the evolution of mergers in merging and non-merging firms[35]. The interaction terms also have negative signs, which once against reinforces that merging firms do not see faster markup growth compared to non-merging firms. In conclusion, a very simple regression analysis arrives at the same results as the 'Monte-Carlo-like' simulation above[36].

35. If I conduct an F-test for joint significance of the three interaction terms and merger term, that is the null hypothesis $H_0 : \beta_{1M} = \beta_{2M} = \beta_{1M} = \beta_M = 0$, it is jointly significant at the 5% level. On the other hand, the joint hypothesis of just the interaction terms, $H_0 : \beta_{1M} = \beta_{2M} = \beta_{1M} = 0$, I fail to reject at the 10% level.

36. While both methods arrive at the same result, I find the former more persuasive as it betters deals with issue of non-merging firms having many 5-year intervals to pick from in a comparison.

6 Discussion

My findings suggest no significant relationship between mergers and acquisitions and the rising aggregate markup within the Swedish manufacturing sector. While specific mergers might increase market power and thereby raise markups at an individual firm level, these effects are not pronounced when observed at the aggregate level. This indicates the presence of alternative factors influencing the rise of markups in Sweden, suggesting that the merger effect is either diluted across the broader economy or counteracted by other competitive forces. While a detailed discussion is outside the scope of this study, the lack of evidence for M&A driving aggregate markups gives credence to the alternative theories proposed, such as the 'Superstar Firms' hypothesis of Autor et al. 2020 or the trade liberalisation theory of De Loecker et al. 2016.

Several factors may explain the lack of a notable impact from mergers on market power. Given Sweden's economic characteristics as a small, open, and highly export-driven economy, the global competitive pressures are significant. Even if mergers increase market shares domestically, international competition could compel firms to maintain competitive pricing, mitigating any potential markup increases. My findings are very different from those of Cao and Zhu 2021, who attribute a substantial portion of markup increases in the U.S. to changes in antitrust laws[37]. As the US is a large enough proportion of the global economy, so that a large US firm will likely be a large global firm, it is possible for mergers to have a larger impact on markups in the US as compared to Sweden. A complimenting explanation to is that the market structure of many industries in my study may more closely resemble Bertrand competition with firms competing on prices rather than quantities, could further explain the subdued impact of mergers on markups.

The analysis in this paper does not directly account for the potential efficiency gains that are often the primary motivation behind mergers and acquisitions (Motta 2004). Should mergers result in significant efficiency improvements, they might lead to reduced marginal costs. Existing literature, reviewed in section 2, often shows that post-merger price reductions reflect these efficiency gains, possibly preventing any significant increases in markups due to competitive market dynamics.

Another factor potentially neutralising the impact of M&A on market power could be effective regulatory oversight. The Swedish Competition Authority, under both Swedish law and EU regulations, scrutinises mergers 'reducing competition in the market' (Konkurrensverket 2024). If the agency deems this to be the case, it either prohibit the merger in its entirety (although this is uncommon) or alternatively force the merged entity to sell of parts of its business to reduce the anti-competitive effect. For some (large) mergers, the European Commission will instead examine the effects and make a ruling.

This rigorous review process could deter mergers that solely aim to enhance market power, particularly if the merged entities anticipate regulatory challenges or requirements to divest significant assets, which would diminish the intended benefits of the merger. Furthermore, a large firm may only pursue a merger that the competition authority might have reservations about if there is is a large

37. The different methodologies employed in these studies, as previously discussed, likely also contribute to the variance in findings.

enough efficiency gain associated with it, since it knows the merger will only be accepted if this is the case.

Moreover, the global nature of the markets in which Swedish firms operate might also dilute the local impact of domestic mergers. Significant market power shifts might occur in cross-border mergers, which are not captured in this study due to the dataset's focus on Swedish entities only. As Alviarez, Head, and Mayer 2021 observe in the alcoholic beverage industry using the 'IO-approach' to markup estimation, cross-border mergers can indeed result in substantial markup increases, a phenomenon I cannot explore with the data in this study..

6.1 Future Research

Future studies could explore the impact of mergers in larger and more varied markets by applying this research framework to data from larger economies, such as the United States. This approach would help ascertain whether the international scope and the prevalence of cross-border mergers in such markets influence the relationship between mergers and markups differently compared to Sweden, an important drawback of this study.

In light of the ongoing debates regarding the validity of the 'production approach' methodology, which I give a brief overview of in section 2.2, it may be fruitful to use one of the alternative approaches proposed for markup estimation on financial statement data, such as Kirov, Mengano, and Traina 2023, De Ridder, Grassi, and Morzenti 2021, Raval 2023 or Demirer 2022. As the literature around the validity of the original De Loecker, Eeckhout, and Unger 2020 methodology is rapidly evolving and contested among researchers, this might be a more relevant idea in the future when the field has agreed on what to consider 'best practice'.

7 Concluding Remarks

Using a firm-level dataset with the financial statements of Swedish limited-liability companies between 1998-2021, I study if mergers and acquisitions explain the rise in aggregate markups in Sweden during this time-period. I estimate markups for Swedish manufacturing firms, using the production approach to markup estimation of De Loecker and Warzynski 2012 and De Loecker, Eeckhout, and Unger 2020. While I do find that markups rise in merging firms, I find no evidence for aggregate markups in merging firms rising more than aggregate markups in non-merging firms. In fact, I find evidence for the opposite, that merging firm's markups rise less than the average non-merging firm.

I conduct two main specifications to compare the markups of merging firms and non-merging firms. The first of these is a 'Monte-Carlo-like' benchmarking process, where I randomly select non-merging firms and a consecutive six-year period in those firm's history 10000 times. Between two years prior to the merger and the year of the merger, merging firms aggregate markup rise at a comparable pace to non-merging firms. For the 1-3 years after the merger however, the pace of rise in aggregate markup is slower than in the lower 10% percentile of the 10000 simulations.

I specify two simple regression models to run on all six-year intervals of markups, for merging and non-merging firms alike, where the markup has been standardised relative to the first year of the six-year interval (two years prior to a potential merger). I then regress the markup on a dummy variable for a firm having merged as well as dummy variables for the six years (relative to the merger). The broad patterns from the 'Monte-Carlo-like' benchmarking process once again hold. There is no positive, significant variable associated with the growth of markups in merging firms in either regression specification. Therefore, the regression models also fail reject the null-hypothesis that merging firms on aggregate do not see a faster growth in markup. As with the 'Monte-Carlo-like' simulation, the regressions, if anything, point towards the converse, that merging firms see smaller rises in markups.

The results of my study contrast the results in the existing literature. This can be explained to some extent by methodological differences, as my study is, to my best knowledge, the first to examine the effect of M&A activity on markups using the production approach. The differences might also be due to my study not including cross-border mergers, which are likely to have an important impact in a small, open economy such as Sweden. The studies that find a positive effect of merger activity on markups are either set in the United States, a large, less export oriented economy, or study one market across many countries. Therefore, it is possible for my results to be compatible with the existing literature.

I offer several reasons for why I cannot establish a significant link between M&A activity and increasing markups. While specific mergers may boost market power individually, these effects are not apparent on a broader scale, possible due to the characteristics of Sweden as a small, open economy where most manufacturing industries face substantial international competition. Furthermore, stringent regulatory oversight from both Swedish and EU authorities could be lessen the impact of mergers on market power. Additionally, efficiency improvements resulting from mergers may lower prices, which offsets potential increases in markups and mirrors the competitive forces in the market. Finally, I present

two possible venues to extend this study, first to replicate it on a larger economy less exposed to external competitive pressures, second to implement different specifications of the production approach in light on the ongoing debate regarding its validity.

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Appendix: Markups in Swedish Manufacturing

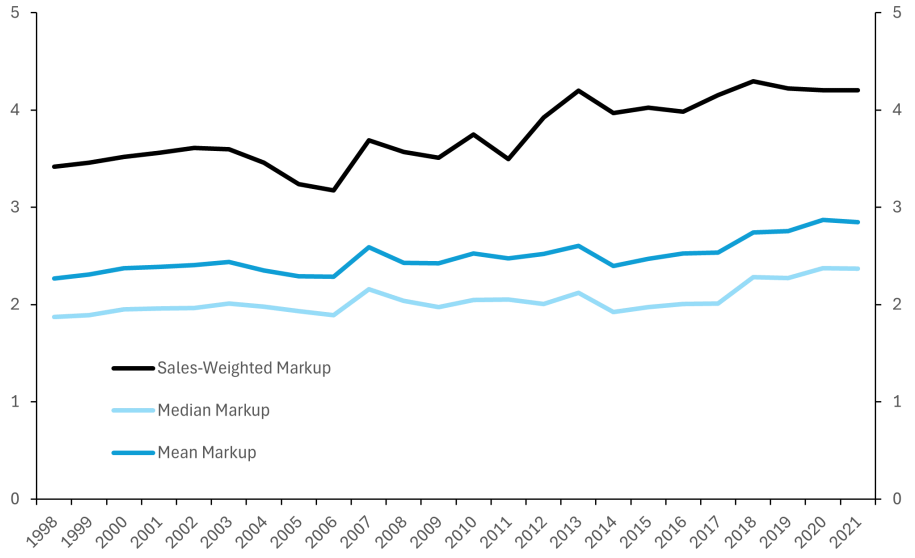


Figure 2: *The evolution of markups over time.*

In the figure above, I document the evolution of markups in Sweden. As in De Loecker, Eeckhout, and Unger 2020, markups have been rising, driven by the upper tail of the markup distribution, although the rise is from a much higher base in Sweden. My results are noticeably higher than the estimates for US data, and other estimates for Swedish data. However, it is not out of step with some estimates of markups, for instance Eeckhout and De Loecker 2018 estimate similar levels of markups in Denmark and Switzerland, countries that are relatively alike to Sweden (small open, export driven economies). Moreover, the estimate for Sweden in that study includes five years of negative markups, which I find unrealistic. As explained in the main text, I believe my estimates of markups are 'upward biased' when compared to studies that estimate markups for all firms, including service firms, as these are likely to have higher revenue shares of labour. Moreover, most papers do not disclose what how they windzorise, and which criteria they use to drop observations. I have used a comparatively accommodating criteria on both fronts, meaning that there are quite many firms with low revenue shares of labour. As seen in equation (9), as the denominator approaches zero, the markup approaches infinity, which can mean that a small number of firms have an outsized impact on the aggregate markup.