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Markups in the Chinese Economy

And the difference between State-Owned Enterprises and Private Publicly Listed Firms

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Abstract
The paper examines the markup levels in the Chinese economy to estimate the level of competition present in the economy and the differences between publicly listed firms and the state-owned enterprises. The markups are estimated with a similar framework to that of the production method, utilizing firms' financial statements. The method estimates the markup by observing revenue from sales divided by the observed cost of the goods sold times the variable output elasticity that is estimated from the data. The results indicate that state-owned enterprises extract lower markups than their private counterparts and that large firms extract lower markups than smaller firms. The overall result is that markups have declined in the Chinese economy over the past three decades. Given a certain set of assumptions the paper recommends further measures to ensure fair competition in the economy.

Keywords: Industrial Organization, Markups, Competition, China, State-Owned Enterprise

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1. Introduction

China is projected to become the world's largest economy[1] by the end of this decade. This has partly been possible through a historical institutional u-turn, from central planning with price controls and public ownership towards a market-based economy and competition. However, despite these recent reforms, the Chinese government still plays a significant role in the economy. The government continues to own and control many large companies in key sectors of the economy. The state-owned enterprises (SOEs) are estimated to have contributed 39 % of Chinas GDP in 2015 (Holz & Sun, 2018). This paper examines the Chinese re-orientation of its economy, focusing on two issues. To what extent is the Chinese economy characterized by competition? What role do the state-owned enterprises (SOEs) play for competition?[2]

Recent research suggests that markets in the mature industrialized world, for example, the US and the EU, have experienced a decrease in the level of competitiveness during the last decades (De Loecker & Eeckhout, 2018). Our hypothesis is that China is different. Privatization was a gradual process with its beginning in 1979 and private firms first being officially recognized in 1999, and property rights were first recognized in 2004. (Hofman, 2018). However, China joined the World Trade Organisation (WTO) in 2001, price controls were a vital part of the economy. The economy was heavily protected by tariffs and export quotas and the competitive pressure from global firms. Our hypothesis is built on the following reasoning:

1. Competition should be more efficient than price regulation in keeping prices close to cost. Since our data spans the entire period from 1992, we should observe the shift towards higher degrees of competition and as such lower markups.
2. Competition may be expected to be especially fierce at an early stage when firms position themselves for a role in their markets. That is, keeping prices low to gain market shares may be viewed as an investment only. Once secure, firms may start to exploit their market positions by raising their markups.

[1] As measured by GDP

[2] Previous studies have only focused on the exporting firms of the Chinese economy and the effect of trade liberalization. The results in these papers suggest that an increase in accessibility to cheap intermediate inputs has increased the markups for trade companies; for example, Fan et al 2017.

3. State-owned enterprises still possess a large share of the market, which is typically not the case for industrialized countries. State-owned enterprises may extract lower markups. They have lower capital costs since they have favourable conditions through the state-owned banks. An indirect effect of the SOEs is also that they put competitive pressure on private companies, as they cannot charge higher prices than their public rivals. However, they also have other objectives than the private firms, such as promoting social cohesion; this is done by, for instance, employing excess workforce.

To this end, we employ some recent methodological advances, enabling us to study the evolution of competition in an economy. These advances have utilized publicly listed firms' financial statements and measured markups using observable parts in the data as well as estimating production functions from the data (De Loecker et al., 2011). This method has previously been used primarily to study already industrialized economies, such as the United States, Canada and the European Union.[3] The results from these studies suggest that competition has suffered during the last decades and that these changes have profound macroeconomic consequences. The reason for the increase in markups seems to be that already large firms with high markups are gaining market shares. Among other things, these increases seem to be driving a decline in the labour share witnessed in western countries and an increase in the capital share. This shift increases the inequality in the economy as more of the economic activity is allocated to capital rich actors.

The method used in this paper estimates the markups by observing the revenue and expenditure data for each firm and estimating the output elasticity for the variable inputs. The revenue and variable cost data are observed in the firms' financial statements. The output elasticities are assumed to be sector and year specific. The result is an expression for the markup that is revenue from sales divided by the cost of the goods sold times the variable output elasticity.

We analyse the Chinese economy by considering two datasets. The first is the Compustat dataset commonly used in similar studies and covers publicly listed companies. The dataset provides us with the data points from the publicly listed firms financial statements. The second

[3] Studies focusing on non-industrialised countries do not find support for an increase in markups overtime (Diez et al, 2018). However, the approach used focuses on the publicly listed companies and these are expected to be less relevant in developing countries.

data set is more novel in this setting and enables us to research the SOEs. The database is the Wind database which aggregates macro, financial and industry data for the Chinese economy into one database. The Wind database provides us with the same data as the Compustat data for the revenue, cost of goods sold and capital data. We then merge the two data sets and are able to estimate the difference between SOEs and the publicly listed firms. Furthermore, the data enables us to study SOEs that is usually not estimated with the method, since the main dataset this method has been used on is the Compustat database.

The results in this paper suggest that (i) state-owned firms have lower markups than private firms and that (ii) larger firms have lower markups than small firms. (iii), The overall trend in the economy is that markups have been declining since the ascension into the WTO. The results support the hypothesis; the first result suggests that the fact that the SOEs have other objectives than profit maximization results in them extracting lower markups, the second results indicate that firms are competing for market shares and positioning themselves to utilize the larger market shares in the future and the third overall trend indicates that the Chinese economy indeed has become more competitive when moving toward the more market-based system.

2. The Chinese economy

This section aims to provide a background and understanding of the Chinese economy and its unique characteristics. The Chinese economy has undergone tremendous changes over the past five decades[4] and has gradually introduced market mechanisms over time. According to Hoffman (2018), the Chinese reforms toward marketisation are divided into three periods: The market seeking reforms (1978-1993), the market-building reforms (1993-2004) and the market-enhancing reforms (2004-).

The first period saw the introduction of enterprises with characteristics that were similar to private enterprises and private enterprises with less than eight employees were allowed in 1984. These companies played a diminishingly small role for overall competition in the economy.

[4] The economic transition from a planned economy towards a market economy began in 1978 (Song 2018).

The second period began when the national congress announced the ambition to create a socialist market economy. This period saw an expansion of the private sector and different corporate forms were introduced.[5] The most important shift was the ascension into the WTO in 2001, which was conditioned on China adopting a market structure reform that entailed high degrees of marketization; lowering of tariffs and the recognition of private property were two of the main institutional changes. The period also saw the expansions of the two stock exchanges: the Shanghai Stock Exchange and the Shenzhen Stock exchange. Overall, the period saw an increase in the level of competition. (Yueh, 2010)

The third period saw a return of the involvement of the state in the market. The involvement is executed via the SOEs and the State-owned banks. The state has also divided the market into industries with different policy goals: 1. Strategic and key industries, 2. Basic and pilar industries, and 3. This may impact the competition in the market substantially. (Song, 2018) The period saw both an increase in competition due to an increase of the private sector and a clearer set of institutional rules however the re-emergence of the state in the market may have had a negative impact. Considering this institutional change, it is of interest to evaluate how much competition is present in the economy and how it has evolved.

3. Literature review

The two most influential studies on market power are Hall (1988) and Bresnahan (1989); these papers have since been further developed by several researchers. One such development is De Loecker and Warzynskis (2012) paper which introduced a new production function approach to estimate markups, which has its foundation in Hall (1988). The method utilizes firm-level data and the cost minimization problem to estimate markups. Further implementations of the method by De Loecker, Eeckhout and Unger (2020) observed an increase in markups by approximately 40 % between 1980 and 2016 in the United States. The authors attribute the change in large to the changes in market composition with the larger firms increasing their market share over time. The large firms extract the markups while mid-level and small firms cannot extract markups, implying an increase in market power (De Loecker et al. 2020). The method has become popular to estimate markups and has been implemented within several

[5] In 2000 the Company law was passed which defines three company types: state-owned, limited companies and joint-stock companies (Karen Jingrong Lin, Xiaoyan Lu, Junsheng Zhang and Ying Zheng 2019).

settings, and one such setting is the global application of Díez et al. (2018), which used the method to study the markups across continents and observed that the mature industrialised countries had seen an increase while the developing countries had not experienced such an increase. China is present in the sample but only as an aggregated part of Asia. Our paper will further expand on the growing body of work that is estimating markups.

The estimation of markups in China has mainly focused on the impact of trade liberalization on export firms. Fan et al. (2017) studied such an impact from 2000 until 2006. The main argumentation in the paper is that the access to inputs through access to world trade through the WTO has lowered the input costs and, as a consequence, increased the markups in the economy. Pure importers of goods have increased their markups, while firms that import for processing have not increased markups to the same degree. This is argued to be due to the fact that the import tax is reduced for the pure import firms while the firms using imports for production since they are duty-free. As such, the paper links markups with tariffs. The paper utilises trade data to estimate prices and tariff levels while using firm-level data to estimate the firms' total factor productivity.

Two other papers concerned with the markups in the Chinese economy are Lu & Yu (2015), and Liu & Ma (2021); both of the papers focus on the effects of the WTO ascension and the impact of trade liberalisation. Both of the papers follow the De Loecker and Warzynski (2012) method and using the annual surveys of industrial production dataset. The result of Lu & Yu (2015) is that the markup discrepancy between firms is reduced after the ascension. Liu & Ma find that the markups increase for importers after the ascension. They also find that the markup increases more due to lower tariffs in less competitive industries (Liu & Ma, 2015).

Our paper will expand the study of the chinses economy beyond the focus on the impact of the exporter status of firms, as well as expanding the time horizon of the study of firms. However, the most important contribution to the study of markups in China is the comparison between the publicly listed firms and the SOEs.

The SOEs were the backbone of the central planning era of the Chinese economy, and their development is a vital part of Chinas transformation into a more market-oriented economy. The SOEs original objective was to implement the government's planning of production and

distribution of goods in non-agricultural sectors. The SOEs have undergone several changes; however, to some degree, they remain the same and have gone from being the only major player in the market to competing with private firms. The SOEs, however, are inherently different from private firms (Song, 2018). The SOEs different objectives are to control the costs in the market, limit the unemployment, implement industrial policy and provide secure output in specific sectors. As of 2006 the SOEs are divided into strategic, pillar and other industries the classifications dictate the objectives of the SOEs.[6] The State controls the market competition and ensure the position of the SOEs within the strategic and pillar industries with administrative, technical and regulatory entry barriers. (Song, 2018)

Previous research has found that the SOEs have lower interest on their debt compared to the private firms and the private firms. Furthermore, the implicit backing of the state results in the SOEs having fewer issues with liquidity. The result is that it is generally harder for private firms to borrow money. Overall, the SOEs' competitive advantage is due to lower efficient tax rates and lower funding costs (García-Herrero & Ng, 2021). The result is that the SOEs have a lot of bad debt caused by overinvestment due to low-interest rates. The consequence of this is a high degree of loss-making SOEs[7] and zombie firms[8]. (Song, 2018)

Further research findings into the SOEs have found issues of corruption and the principal-agent problem since they have two competing objectives and the managers of the SOEs abused their positions to benefit themselves. (Lin et al., 2020). Further studies have found that the SOEs have less cost-effective than the private firms as well as being less efficient than the private firms; this is highly related to the function of the SOEs as both a commercial entity and a provider of a public good. (Lin et al., 2020) The state also utilises the SOEs as the vehicle for industrial policy implication, which further complicates the objective of the SOEs.

The overall findings of the previous research are that the SOEs have an advantageous position in the market while at the same time they are less efficient and are both a provider of output

[6] These are not strictly implemented but works as guidelines. The classifications are presented in appendix A. Our GICS sector classification does not enable us to research the difference between these classifications.
[7] An estimated 20-38 % of the SOEs were making losses between 2003 and 2013. (Song, 2018)
[8] Firms that are dependent on bailouts. These are particular present in the steel, coal and metal industries (Song, 2018)

and public goods. Studies have indicated that the government uses the SOEs to exhort control over the economy and that they are not purely a producer of a given good. (Naughton, 2018)

Our study will add to the litterateur concerning the SOEs in the Chinese economy by evaluating the differences in markups of SOEs and private firms.

4. Framework for Estimating the Markups

In a perfectly competitive economy price will be equal to a firms' marginal cost. The marginal cost is the cost of producing one extra unit of output. When firms are able to charge prices higher than the marginal cost the market has moved away from perfect competition. The quotient of the price and the marginal cost is as such defined as the markup:

$$Markup = \frac{P}{MC} \tag{1}$$

As the price (P) and the marginal cost (MC) are not observable, we have to adopt a different approach to estimate the markup. Production is a function of two production factors Q(K, L) where K is capital which is fixed in the short run and L which is the only variable input. Our employed framework will enable us to estimate markups for each year over a long-time horizon and for many firms while requiring access only to firms' financial statements. The approach is based on the following relation:

$$\mu \equiv Markup = \left(\frac{PQ}{WL}\right)\left(\frac{\partial Q}{\partial L}\frac{L}{Q}\right) \tag{2}$$

In equation 2, the P is the price of the output, Q is the quantity of the output, W is the input price, and L is the quantity of the input for the given firm.[9] The identification of the markups then relies on the two factors.; the first factor is the quotient revenue and the variable cost. This part is directly observable in our data as sales and cost of goods sold. The second part is the output elasticity of the variable inputs, that is needed for the estimation. The output elasticity of the variable input is the percental change of output when we change the input. This part is not directly observable in our data and must therefore be estimated. We consider the elasticity

[9] P*Q is observed as revenue in the data and W*L is observed as the cost of goods sold.

to be sector- and time-specific to get a more accurate estimate. The estimation method of the output elasticity of the variable input is presented in the coming section.

To prove equation 2, first note that MC = w ($\partial L/\partial$Q), thus the first step of the proof is shown in equation 3:

$$\frac{P}{MC} = \frac{P}{W\frac{\partial L}{\partial Q}} \tag{3}$$

Which is the same as equation 4:

$$\frac{P}{MC} = \frac{P}{W}\frac{\partial Q}{\partial L} \tag{4}$$

Then the final operation is to multiply the expression with $L\ Q * Q\ L$ which is possible since it is the same as multiplying with 1. The final definition of the markup is then:

$$\mu = \frac{P}{MC} = \frac{P}{W}\frac{\partial Q}{\partial L} = \left(\frac{PQ}{WL}\right)\left(\frac{\partial Q}{\partial L}\frac{L}{Q}\right) \tag{5}$$

The expression is the same as the one presented in equation 2. The first part of the right-hand side is observed as sales (P*Q) and the second part is observed as cost of goods sold (W*L). While the second part is the output elasticity of the variable input $\left(\frac{\partial Q}{\partial L}\frac{L}{Q}\right)$, which has to be estimated. The method of estimation is explained in the following subsection.

4.1 Output Elasticity

The second factor of equation 2 is the output elasticity of the variable input which measures how the output changes when we change the variable input. The output elasticity is the $\frac{\partial Q}{\partial L}\frac{L}{Q}$ part of the right-hand side in expression 5. To be able to estimate the output elasticity, we specify a Cobb-Douglas production function where quantity is decided by a productivity parameter (denoted by Ω), the variable input (denoted by L)[10], capital (denoted by K) and an error term (denoted by ε). The production function is specified in equation 6. The productivity

[10] The variable input in this paper is a composite of all variable inputs and as such may be treated as a scalar.

is unobserved and is firm specific. The restriction that $\beta + \gamma = 1$ is not implemented since this would restrict the results to constant returns to scale.

$$Q_{i,t} = L^{\beta}{}_{i,t} K^{\gamma}{}_{i,t} * \Omega_{i,t} e^{\varepsilon_{i,t}} \quad (6)$$

The economy consists of N firms, indexed by i = 1, …, N and t denote year. We consider sector-wide elasticities; all of the firms within a given sector and a given year have the same elasticity. Hence the beta and omega will be the same for all firms within a sector at a given year. The productivity parameter is unobserved. The regressions are therefore performed for each sector and the corresponding year individually. To estimate the model, we log transform expression 6, where we denote logs with lowercase letters. The error term has become additive and assumed to be random.

$$q_{it} = \beta_t l_{i,t} + \gamma_t k_{i,t} + \omega_{i,t} + \varepsilon_{i,t} \quad (7)$$

The output elasticity is identified in this expression as the β_t term since this term is the output elasticity of the variable input and the output elasticity of the capital is γ_t. The returns to scale within the sector at a given time is given by $\beta_t + \gamma_t$. The proof of the equality of output elasticity of the variable input is and β_t is presented in the appendix B, while the estimations of β_t are presented in appendix C. The data used to estimate the elasticity is the logged values of sales (q_{it}), the cost of goods sold ($l_{i,t}$) and the data on the stock of capital ($k_{i,t}$). There are a few problems when using the revenue and costs data, rather than the other option of using quantity data, this is essential to discuss.

The main issue is that this results in us using the revenue elasticity in place of the output elasticity (Bond, 2020). The necessary assumption for the revenue elasticity to be equal to the output elasticity is for the firms to be price takers. Our results are, therefore, possibly subject to the omitted price variable bias (Van Beveren, 2012). Such a bias is generally understood to bias results downwards (De Loecker et al, 2016). This is because of the generalisation that price and output are negatively correlated. An increase in the output will generate a greater supply and, as a result lower price. This impacts the markup level but will not impact the difference estimated between the state-owned and private firms.

Since the data available for this sample size is reported in revenues and costs, the revenue-based estimation is the only viable option when considering such a large part of the economy. When considering the level results, we need to proceed with caution. Other methods of estimating the elasticity are presented in the robustness chapter to comment on the robustness of the results and dealing with production shocks.

We consider different output elasticities over different sectors, because we expect that different sectors have different production technology. We also expect that technology changes over time; this is further supported by the expansion of the Chinese economy since the introduction and industrialisation will impact the production capabilities in the economy. We also consider the case where the output elasticities are industry-wide rather than sector-wide. However, we only have the data on industry classification for the private firms and not the SOEs. Therefore, this is only considered as a part of the robustness exercises.

5. Data Collection and Descriptive Statistics

Two data sources are used to estimate markups, the first is the Compustat database which is used for the publicly listed firms and the second is the Wind database which is used for the SOEs. Previous studies on the markups that include China main focus has been the impact of trade liberalization, our data sample will enable us to estimate the Chinese market over time as well as comparing the SOEs to the publicly listed firms. First, we introduce the Compustat database and then the Wind database. As such the data doesn't allow us to study smaller firms since the SOEs and the publicly listed firms are larger firms. However, the two types of firms are among the most important types in the economy, this is illustrated by the fact that the SOEs contributed 39 % of GDP in 2015 (Zhang, 2019). The publicly listed companies had a market capitalization of 94 % of GDP in 2015 (Worldbank, 2021). The two datapoints are not comparable but illustrate that both types of firms are large part of the economy.

Compustat

Compustat provides financial data for public firms, from 1992 to 2019. This paper studies 3587 listed companies, and the sample covers 86% of the total number of the public companies. The collected variables are presented in table 5.1.[11]

Wind

The second data base is the Wind database covers the SOEs, which provides substantial coverage of public firms in the Chinese market. The data covers the period 1992 to 2019, which meets our requirement of data. Similarly, we extracted firm-level financial statements, which allows us to measure markups of SOEs, this data is the same type as for the private firms which enables us to compare the two. The data covers 1118 SOEs from 1992 to 2019. The same kind of data that was collected from the Compustat database has been collected for sales, cogs, capital and GICS sector. The data for investments, overhead costs, industry classification and dividends data were unavailable for the SOEs. This is due to the fact that they are not required to provide this data. The publicly listed firms are required to go through audits and publicise parts of their data, this gives a reliability of the collected Compustat data. The data collected from the Wind database does not follow such regulated audits, and as such is less reliable (Wang, 2011). Therefore, some precautions are necessary when considering the SOE data, the diversion between the costs and sales may be minimized to project a positive image of the SOEs. When considering our final analysis, we need to consider this possibility. One further thing to note is that some publicly listed firms are controlled by the state, and in some firms the state own a significant share of the shares and may control over these companies as well. We are unable to control for the ownership share of the state.

There are public firms that are in fact state owned and controlled by the State-owned Assets Supervision and Administration Commission (SASAC), the SASAC lists these on their website (SASC, 2021). Because of this these state-owned firms are present in the Compustat database rather than the wind database. This concerns 36 publicly listed firms that in this paper will be

[11] The necessary macroeconomic variables are collected from the world bank; these are used to deflate the collected data. The GDP deflator is collected from the world bank; this is done to compare different periods without attributing differences due to inflation.

considered SOEs. Within this study the private publicly listed companies will be referred to as private firms, even though we do not mean the entirety of private firms in china. Previous studies considering public SOEs have had access to the number of shares owned by the State and since we do not have access to this, we only consider the firms that are under direct control of the SASAC, these have been considered sate owned in previous literature (Qiang, 2003).

The result of the data collection is an unbalanced panel data, which is are expected since firms are entering the sample over the studied period. This may have an impact on the error terms and to deal with such issues the fixed effects regressions will utilise robust vce clustered standard errors, clustered by firm, since we expect high ingroup serial correlation.

Descriptive

The collected variables collected and utilised in the main paper[12] is presented in table 5.1 and these are the values used to estimate the markup equation presented in the framework. The description of each of the variables are also included.

Table 5.1 Variable Description

Variable used as	Description	Variable from Compustat	Variable in Wind
Sales	Measure of the total value of sales in millions of Yuan	Sales	Sales
Variable Input costs	Measure of total Cost of Goods sold in millions of Yuan	COGS	COGS
Capital Stock	Measure of total costs of Plant, Property and Equipment in millions of Yuan	PPEGT	PPE
Sector classification	Global Industry Classification system	GICS	GICS

Source: Compustat & Wind

Table 5.2 illustrates the observations by sector and shows that the largest sector within the sample is the industrials sector and that the smallest sector is the communication services. Materials and industrials account for almost 45 % of the sample.[13] It also illustrates that the complete data covers 65736 observations. The GICS sector system is presented in appendix D.

[12] For the private firms we also collect data on industry classification, Overhead costs and investments. However, that data is only used in the robustness checks and the appendix of the paper.

[13] This may be attributed to the fact that they are large sectors and sectors with observations through all periods

Table 5.2 Observations by sector

GICS Sectors	Freq.	Per cent	Cum.
Energy	2157	3.28	3.28
Materials	12339	18.77	22.05
Industrials	18128	27.58	49.63
Consumer Discretionary	10265	15.62	65.24
Consumers Staples	4351	6.62	71.86
Health Care	4849	7.38	79.24
Information Technology	9057	13.78	93.02
Communication Services	1674	2.55	95.56
Utilities	2916	4.44	100.00
Total	65736	100.00	

The number of observations by time period and by private and SOEs are illustrated in table 5.3. The table shows the increase of observations over time due to the expansion of the market as well as illustrating the share of the SOEs over the period. The number of observations increased by approximately 5000 when considering the period 2000-2009 and 2010-2019. The SOEs share of the sample declined from 38% to 28 %.

Table 5.3 Observations by Year

Years	Private	SOE	Share of SOEs	Total
1992–1999	14067	5403	38 %	19470
2000–2009	15216	5429	35 %	20645
2010–2019	19957	5664	28 %	25621
Total	49240	16496	34 %	65736

Table 5.4[14] reports the descriptive statistics of the variables in the paper. The 75th percentile have cost of goods sold 8 times larger than the 25th percentile, the same pattern is discernible for the Sales and the Capital.[15] The mean markup within the sample is 1.23, prices 23 % above the marginal cost. For the markups there is also a difference between the percentiles with the 75th percentile extracting 40 % higher markups than the 25th percentile. Note that the share of sales values of zero do not indicate a 0 % share of sales but a very small share. The distribution

[14] Distribution plots of the variables are provided in appendix E
[15] 7 times larger for the sales and 7.8 times larger for the capital.

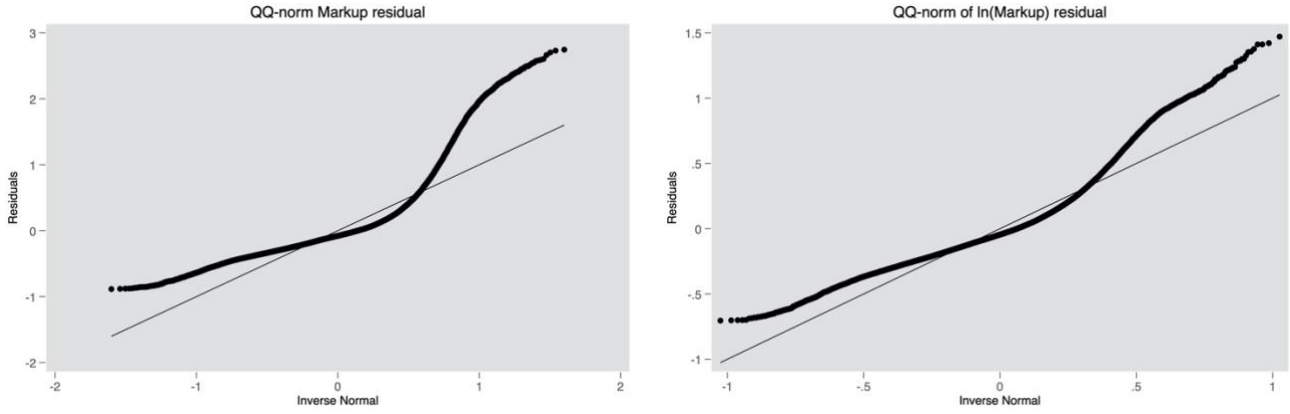
of share of sales has a low dispersion between the 25th percentile, the median and the 75th percentile, while few firms have high shares of the share of sales.[16]

Table 5.4 Distribution of variables

Variable	Obs.	Mean	Min	P25	Median	p75	Max
Variable input (log)	65736	6.998	-1.41	5.872	6.878	7.982	14.851
Sales (log)	65736	7.337	-.573	6.282	7.191	8.223	14.884
Capital (log)	65736	6.381	-5.865	5.34	6.322	7.395	14.422
Markup	65736	1.228	.722	.963	1.112	1.341	3.806
Share of Sales	65736	.004	0	0	.001	.002	.73

To be able to obtain reliable p values one of the conditions is that the error term is normally distributed, this condition is not necessary for obtaining unbiased results. It does however increase the reliability of the confidence intervals. To test the error distribution of our dependent variable we plot a quantile-quantile plot of the residuals, for the distribution to be considered normal it should be close to a 45-degree line. The result indicates that there might be issues with normal distribution of the error terms, therefore we log transform the dependent variable to mitigate the issue. The result is an improvement in the distribution of the error terms. The results are presented in figure 5.1.

Figure 5.1 QQ Normal Plot



[16] 266 firms have share of sales above 10 %.

6. Results

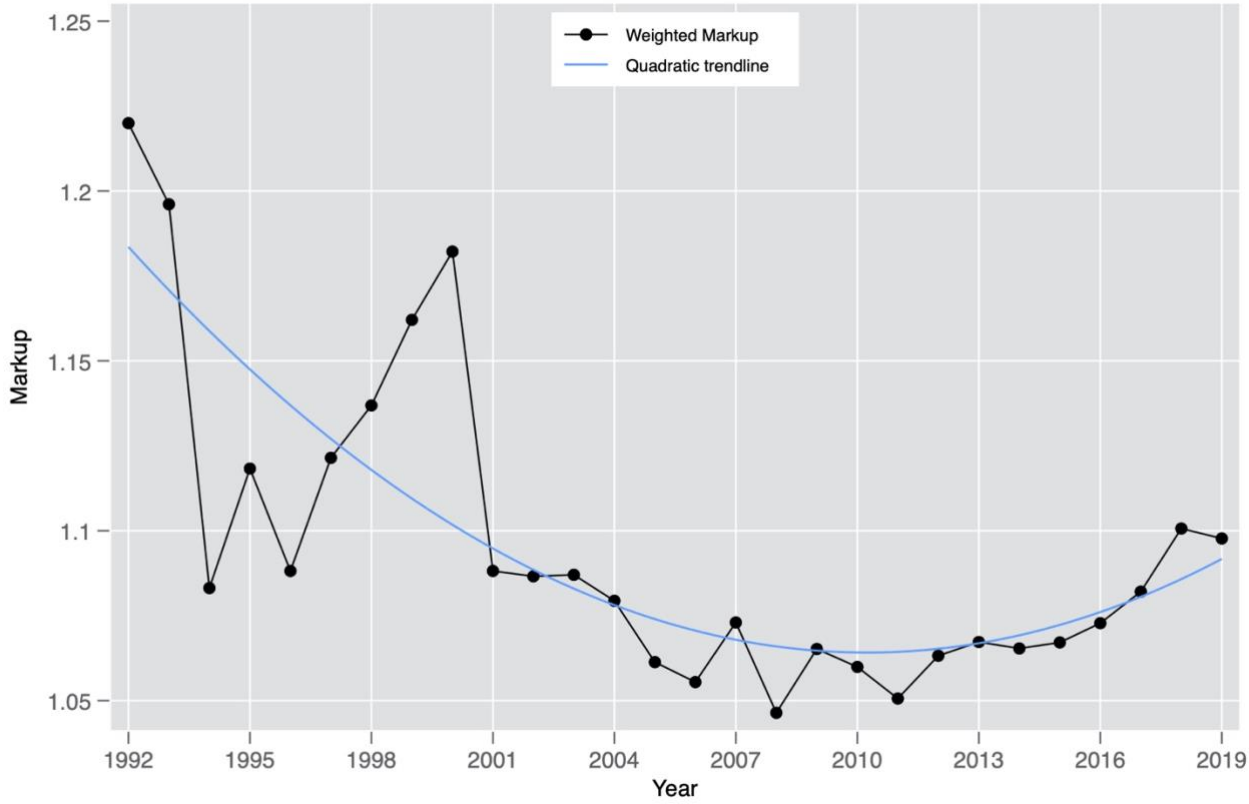
6.1 Evolution of Markups 1992-2019

When considering the evolution of markups over time, it is crucial to note that not all firms are equally relevant in the economy since larger firms account for a larger share of sales. To account for this fact, we construct weights that are constructed to increase the importance of the larger firms. The weights are determined by the share of sales each firm has in their given sector and year; if a firm account for 20 % of a sector, their markup will determine 20% of that sectors markup. The calculation for the weighted markup is presented in expression 8:

$$\mu_t = \sum_i m_{i,t}\mu_{it} \tag{8}$$

Where μ_t is the estimated markup in a given year, $m_{i,t}$ is a given firms weight in a given year and μ_{it} is the estimated markup of firm i in a given year. The results are presented in figure 6.1. The figure illustrates that the weighted markups in the economy between 1992 and 2019. In 1992 a markup of approximately 23 % above marginal cost; however, this period only consists of 48 observations. In 2019, the measure approximated a markup of 10 %. The markup decreased in the economy over the period. There seems to be a structural shift when we enter the market building period; however, it is difficult to assert this since the sample only covers the period from 1992. However, as this period started to allow for an increase of private firms, the theoretical foundation for such an interpretation is solid. The second shift is the ascension into the WTO. The ascension was conditioned on several structural reforms that had to be achieved before the ascension. The ascension resulted in the abolishment of centrally set prices, which would result in price competition between firms. Parallel with this evolution, access to global trade would reduce costs and reduce the price competition's impact. It may be the case that the larger companies were subject to international competition and the new price competition, further limiting their ability to extract markups. As such, the weighting takes this into account. The ascension entailed a marketisation and theoretically should suggest an institutional shift for the economy. When considering the difference between the SOEs and the private firms, we will focus on the period of the ascension. Another impact noticeable in figure 6.1 is the financial crisis in 2008; however, the chock is quickly mitigated.

Figure 6.1. Weighted evolution of markups between 1992 and 2019.



To control if there has been a significant decline in markups over time, we consider a linear regression with firm fixed effects and yearly dummies as the explanatory variables of the dependent variable log of markup. This will enable us to estimate the differences between each year compared with the baseline of 2001 and estimate the level of markup by year. The firm-fixed effect eliminates the differences between the firms due to the aspects of size, location, industry or other variations. Because there is such a major structural shift because of the ascension into the WTO, it may be challenging to assert results when comparing pre- and post-ascension. The regression will therefore focus on the period from 2001 and forward. The result of the regression is presented in table 6.1 in model 3 below, with each $5^{\text{-year}}$ Dummy reported. So, the 2007 dummy is the difference in markups compared to 2001; the same is true for 213 and 2019.

The result of the model supports the result that the markups are declining when controlling for firm fixed effects. The results report a baseline markup of 1.24 in 2001 ($e^{0.2159} = 1.24$). The results are significantly lower markups compared to 2001 at the 1 % level from 2005. The interpretation is that the markups are approximately 3 % lower in 2005 compared to 2001. The difference between 2019 and 2001 is an estimation of 6 % lower markups. The adjusted r^2

value, explanatory power of the model, is 0.78, indicating high explanatory power. Each firm has its own fixed effects, and as such, a lot of information is used in the model and the r^2 doesn't tell us much. The results support the claim that there has been a decrease in markups between 2001 and 2019. The result seems to indicate the decrease of markups since the ascension into the WTO and as such indicate that the market reformation has had positive effects.

We will further examine models that attempt to isolate which factors impact the markup. However, first, we will look at how entry, reallocation, and firm's markup decisions impact markups' evolution.

Table 6.1. Results of the analysis with three different models.

	Dependent variable:		
	Ln(Markup) b/se		
	(1)	(2)	(3)
soe=1	-0.2764***	-0.2601***	
	(0.005)	(0.029)	
Materials * soe=1		0.0496*	
		(0.030)	
Industrials * soe=1		0.0103	
		(0.031)	
Consumer Discretionary * soe=1		-0.0202	
		(0.031)	
Consumers Staples * soe=1		-0.0692*	
		(0.040)	
Health Care * soe=1		-0.4014***	
		(0.044)	
Information Technology * soe=1		-0.0702**	
		(0.034)	
Communication Services * soe=1		0.3585**	
		(0.182)	
Utilities * soe=1		-0.0773*	
		(0.045)	
Year=2001 (base)			0.2159***
			(0.005)
Year Year=2007			-0.0261***
			(0.006)
Year=2013			-0.0529***
			(0.007)
Year=2019			-0.0617***
			(0.008)
Year FE	Y	Y	
Sector FE	Y		Y
R2	0.2025	0.1243	0.8010
R2-adjusted	0.2023	0.1238	0.7844
N	61329	61351	61329

Significance codes: *p<0.10, **p<0.5, ***p<0.01

6.2 Explanations of the Decline

We consider three aspects that may impact the markups; entry, reallocation and if firms change their markup over time. We consider three counterfactual cases in this section[17]:

- The first one is how would have the markups evolve if it only consisted of the net entering of firms. (Green line)
- the second one considers how markups would have evolved if markups only changed from reallocation of sales, if costumers start buying from different firms and no changes in markups occurred. (Black line)
- The final one considers how markups would have evolved if firms keep their share of sales from the previous period and changed their markup. (Blue line)

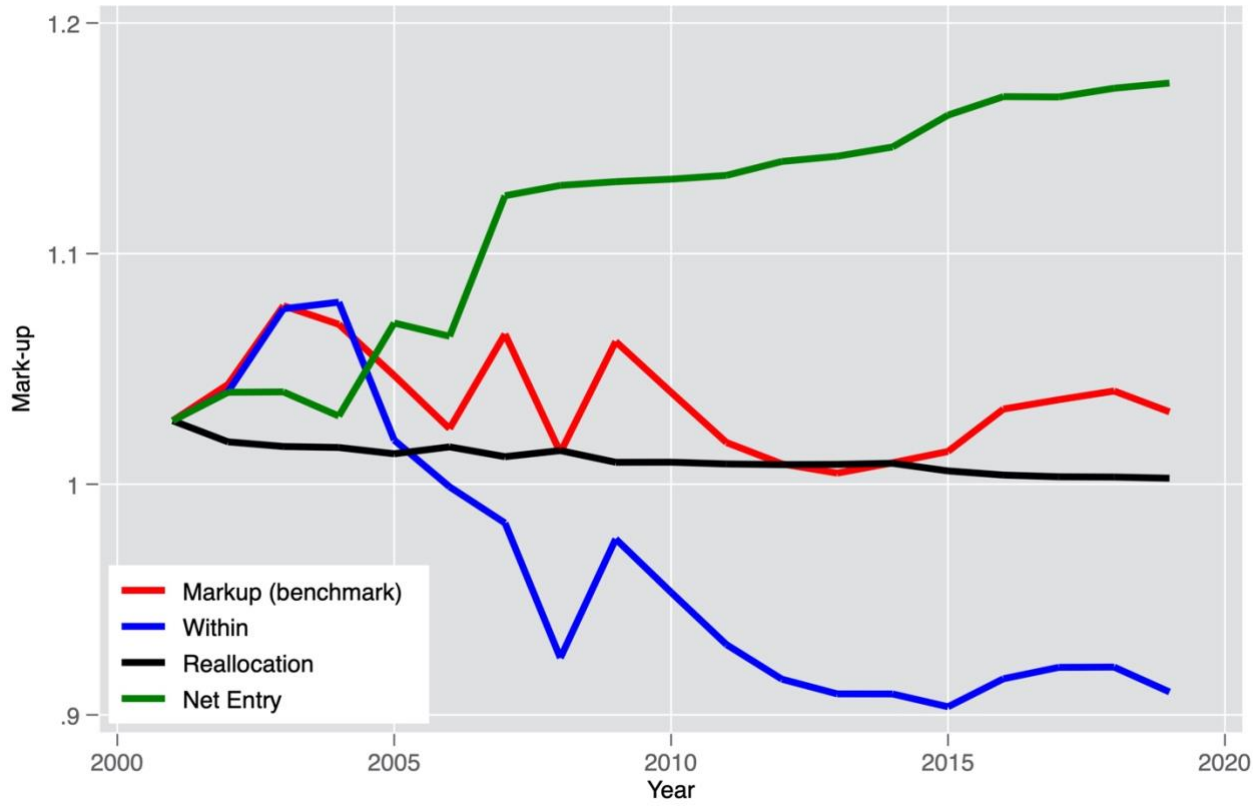
We set the baseline year as 2001 and plot the changes for each category. Each line in figure 6.2 represents one of the aforementioned cases, apart from the baseline estimation of markup represented by the red line, which is slightly different from the results in the previous section since the weights are only weighted by year. The conclusion is that the different parts would generate very different evolutions of the markups.

[17]This is calculated with the following expression:

$$\Delta\mu_t = \sum_i m_{i,t-1} * \Delta\mu_{it} + \sum_i \tilde{\mu}_{i,t-1} * \Delta m_{i,t} + \sum_i \Delta\mu_{i,t} * \Delta m_{i,t} + \sum_{i\in Entry} \tilde{\mu}_{i,t} * m_{i,t} + \sum_{i\in Exit} \tilde{\mu}_{i,t-1} * m_{i,t-1}$$

Within the expression the following definitions are applied $\tilde{\mu}_{i,t} = \mu_{it} - \mu_{t-1}$ and $\tilde{\mu}_{i,t-1} = \mu_{it-1} - \mu_{t-1}$. The first term is the change in markup and keeping the share of sales from the previous period; this expression is called the Δwithin term. The first term represents the change in markup caused by firms increasing their markup while keeping their share of sales constant, this term we call the Δwithin-term. The second term measures how markups change due to changes in the share of sales while keeping the markup fixed, this term is called the Δmarket share-term. The third term is the Δcross-term which considers simultaneous changes in markups and share of sales. The sum of the Δmarket share-term and the Δcross-term is considered as the Δreallocation-term. This is the changes due to only reallocation of sales. The last two terms are the Δnet entry term; this term increases markups if the entering firms have higher markups than the firms exiting firms.

Figure 6.2. Decomposition of the markup



We first consider if the changes in markup were only caused by firms adjusting their markups while maintaining their share of sales from the previous period. The blue line illustrates the effect of this in figure 6.2. There is an increase in markups up until 2004. A decline of the markup with a sharp decline during the 2008 financial crisis countered with a sharp increase than to resume the decrease and levelling out at a level of approximately 0.9. The results illustrate that firms are lowering their markups over time; this may be due to an expansion effort to continue to grow. The term may also illustrate that the firms have low pricing power.

If markups were only to be caused by if customers bought from a new firm in a new period, reallocation of economic activity, the markup would be declining slowly from 1.03 to 1 over the period. There seems to be a weak impact of economic reallocation. The results also indicate that reallocation is even throughout the period however slightly decreasing. There seems to be insufficient evidence of reallocation effects toward higher markups firms. This is the opposite trend reported by De Loecker et al. (2019). There seems to be a weak reallocation effect toward low markup firms. The reallocation to lower markup firms is natural if this corresponds to lower

prices; this may also be correlated to the fact that the firms do not have market power and, as such, are incapable of raising markups and keeping their market share. While in the mature economies, the firms have market power and can use it to increase their market shares while maintaining markups.

The net entry illustrates that the firms entering the markup have higher markups than those leaving the market; this is logical since we expect the firms with negative markups to exit the market at a higher rate since they are loss-making. When considering the expansion of the market, this is not a small group of companies; the common denominators of entering firms are that they possess a small share of the sales and that they are private publicly listed firms. At the same time, the incumbent firms are larger in terms of the share of sales. There will also be a difference in capital cost, where new entrants will have a higher cost of capital. The decomposition further illustrates that the markups are indeed different between firms. The results seem to indicate low pricing power since the within term is declining and that economic activity is slowly being reallocated towards low markup firms.

After considering the evolution of markups and noting that the results are substantially different from the results reported for the industrialised countries, we will therefore examine the impact of the SOEs in the following section.

6.3 SOEs have lower markups

We consider the impact that the SOEs may have on markups in the Chinese economy. The first step towards considering such an impact is to estimate if there is a difference in markup levels between the SOEs and the private firms. We expect the SOEs to have lower markups for two main reasons: The SOEs have higher costs because they are expected to soak up the extra workforce. The SOEs are viewed as a vital part of the Chinese economic system. Besides producing goods, they are expected to impact price levels downwards, promote social stability, and produce public goods (Song, 2018).

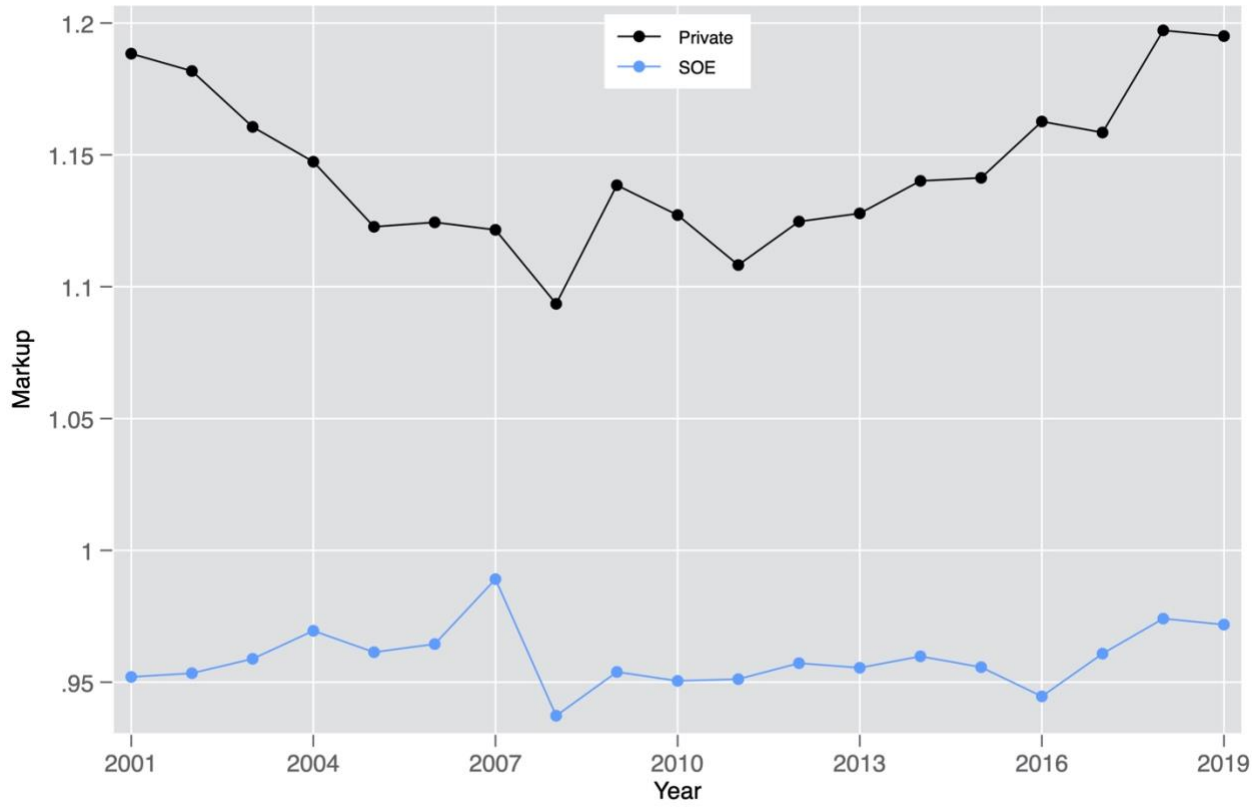
The results are presented in figure 6.3, where the markups are weighted by the same principle as before; however, the SOEs and the private firms are weighed separately. We do this to adjust for the size of the firms as they will have a larger impact on the markup extracted.

$$\mu_{t,SOE} = \sum_i m_{i,t}\mu_{it} \quad (9)$$

The results in figure 6.3 indicate that the SOEs extract a substantially smaller markup than the private firms. As expected, the SOEs seem to be extracting lower markups. These initial results seem to indicate that the SOEs are a part of why we observed low levels of markups in the overall economy. However, the results seem to indicate relatively stable markups ranging from 19 % above marginal costs for the private firms to about 10% above marginal cost at the lowest. There seems to have been a decline in markups from 2001 until 2011 and then an increase up until 2018 for the private firms. The figure also illustrates that the SOEs have markups below 1, varying around 5% below marginal cost. As such, the SOEs are loss making; previous research has noted that they are inefficient, and as such, this is not unreasonable. However, as mentioned concerning the estimation of the output elasticity, it may be mismeasured. However, the same level difference will still be present. The markup of the SOEs seems to be more stable over time, further implying the policy objectives of SOEs.

To further examine if SOEs have lower markups, we consider a linear fixed-effects regression model. This enables us to statistically examine if they have a different markup level. We specify a model with a dummy for the SOEs and a fixed effect parameter for year and sector, which are regressed on the logged value of the markup. The results are presented in table 6.1 model 1.

Figure 6.3. Markup differences between Private firms and SOEs



The results indicate that the SOEs have 27 % lower markups than the private firms, significant at the 1 % level. This further reinforces the result that the SOEs have lower markups. When transforming the results from their logged values, the predicted markup is 1.26 for the private firms and 0.96 for the SOES. There is a strong foundation for the statement that SOEs are extracting lower markups than their private counterpart; this follows our hypothesis. However, there may exist several confounding factors that impact the markups. The first of these that is going to be explored is the impact of sectors on the markup.

6.4 SOEs lower markups cannot be explained by sectorial or size factors

Sectorial differences

The results in the previous section indicated that the SOEs have lower markups than the private firms. One possible explanation for this may be that SOEs have lower markups because SOEs are active in low markup sectors.[18] It may also be the case that sectors with many SOEs are low

[18] The different markup levels by sectors are presented in appendix F. The SOEs share of sales by sector is presented in also presented in appendix F.

markups sectors since there are many SOEs present. Therefore, we aim to examine if SOEs extract lower markups in the specific sectors as well. To control for this, we construct a linear fixed-effects regression model with an interaction term between the SOEs and the sectors and a yearly fixed effect. The interaction will show if SOEs are extracting lower markups in the interacted sector. The results are presented in table 6.1 model 2, with the pure sector effects excluded and only the impact of SOEs presented.

The results indicate that the SOEs do not extract lower markups because they have a higher presence in low markup sectors; this is since they have lower markups in each sector since only the communication interaction terms cancel out and dominate the SOE-Dummy. Important to note is that the communications services are a high markup sector (see appendix D). We are unable to conclude that SOEs extract lower markup because of a higher presence in low markup sectors, and thus far, we still the results indicate that SOEs extract lower markups simple because they are SOEs.

Size matters

Another factor that may impact the difference between the SOEs and the private firms is that the SOEs are, on average larger than the private firms.[19] In this section, we analyse the effect of firm size on the markups. There are two factors at work within the size dimension. First, it is assumed that firms that offer a given good at a lower price will obtain larger market shares and grow. However, when a firm is sufficiently large, it may reach some power over the market and increase markups without losing customers.

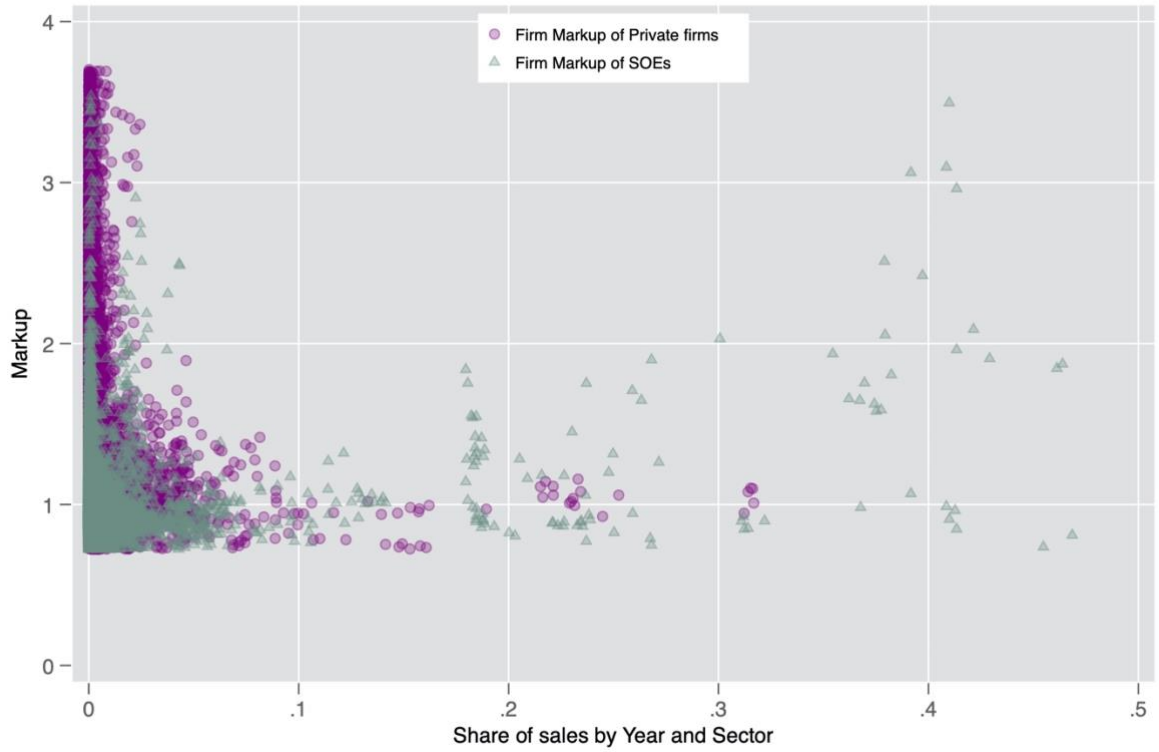
When considering the impact of size on the markup, it is reasonable to consider such a relationship to be non-linear. This is illustrated in figure 6.4. The figure illustrates that the relationship is non-linear and that the smaller firms are extracting the highest markups. This contradicts the findings of the previous research; one aspect may be that the smaller firms have a higher overhead costs as a share of their revenue. The figure also illustrates that it is the large SOEs that are extracting high markups rather than the larger private firms.[20] The larger the private firm the lower the markup while the same relationship for the SOEs doesn't seem to

[19] Approximately 2 % of the SOEs are among the top 1 % share of sales firms while 0.5 % of the private firms are among them. 60 % of the top 1% firms with the largest share of sales are SOEs (there are 273% more private firms than SOEs in the sample).

[20] The data points of SOEs with share of sales greater than 0.3 and markups higher than 1.5 are all in the communication services.

hold. It is important to note that the very large SOEs are a small share of the markup and as such we perform more thorough regression analysis. However, we further investigate if this relationship holds. Important to note is that there are about 60 000 points in figure 6.4, which indicates that the firms with a share of sales above 0.2 are approximately 0.1 %. Therefore, we consider a model with both the log of share of sales within a sector and year and the share of sales within a sector and year. It might be that firms are able to use the size advantage in specific sectors and not others. To control for this, we will utilise sector fixed effects when estimating the markup; we also employ yearly fixed effects.

Figure 6.4. Scatterplot of each firm's yearly markup by private firms and SOEs (2001-2019)



To control for if the SOEs have lower markups due to their size, we consider a linear regression model with year and sector fixed effects with the logarithm of markups as the dependent variable interacted with the logged share of sales and the share of sales. Table 6.2 presents the marginal effects of size and SOEs; the complete regression is presented in appendix G. The results indicate two main findings the SOEs have lower markups than the private firms, here estimated to be around 25 % lower than the private firms; this indicates that the SOEs do not extract lower markups because they are, on average larger. The second result is that the larger firms are extracting lower markups than the smaller firms, here approximated as when we

increase the share of sales within the sector by 10%, we expect the markup to decrease by 0.5 %.

Table 6.2 Marginal effect of share of sales and SOE

	Dependent variable:
	Ln(Markup) dy/dx / delta se
Share of Sales	-0.048*** (0.002)
SOE=1	-0.257* (0.006)
N	61351
Significance codes: *p<0.10, **p<0.5, ***p<0.01	

Note: dy/dx for factor levels is the discrete change from the base level.

The conclusion from this section is that the SOEs extract lower markups than the private firms when controlling for size, sector and year. As such, we do not seem to be able to explain the lower markups of SOEs by that they are larger or have a higher presence in low markup sectors. . One reason that the SOEs may have lower markups may be that they have higher marginal costs. Research of the SOEs has reported that they are less efficient due to several factors. It may then be the case that they have lower markups are not due to lower price but due to higher costs. However, we are unable to infer this from the data. Given that the SOEs have lower markups without obtaining that the private firm converges to its level of markup, other things may impact the markups extracted by the private firms.

The result that larger firms extract higher markups, as the results in the industrialised world, have low support when considering our results. Our result indicates that larger firms extract lower markups. This result is important since it may explain the overall evolution of the markup in the economy, considering that large firms have lower markups and possess a larger share of the sales. This indicates that the firms are positioning themselves and are unable to exhort any market power.

7. Robustness

The main assumption of the paper is the one concerning the production technology of the market, and by extension the output elasticity. The output elasticity is the part of the mark-up measure subject to assumptions and as such will have a major impact on the estimation. There are a few concerns regarding the elasticity estimation using the Cobb-Douglas approach used in the main paper. The robustness exercises only utilise data from publicly listed firms due to lack of data for the SOEs.[21] The main issues these approaches aim to solve are the simultaneity and selection biases issues.

Industry classification

One main issue may that the sector wide estimation of mark-ups is too wide and hence a division by industry may be more suitable. The elasticity is remeasured using the GICS industry classifications, they are still time varying on a yearly basis (indicated by t). The Where ind specifies each industry. The following expression is used for the estimation of the output elasticity (β) :

$$q_{ind,t} = \omega_{ind\,,t} + \beta v_{ind,\ t} + \alpha k_{ind,\ t} + \varepsilon_{ind,\ t} \qquad (10)$$

The data points utilised are the same as before $q_{ind,t}$ is the sales in industry i at year t, $v_{ind,\ t}$ is the cost of goods sold in industry i at year t and $k_{ind,\ t}$ is the capital stock in industry i at year t.

Fixed Effects

There are a few issues when estimating the production with an ordinary-least squares approach, namely simultaneity and selection biases. The simultaneity is due to productivity shocks and in extension the correlation between our explanatory variable and the error term. This is due to the fact that the input decision is made by the firm who has information about productivity shocks and base their choice of input on this estimation, the shock is not observed when estimating the model, however. Since the OLS approach is unable to account for these shocks, the results will be biased, in the direction of the shock. The issue may be solved by using a

[21] The spending on investments and industry classification data is only availible for the private firms.

fixed effects estimation of the productivity, the approach eliminates the time-variation and thereby shocks. Below we introduce the fixed effects approach with firm fixed effects.

$$y_{it} = \sum_{j=2}^{k} \beta_j X_{ijt} + \delta_t + \sum_{i=1}^{n} \alpha_i A_i + \varepsilon_{it} \quad (11)$$

J and k in our case are the cogs and capital variables the delta is the time specific effect and $\alpha_i A_i$ is a dummy variable for every individual firm which is a firm fixed effect on the dependent variable, y_i and the ε_{it} is an error term for each firm in each period. This approach will yield estimations of output elasticities that are without the simultaneity issue, but only if firm-specific productivity is time invariant. The approach doesn't deal with the selection bias of selecting surviving firms. To capture the time varying aspect and the selection bias the Olley-pakes production approach is implemented.

Olley-Pakes

The Olley Pakes approach deals with two of the issues that arise when estimating production functions, namely simultaneity and selection bias. The simultaneity issue is due to the firms being able to observe productivity shocks and adjust output, however we are unable to observe such a shock and the error term becomes correlated with the output variable. This is the same issue that the fixed effects model addressed however at the cost of ignoring time in varying production. The selection bias is due to the fact that the firms used to estimate the output is that we don't account for the exiting firms and the correlation between future profits and the capital stock, and the relationship that firms with high capital stocks are more likely to stay in the market. (Yasar et al. 2008)

The approach setup is cantered around the firm decision to stay in the market or exit it as well as the assumption that investments are positively correlated with the productivity shocks. The investment decision follows:

$$I_{it} = I(\Omega_{i,t}, K_{it} a_{it}) \quad (12)$$

Where $\Omega_{i,t}$ is the productivity shock, K_{it} is the capital stock and a_{it} is the firm's age. The approach assumes a Cobb Douglas technology and will result in a two-stage estimation. [22] The specified Cobb Douglas function is defined as:

$$q_{i,t} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \beta_a a_{it} + \mu_{it} \quad (13)$$

In the expression 13, $q_{i,t}$ is the sales of firm i in year t, l_{it} is the cost of goods sold of firm i in year t, k_{it} is the capital stock of firm i in year t and a_{it} is the age of firm i in year t. μ_{it} is the error term that consists of the following expression:

$$\mu_{i,t} = \Omega_{i,t} + \eta_{i,t} \quad (14)$$

The $\Omega_{i,t}$ is the productivity shock observed by the firm but not observable when estimating the model and $\eta_{i,t}$ is unobserved by everybody. As such $\Omega_{i,t}$ impacts firm actions while $\eta_{i,t}$ doesn't. The method then requires us to estimate the productivity shock. This is done by inverting the investment decision function, expression 12. (Yasar et al. 2008) Which yields the following expression:

$$\Omega_{i,t} = I^{-1}(I_{it}, K_{it}, a_{it}) = h(I_{it}, K_{it}, a_{it}) \quad (15)$$

The assumption is that the productivity shocks are strictly increasing in investments. The expression for the productivity shocks is then a function of investments, capital stock and age). Utilising this expression and that the error term consists of two parts we may specify expression 16 by inserting expression 14 and 15 into it expression 13. This yields the following expression:

$$q_{it} = \beta_l l_{jt} + \phi(i_{i,t}, k_{i,t}, a_{it}) + \eta_{jt} \quad (16)$$

Where $\phi(i_{i,t}, k_{i,t}, a_{it}) = \beta_0 + \beta_k k_{it} + \beta_a a_{it} + h(I_{it}, K_{it}, a_{it})$. As such we have an expression where we are able to estimate the output elasticity of cost of goods sold those controls for unobserved productivity via the ϕ function and the error term is then not correlated with the

[22] However, the output elasticity will be identified in the first stage and as such we will not go beyond the first stage.

inputs. This is since the function of ϕ may be estimated with a low order polynomial, in our case we utilise a second-degree polynomial of age, capital and investments. (Yasar et al. 2008) As a result of this, we have estimated a consistent estimator of the elasticity and will below perform robustness exercises below using the estimated elasticities.

The result is a lower estimation of the elasticity; however, the impact is quite small. This result suggests an overestimation of the elasticity and in turn the mark-up. To deal with this issue a fixed effects approach is introduced. The fixed effects approach results in a higher output elasticity than the baseline estimation. This implies that we are underestimating the mark-up. However, one key issue with the fixed effects estimator is that it is not time varying, however we allow it to vary three times in our estimation. To deal with the simultaneity problem the Olley-Pakes approach is suitable and allows for time varying differences.

This illustrates the model's dependency on the assumption on the assumed production function, hence the results are not to be perceived as robust under different production function approaches as we would like. One key aspect given the results are how much production varies with time, if we do not expect production capabilities to vary over time the fixed effects approach may be viable. The results in figures 8.1 and 8.2 illustrate that the consistent estimators are very different. The fixed effect estimator generates the highest levels of markups while the Olley-Pakes approach results in the lowest markups, the difference from the baseline is about a markup approximately 8 % lower, 20015 and onwards, while they are closer in previous periods. While the fixed effects approach is approximately 8 % higher than the baseline. The industrywide specification follows the baseline closely. Overall, all methods illustrate an increase of about 0.1 over the period from 2001 to 2019. The robustness checks illustrate that the main result is viable, and that the observation of the trend holds under several assumptions. However, the level is impacted by the choice of elasticity. Given that the approach's sensitivity of the correct output elasticates for the markups we are unable to deter anything about level as such but rather the differences are what matters in the paper.

Figure 8.1 Output elasticity of the composite good with four methods

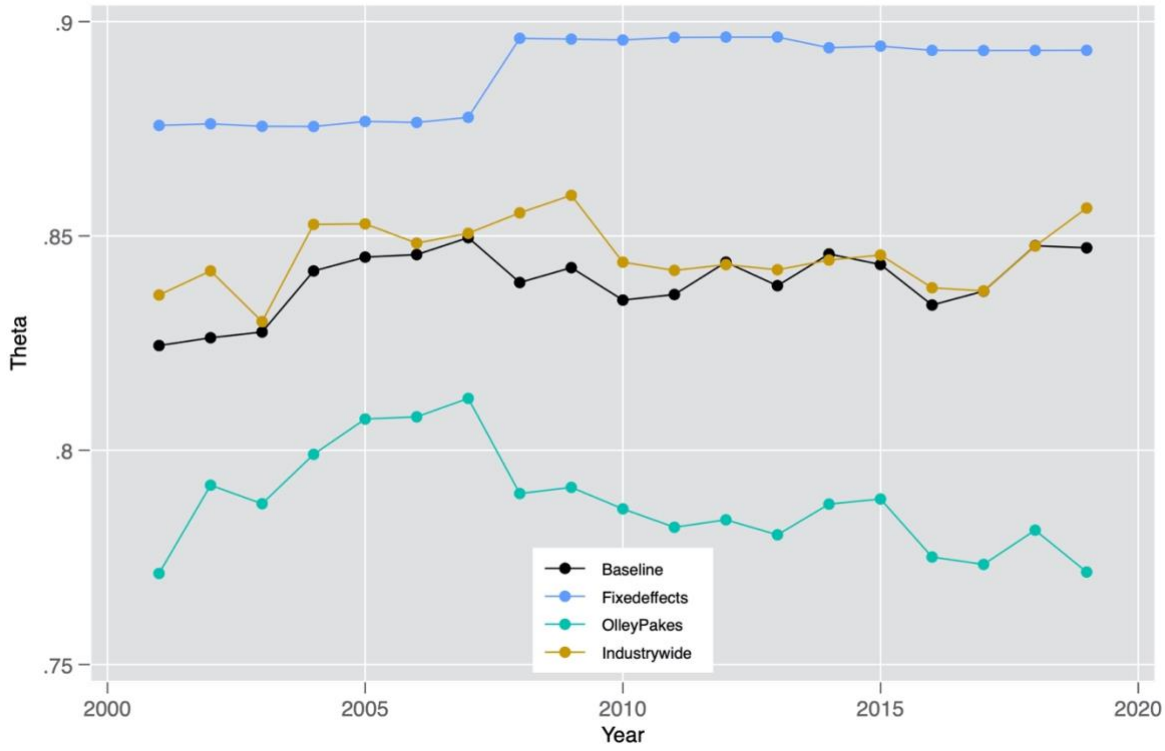
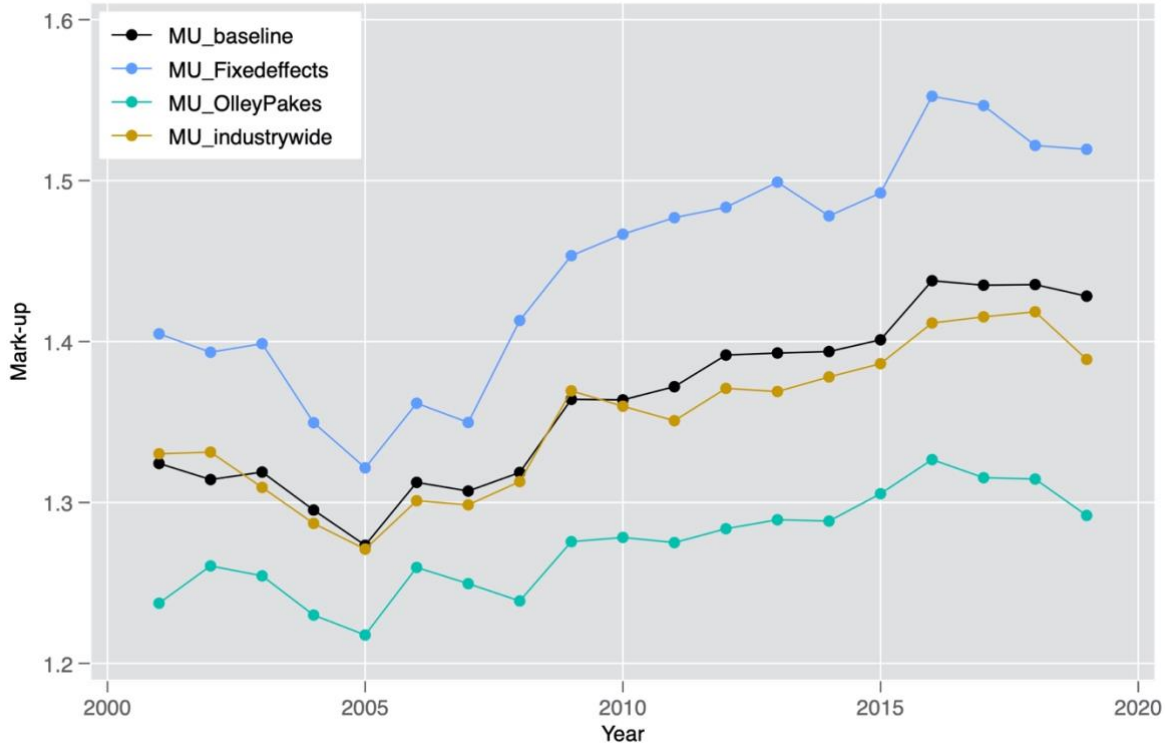


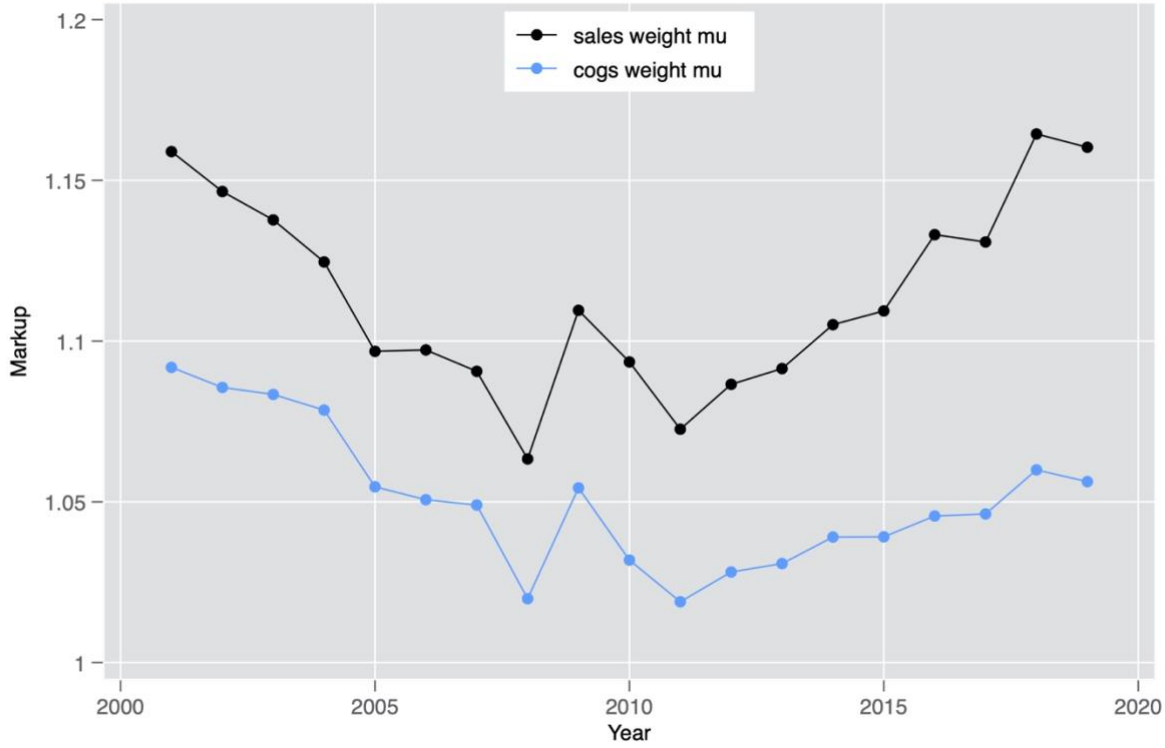
Figure 8.2 Markup estimated with 4 different thetas



Weights

Another important aspect is the weight used in estimating the results, Different weights will impact our estimation of the change in mark-up over time. However, in the estimations of mark-up we do not use the weighted results. They will however impact our analysis of the change in the overall mark-up of the economy. The weights are important since depending on size a given firm will impact the market differently. First, we consider weighting the mark-up by the cost of goods sold rather than sales and then we consider weighting by industry rather than the sector.

Figure 8.4 Mean Weighted Markup over time weighted by COGS and Sales

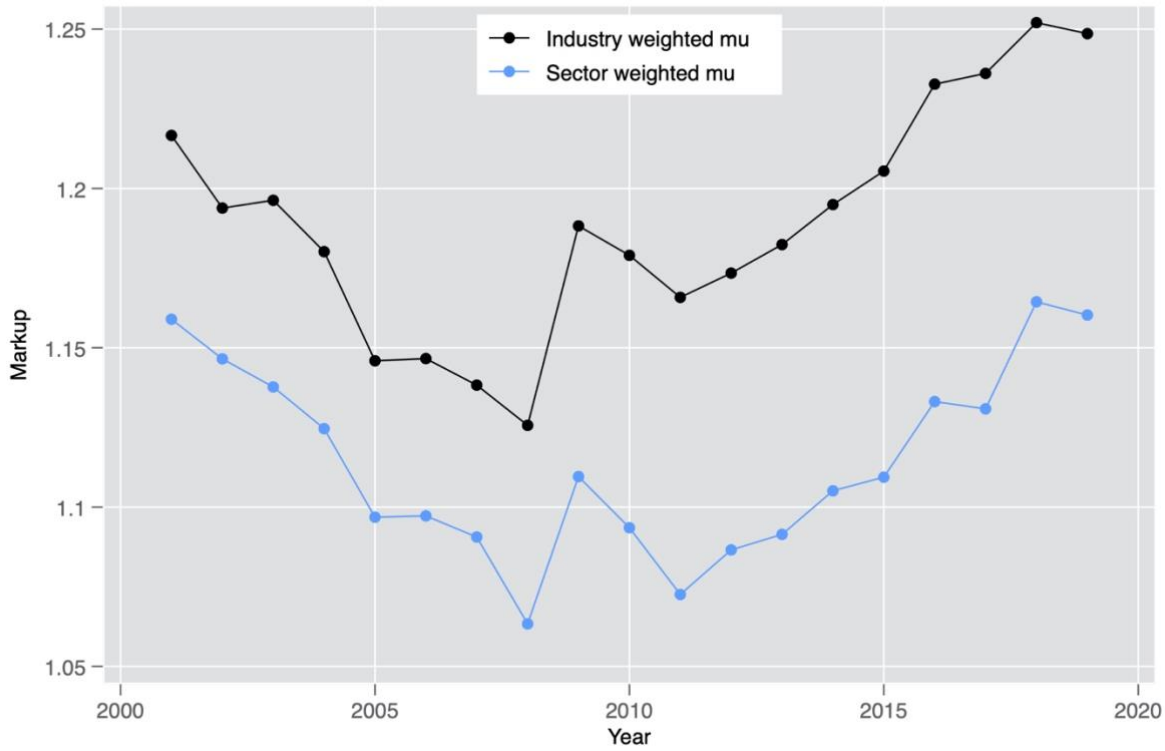


Considering the inputs as the weight rather than the output yields the results of figure 8.4. When weighting by the inputs the mark-up is measured to be approximately 0.1 units lower than when weighting by outputs. However, output is a more viable measure since this also accounts for the productivity of each individual firm.

The other important weighting option is if the weighting is performed at the sector level or at the industry level. If we are considering the weight as a share of a given market than the industry level would be appropriate. However, if we are considering the entirety of the economy the sector weighed is more appropriate. The industry weighted results are approximately 0.1 units

higher than the sector weight from 2010 (see figure 8.5) this is due to the fact that smaller sectors with higher mark-ups gain a l larger weight. The results further illustrate that the choice of weight impact the measured mark-up. If we would measure in a narrower way. The markups would be higher. The use of sector wide measure in the paper is due to the fact that we want to account for the market overall, when dividing the market by sector certain industries will be attributed larger weights and such a measure will not be reasonable when considering the entirety of the economy.

Figure 8.5 Industry & Sector weighted markups



Private firms and size by share of sales of industry

One other aspect that may impact the markup is the share of the industry rather than the sector. Since industries are divided into more groups, the impact of the weight will differ from the sector division. For instance, if small markup firms are larger, then the impact of the share of sales will have a negative impact on the markup. A division by industry will reduce this effect. We estimate a model with the share of sales by industry as the explanatory variable. The results are presented in table 10.1.

Table 10.1 Regression of three specifications of sales on the logged markup

	Dependent variable:		
		Ln(Markup) b/se	
	(1)	(2)	(3)
Ln(Share of Sales)	-0.0600*** (0.003)	-0.0519*** (0.010)	0.0653*** 0.021
Share of Sales		0.0008 (0.001)	0.0246*** (0.004)
Share of Sales^2			0.0014*** (0.000)
Constant	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
R2	0.2982	0.2983	0.3015
R2-adjusted	0.2813	0.2814	0.2846
N	46328	46328	46328
Significance codes: *p<0.10, **p<0.5, ***p<0.01			

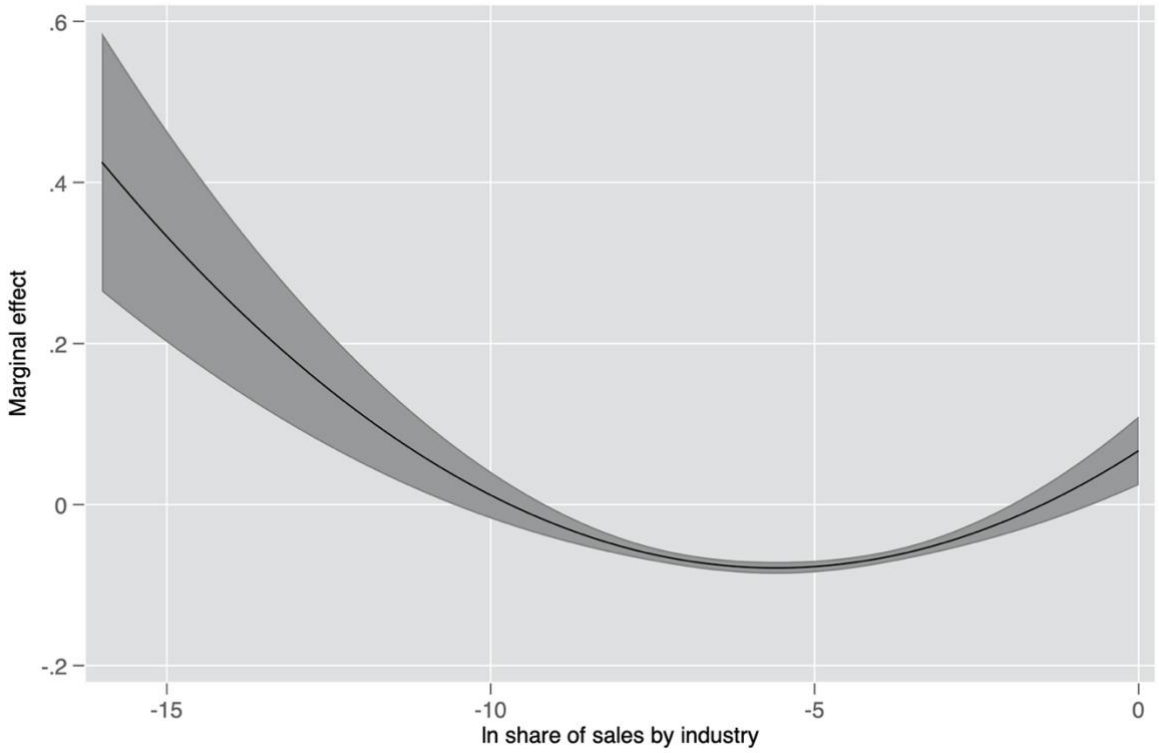
Table 10.2 Marginal effect of model 3 in table 10.1

	Dependent variable:
	Ln(Markup) dy/dx / delta se
Ln(Share of Sales)	-.0546*** (0.0021)
N	46328
Significance codes: *p<0.10, **p<0.5, ***p<0.01	

The results are similar to the results when measuring the share of sales by sector. However, the third-degree polynomial model is significant when considering industry. The marginal effect of the share of sales within an industry is illustrated in table 10.2, this is the marginal effects based on regression 3 in table 10.1. The result is that an increase of 1 % of share of sales within a sector implicates a decrease in markups by 0.0546 %. The confidence band for the predicted logged value of the markup illustrate that at first the markups increase with size to then begin

to decline and then a slight increase in the markup when firms approach 100 % of the share of sales in a sector.

Figure 8.6 Confidence band of marginal effect of share of industry sales on Markup



The highest markups are extracted by firms of 0.004% share of sales, and they extract a markup of about 60% higher than marginal cost. The markup declines from this point up until a firm reaches above 50 per cent of the share of sales within an industry, and then a firm is predicted to extract a markup of 7 % above marginal cost, which is predicted to be 12 % if a firm has 100% of the share of sales within an industry. The prediction of 100 % of the share of sales is smaller than 60 %, and hence the prediction that it is the smaller firms that extract, the higher markups are still viable. For the private firms, it still seems that the size impacts the markup.

This robustness check illustrates that the result that the larger firms are extracting lower markups have a strong foundation, even still when considering the industry classification. As the share of sales grows when considering smaller industry divisions, the result provides a strong case for size impacting markups.

8. Conclusions

Given our result the initial hypotheses seem to have been viable, the price competition seems to be more effective given the decrease in markups over time, there seem to be a high level of competition, supported by the high degree of price competition observed as the within term and the finding that larger firms are extracting lower markups and finally the finding that the SOEs seem to be extracting lower markups indicate a different conduct of the SOEs.

The result that the markup has decreased over time when controlling for firm fixed effects indicates that the market reform may have had a positive impact on the competitiveness of the market. This is since we estimate a decrease in markups since the ascension into the WTO. If this is indeed the case than it would be advisable for the Chinese government to allow for an increase of private interests within the economy and further reduce their positions in the market as opposed to the current trend of reasserting the role of the state in the economy. The results also indicate the importance of competition within an economy.

The results that the markup of the SOEs is approximately 25 % lower than the private firms, that there seem to be high price competition within the economy combined with the assumption based on previous research that SOEs have higher marginal costs and are less efficient opens up for the possible interpretation that SOEs are limiting the efficiency in the market. This is based on that markup are defined as the quota of price and marginal costs and assuming that the main reason why the SOEs have higher markups is higher costs indicate an inefficiency in competition. Further considering that previous research has found that the SOEs have unfair competitive advantages it would be advisable to level the playing field between private firms and SOEs to increase efficiency. This is based on the assumption that SOEs have higher costs and would be invalid if this doesn't hold, as such we suggest further research should focus on the magnitude of the cost differences between private firms and SOEs.

It may be the case that the smaller firms are extracting higher markups since they have larger issues with liquidity and have to pay higher interest rates than the larger firms, which most likely is considered to be safer to lend money to and as such are able to extract lower markups. This finding also may indicate that the antitrust policy not necessarily should be mainly concerned with the size of a firm. If the markups are considered a sufficient approach to

measuring the competition level and the issues are when firms extract high markups than the market regulation should not be too concerned with the larger firms but rather the smaller firms. This may change in the future if the hypothesis that the larger firms are positioning themselves is indeed valid. This further suggests that there are other issues impacting the competitiveness in the economy that it is necessary to evaluate, this is something we are unable to answer within the scope of this paper and further studies should focus on what negatively impacts the competitiveness in the economy.

Our overall recommendations to increase efficiency in terms of our paper supports further reforms to ensure fair competition in the market, and that market reform so far might have had a positive impact on the competition in the economy and finally that anti-trust policy should evaluate the markups of the smaller firms and research if it is indeed a financial markets issue or if there is something else going on. The result that price-competition seem to be working well should also suggest the efficiency of competition within the economy and further steps to ensure fair competition should be taken. However, the Chinese government is not solely concerned by efficiency, but social stability, control and overall stability is possibly the most relevant objectives of the Chinese state. As such radical changes is unlikely when considering the SOEs since they are viewed as an essential promoter of these objectives. As such we suggest the continuation of the gradual reformations of SOEs. Due to the special responsibility of SOEs accounted for in the previous research, the question becomes how to deepen the reform while maintaining social stability. One possible method we suggest is “sub-region reform”. By selecting specific regions to deepen reforms, such as create a competitive market environment and further promote privatization within the region, Moreover, the reforming experience in the reform could apply to other regions. That is, first implement regional deepening reform, then extend it to rother regions and then the whole country. Also, the policy maker may consider the reform by sectors, as has been done with the market division of 2006, however we suggest more specific sector definitions. In a competitive market, the government should focus on fair competition, and let the SOEs adjust to marketization. In the resource industries such as energy and material sectors, the SOEs still dominate the market, however, to improve the efficiency of SOEs, it is also necessary to introduce private companies. In this situation, the government should consider the reform of regulations, such as adjusting regulations to lower the entry barriers, and improve market transparency, this may be done by tax-reform and to get rid of the preferable loans of the SOEs. In short, our analysis on SOEs suggested that the market

efficiency could be improved and the reform of SOEs should be continued. But the policy maker should know that reform of SOEs is complicated: specific regions, industries should explore reform specific measures to make the SOEs efficient and active in the market.

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10. Appendix

Appendix A

Table 10.4 Ownership goal of SOEs by industry

Industry group	Industries included	Ownership goal
Strategic and key industries	Defence, power generation and distribution, oil and petrochemicals, telecommunication, coal, civil aviation, shipping	Maintaining 100 per cent state ownership or absolute control; increasing state-owned assets in these industries
Basic and pillar industries	Machinery, automobiles, IT, construction, steel, base metals, chemicals, land surveying, research and development	Absolute or conditional relative controlling stake; enhancing the influence of state ownership even as the ownership share is reduced, where appropriate
Other industries	Trading, investment, medicine, construction materials, geological exploration	Maintaining necessary influence by controlling stakes in key companies; in non-key companies, state ownership will be reduced

Source: Extracted from Song (2018: Table 19.1, p. 357).

Appendix B

The proof that beta is equal to the output elasticity. We consider the Cobb Douglas function specified for our data. Where PQ denotes the value of sales, WL denotes the cost of goods sold and RK denotes the cost of capital. The output is then defined by the following Cobb Douglas function.

$$(PQ) = A(WL)^{\beta}(RK)^{\gamma} \qquad (C1)$$

We then take the derivative of the PQ with respect to the variable input (WL) and obtain the following expression.

$$\frac{\partial(PQ)}{\partial(WL)} = A\alpha(WL)^{\beta-1}(RK)^{\gamma} \qquad (C2)$$

Expression C2 may then by rearranged by separating $(WL)^{\beta-1}$ into two components: $(WL)^{\beta}$ and $(WL)^{-1}$. This yields expression C3.

$$\frac{\partial(PQ)}{\partial(WL)} = A\alpha(WL)^{\beta}(WL)^{-1}(RK)^{\gamma} \qquad (C3)$$

The raised to the power of one operator is the same as dividing with the value that is raised to it. As such we divide the right-hand side with WL. Which results in expression C4.

$$\frac{\partial(PQ)}{\partial(WL)} = \frac{\beta A(WL)^{\beta}(RK)^{\gamma}}{(WL)} \qquad (C4)$$

The numerator of the right-hand side may be expressed as $\beta * PQ$ since the C1 expression states that: $A(WL)^{\beta}(RK)^{\gamma}E^{\varepsilon} = (PQ)$. Inserting this into expression C4 yields the following expression.

$$\frac{\partial(PQ)}{\partial(WL)} = \beta\frac{PQ}{WL} \qquad (C5)$$

Rearranging the expression C5 so that β is on its own results in the result that β is equal to the output elasticity of the variable input, shown in expression C6.

$$\beta = \frac{\partial(PQ)}{\partial(WL)}\frac{WL}{PQ} \qquad (C6)$$

The problem that the revenue elasticity is not equal to the true output elasticity is stated in expression C7. This issue is discussed in the main text.

$$\frac{\partial(PQ)}{\partial(WL)}\frac{WL}{PQ} \neq \frac{\partial(PQ)}{\partial L}\frac{L}{Q} \qquad (C7)$$

Appendix C

Table 10.2 Regression of output elasticity

	Dependent Variable:
	Ln(Sales)
	b/se
Ln(Cost of goods sold)	0.863***
	(0.024)
Ln(Capital stock)	0.105***
	(0.020)
Constant	Yes
R2-adjusted	0.97
N	125
Significance codes: *p<0.10, **p<0.5, ***p<0.01	

Table 10.2 illustrates an example of a calculation for the output elasticity of the variable input. The estimated theta is for the energy sector in 2010. Ln(Sales) is the logged value of sales which is used as output, Ln(Cost of goods sold) is the logged value of cost of goods sold which is used as the variable input and Ln(Capital stock) is the logged value of property, plant and equipment used as the capital stock. The estimated output elasticity in this example is 0.86.

Appendix D

Table 10.1 Table of GICS classification

Sector		Industry Group		Industry		Sub-Industry	
10	Energy	1010	Energy	101010	Energy Equipment & Services	10101010	Oil & Gas Drilling
						10101020	Oil & Gas Equipment & Services
				101020	Oil, Gas & Consumable Fuels	10102010	Integrated Oil & Gas
						10102020	Oil & Gas Exploration & Production
						10102030	Oil & Gas Refining & Marketing
						10102040	Oil & Gas Storage & Transportation
						10102050	Coal & Consumable Fuels
15	Materials	1510	Materials	151010	Chemicals	15101010	Commodity Chemicals
						15101020	Diversified Chemicals
						15101030	Fertilizers & Agricultural Chemicals
						15101040	Industrial Gases
						15101050	Specialty Chemicals
				151020	Construction Materials	15102010	Construction Materials
				151030	Containers & Packaging	15103010	Metal & Glass Containers
						15103020	Paper Packaging
				151040	Metals & Mining	15104010	Aluminum
						15104020	Diversified Metals & Mining
						15104025	Copper
						15104030	Gold
						15104040	Precious Metals & Minerals
						15104045	Silver
						15104050	Steel
				151050	Paper & Forest Products	15105010	Forest Products
						15105020	Paper Products
20	Industrials	2010	Capital Goods	201010	Aerospace & Defense	20101010	Aerospace & Defense
				201020	Building Products	20102010	Building Products
				201030	Construction & Engineering	20103010	Construction & Engineering
				201040	Electrical Equipment	20104010	Electrical Components & Equipment
						20104020	Heavy Electrical Equipment
				201050	Industrial Conglomerates	20105010	Industrial Conglomerates
				201060	Machinery	20106010	Construction Machinery & Heavy Trucks
						20106015	Agricultural & Farm Machinery
						20106020	Industrial Machinery
				201070	Trading Companies & Distributors	20107010	Trading Companies & Distributors
		2020	Commercial & Professional Services	202010	Commercial Services & Supplies	20201010	Commercial Printing
						20201050	Environmental & Facilities Services
						20201060	Office Services & Supplies
						20201070	Diversified Support Services
						20201080	Security & Alarm Services

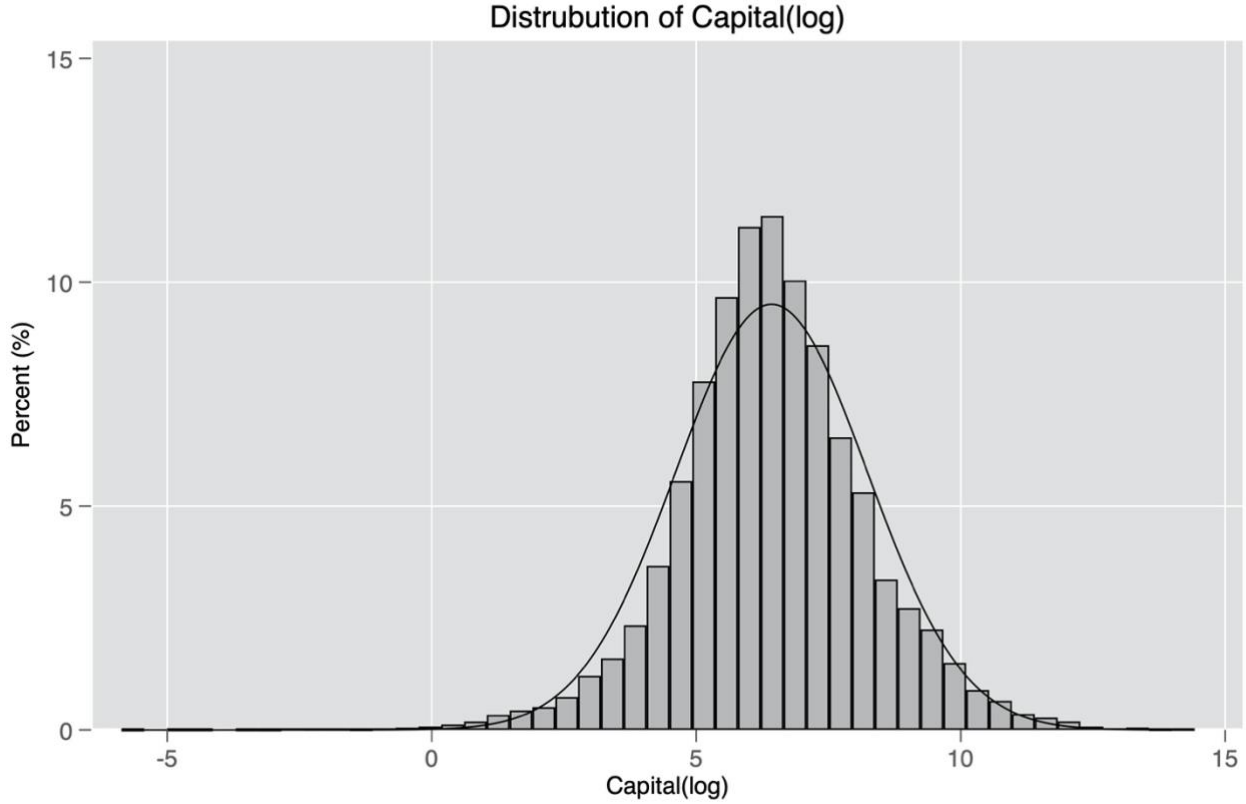
				202020	Professional Services	20202010	Human Resource & Employment Services
						20202020	Research & Consulting Services
		2030	Transportation	203010	Air Freight & Logistics	20301010	Air Freight & Logistics
				203020	Airlines	20302010	Airlines
				203030	Marine	20303010	Marine
				203040	Road & Rail	20304010	Railroads
						20304020	Trucking
				203050	Transportation Infrastructure	20305010	Airport Services
						20305020	Highways & Railtracks
						20305030	Marine Ports & Services
25	Consumer Discretionary	2510	Automobiles & Components	251010	Auto Components	25101010	Auto Parts & Equipment
						25101020	Tires & Rubber
				251020	Automobiles	25102010	Automobile Manufacturers
						25102020	Motorcycle Manufacturers
		2520	Consumer Durables & Apparel	252010	Household Durables	25201010	Consumer Electronics
						25201020	Home Furnishings
						25201030	Homebuilding
						25201040	Household Appliances
						25201050	Housewares & Specialties
				252020	Leisure Products	25202010	Leisure Products
				252030	Textiles, Apparel & Luxury Goods	25203010	Apparel, Accessories & Luxury Goods
						25203020	Footwear
						25203030	Textiles
		2530	Consumer Services	253010	Hotels, Restaurants & Leisure	25301010	Casinos & Gaming
						25301020	Hotels, Resorts & Cruise Lines
						25301030	Leisure Facilities
						25301040	Restaurants
				253020	Diversified Consumer Services	25302010	Education Services
						25302020	Specialized Consumer Services
		2550	Retailing	255010	Distributors	25501010	Distributors
				255020	Internet & Direct Marketing Retail	25502020	Internet & Direct Marketing Retail
				255030	Multiline Retail	25503010	Department Stores
						25503020	General Merchandise Stores
				255040	Specialty Retail	25504010	Apparel Retail
						25504020	Computer & Electronics Retail
						25504030	Home Improvement Retail
						25504040	Specialty Stores
						25504050	Automotive Retail
						25504060	Homefurnishing Retail
30	Consumer Staples	3010	Food & Staples Retailing	301010	Food & Staples Retailing	30101010	Drug Retail
						30101020	Food Distributors
						30101030	Food Retail
						30101040	Hypermarkets & Super Centers
		3020	Food, Beverage & Tobacco	302010	Beverages	30201010	Brewers
						30201020	Distillers & Vintners
						30201030	Soft Drinks
				302020	Food Products	30202010	Agricultural Products
						30202030	Packaged Foods & Meats
				302030	Tobacco	30203010	Tobacco
		3030	Household & Personal Products	303010	Household Products	30301010	Household Products
				303020	Personal Products	30302010	Personal Products

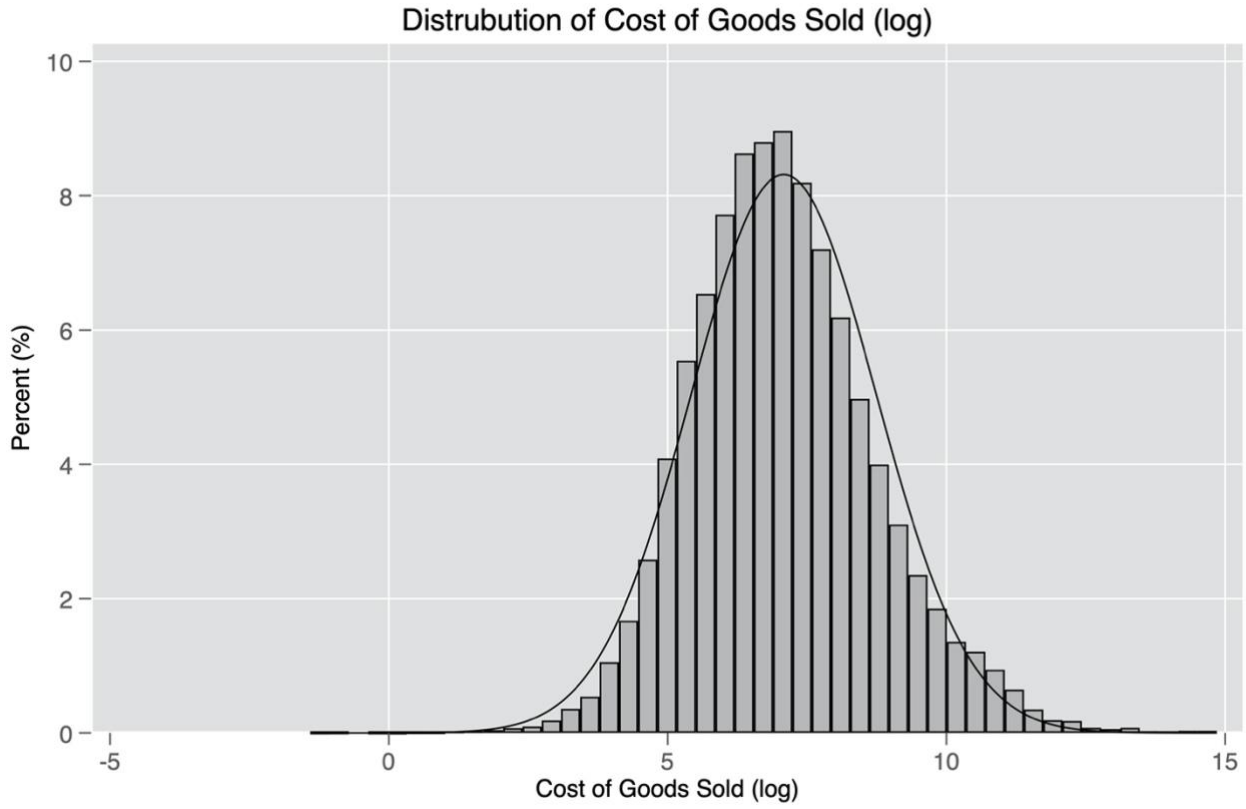
35	Health Care	3510	Health Care Equipment & Services	351010	Health Care Equipment & Supplies	35101010	Health Care Equipment
						35101020	Health Care Supplies
				351020	Health Care Providers & Services	35102010	Health Care Distributors
						35102015	Health Care Services
						35102020	Health Care Facilities
						35102030	Managed Health Care
				351030	Health Care Technology	35103010	Health Care Technology
		3520	Pharmaceuticals, Biotechnology & Life Sciences	352010	Biotechnology	35201010	Biotechnology
				352020	Pharmaceuticals	35202010	Pharmaceuticals
				352030	Life Sciences Tools & Services	35203010	Life Sciences Tools & Services
45	Information Technology	4510	Software & Services	451020	IT Services	45102010	IT Consulting & Other Services
						45102020	Data Processing & Outsourced Services
						45102030	Internet Services & Infrastructure
				451030	Software	45103010	Application Software
						45103020	Systems Software
		4520	Technology Hardware & Equipment	452010	Communications Equipment	45201020	Communications Equipment
				452020	Technology Hardware, Storage & Peripherals	45202030	Technology Hardware, Storage & Peripherals
				452030	Electronic Equipment, Instruments & Components	45203010	Electronic Equipment & Instruments
						45203015	Electronic Components
						45203020	Electronic Manufacturing Services
						45203030	Technology Distributors
		4530	Semiconductors & Semiconductor Equipment	453010	Semiconductors & Semiconductor Equipment	45301010	Semiconductor Equipment
						45301020	Semiconductors
50	Communication Services	5010	Communication Services	501010	Diversified Telecommunication Services	50101010	Alternative Carriers
						50101020	Integrated Telecommunication Services
				501020	Wireless Telecommunication Services	50102010	Wireless Telecommunication Services
		5020	Media & Entertainment	502010	Media	50201010	Advertising
						50201020	Broadcasting
						50201030	Cable & Satellite
						50201040	Publishing
				502020	Entertainment	50202010	Movies & Entertainment
						50202020	Interactive Home Entertainment
				502030	Interactive Media & Services	50203010	Interactive Media & Services
55	Utilities	5510	Utilities	551010	Electric Utilities	55101010	Electric Utilities
				551020	Gas Utilities	55102010	Gas Utilities
				551030	Multi-Utilities	55103010	Multi-Utilities
				551040	Water Utilities	55104010	Water Utilities
				551050	Independent Power and Renewable Electricity Producers	55105010	Independent Power Producers & Energy Traders
						55105020	Renewable Electricity

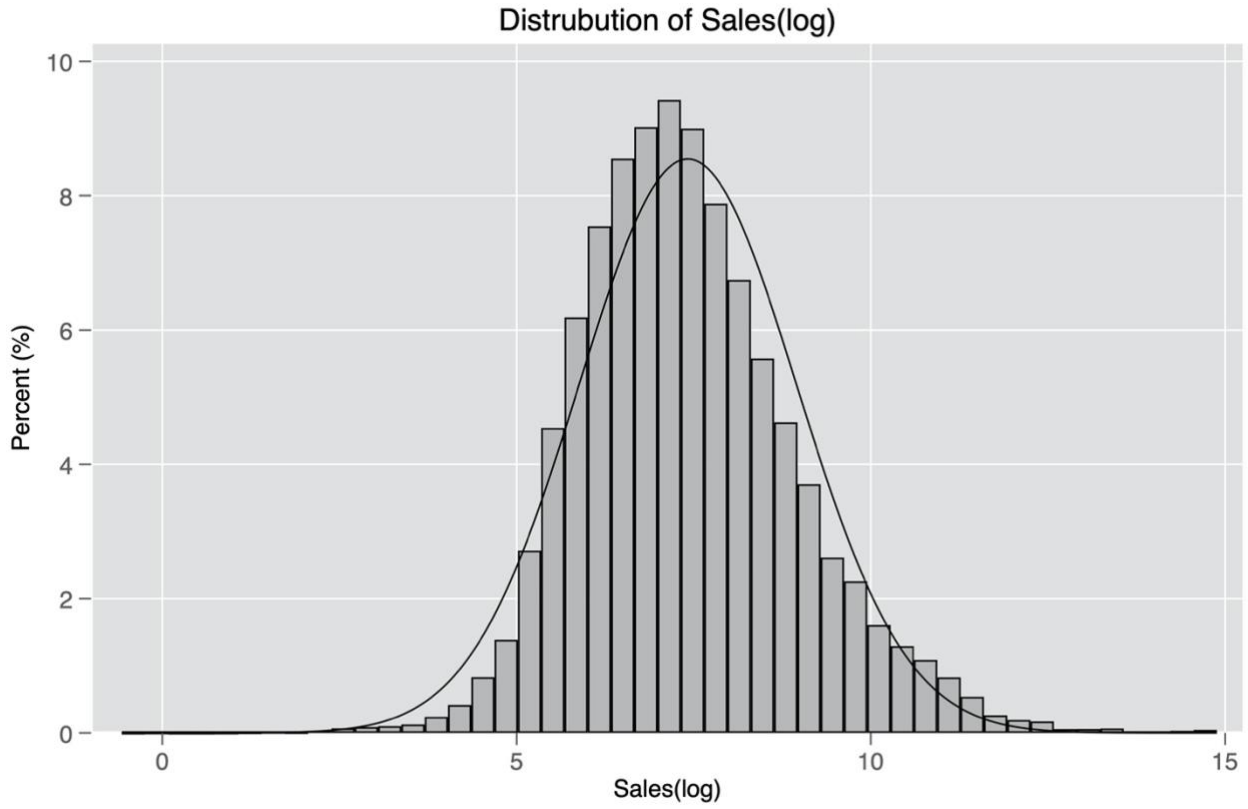
Source: GICS

Appendix E

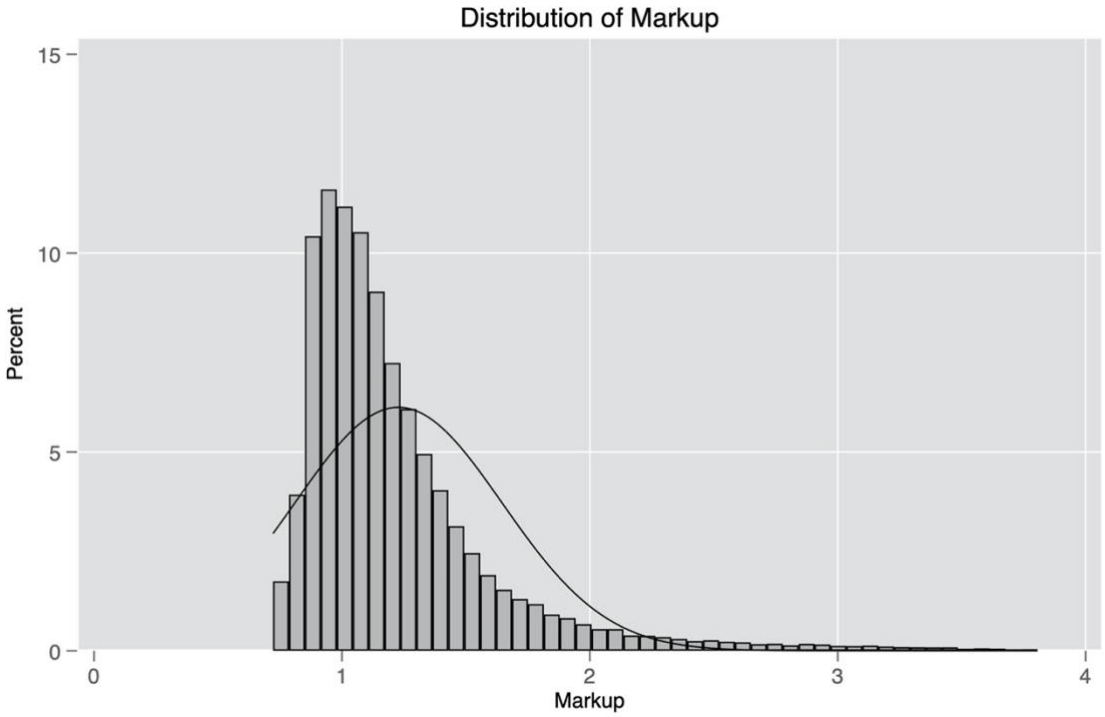
Figure 10.4 Distribution of the variables

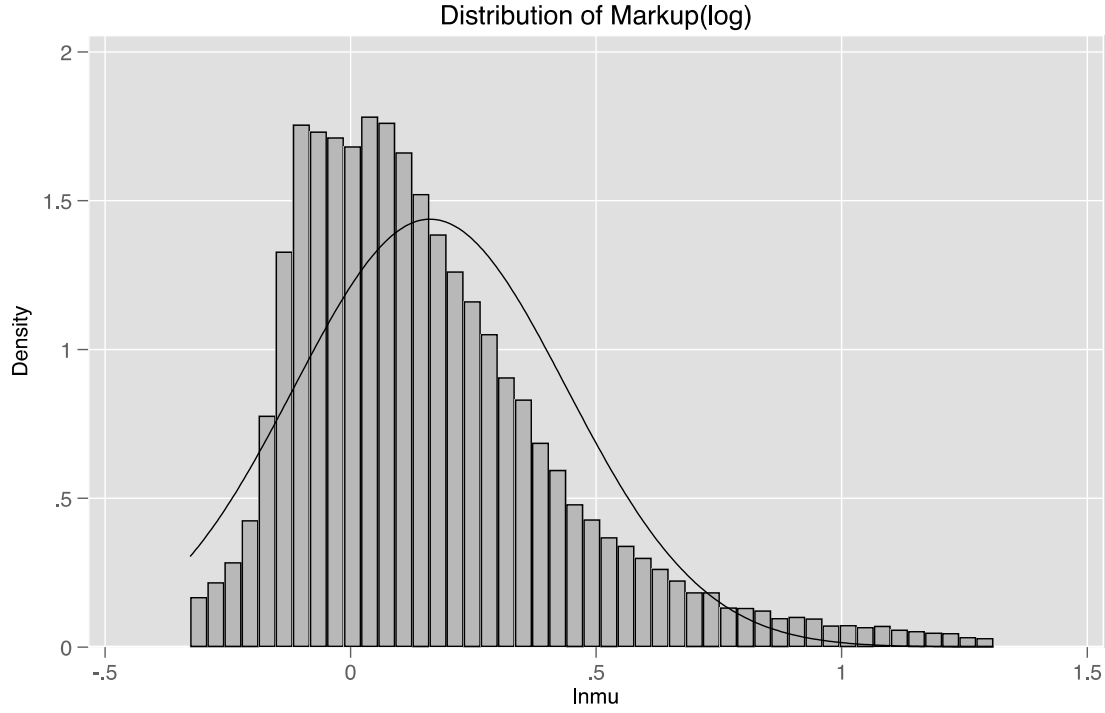





Distrubution of Sales(log)
Percent (%)
0
2
4
6
8
10
0
5
10
15
Sales(log)


Distrubution of Share of Sales
Percent (%)
0
2
4
6
8
-15
-10
-5
0
Share of Sales (log)

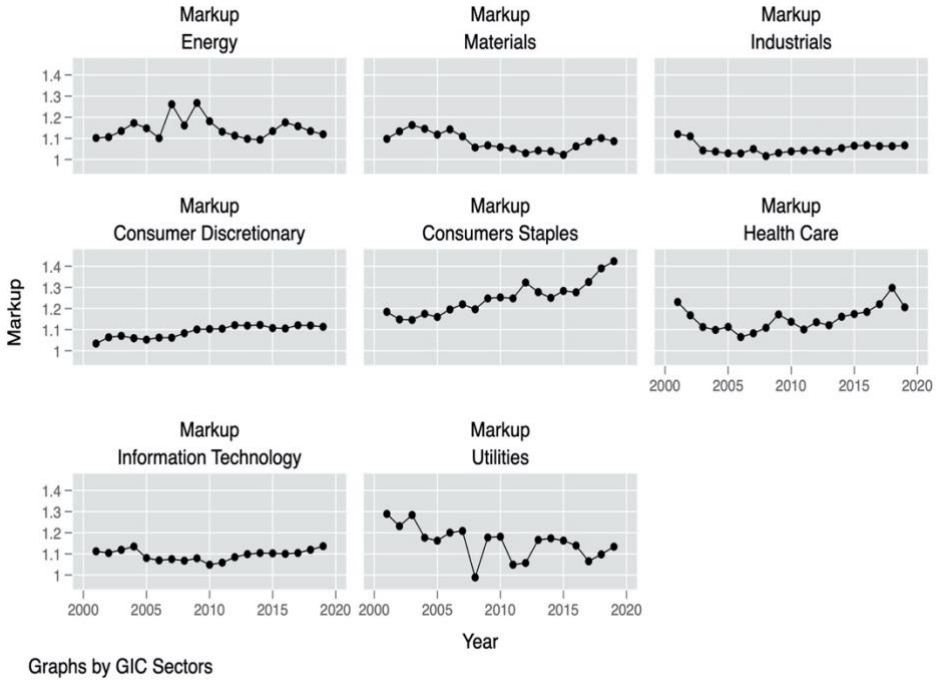

Distribution of Markup
Percent
15
10
5
0
0
1
2
3
4
Markup


Distribution of Markup(log)
Density
2
1.5
1
.5
0
-.5
0
.5
1
1.5
lnmu

Appendix F

The sales weighted markups by sector are presented in figure 10.1. The communication services sector is presented in separately the reason for this is the fact that the markup in the sector is higher than the other sectors and differences between periods for the other sectors would not be visible within a joint illustration. Table 10.3 is the full regression results when considering sectors and 10.4 is the SOEs share of sales.

Figure 10.1 Markup over time by Sectors



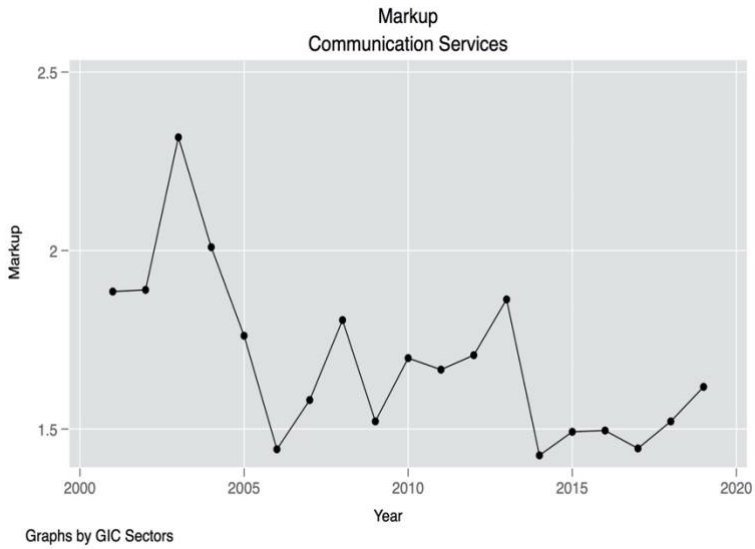


Table 10.3 Regression of Sectors on the logged Markup

	Dependent Variable	
	Ln(Markup)	
	b/se	
	(Base)	(Interaction Model)
Energy (Baseline)	0.1305***	0.2325***
	(0.019)	(0.022)
Materials	-0.0166	-0.0622***
	(0.019)	(0.022)
Industrials	0.0314	0.0064
	(0.020)	(0.023)
Consumer Discretionary	0.0145	-0.0067
	(0.020)	(0.024)
Consumers Staples	0.0442*	0.0338
	(0.026)	(0.029)
Health Care	0.1990***	0.2133***
	(0.032)	(0.034)
Information Technology	0.1013***	0.0620**
	(0.021)	(0.024)
Communication Services	0.1756***	0.0729*
	(0.039)	(0.041)
Utilities	-0.0869***	-0.0347
	(0.029)	(0.036)
soe=1		-0.2601***
		(0.029)
Materials * soe=1		0.0496*
		(0.030)
Industrials * soe=1		0.0103
		(0.031)
Consumer Disc. * soe=1		-0.0202
		(0.031)
Consumers Staples # soe=1		-0.0692*
		(0.040)
Health Care # soe=1		-0.4014***
		(0.044)
Information Tech. * soe=1		-0.0702**
		(0.034)
Communication Serv. * soe=1		0.3585**
		(0.182)
Utilities * soe=1		-0.0773*
		(0.045)
Year FE	Yes	Yes
R2-adjusted	0.0531	0.1238
N	61351	61351
Significance codes: *p<0.10, **p<0.5, ***p<0.01		

Table 10.4 SOE Share of Sales by Industry

Sector	SOE share of sales	Private firms share of sales
Energy	70%	30 %
Materials	46%	54 %
Industrials	62%	38 %
Consumer discret.	37%	63 %
Consumer staples	30%	70%
Health Care	27 %	63%
Information tech	25%	75%
Communication serv.	76%	24%
Utilities	66%	34%

Appendix G

Table 10.5 illustrates three different models for estimating the impact of size, the second one is used in the main text. Figure 10.2 illustrates the predicted marginal effect of size on markups.

Table 10.5 Regression of the impact of size on the log of markup

	Dependent variable:		
	Ln(Markup) b/se		
	(1)	(2)	(3)
Ln(Share of Sales)	-0.0606***	-0.0060	0.01694***
	(0.002)	(0.013)	(0.039)
Share of Sales		0.0037***	0.0291***
		(0.001)	(0.005)
Share of Sales^2			0.0011***
			(0.000)
Constant	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
R2	0.1463	0.1496	0.1534
R2-adjusted	0.1459	0.1492	0.1530
N	60124	60124	60124

Significance codes: *p<0.10, **p<0.5, ***p<0.01

Figure 10.2 marginal effect of size on the logged Markup

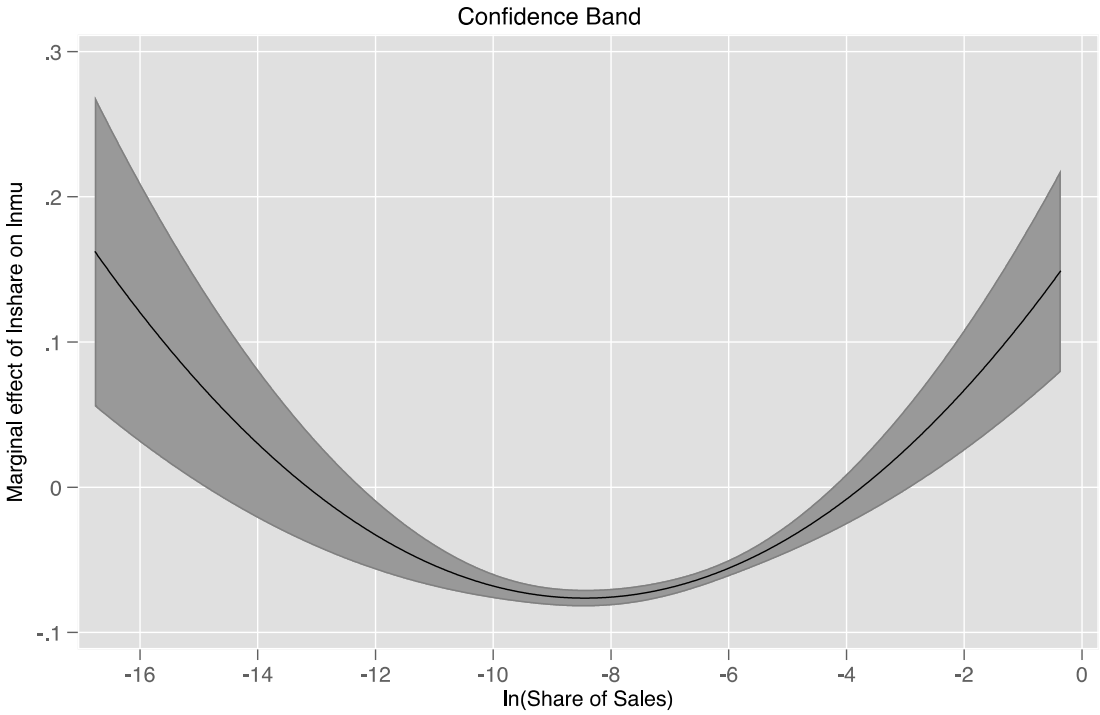
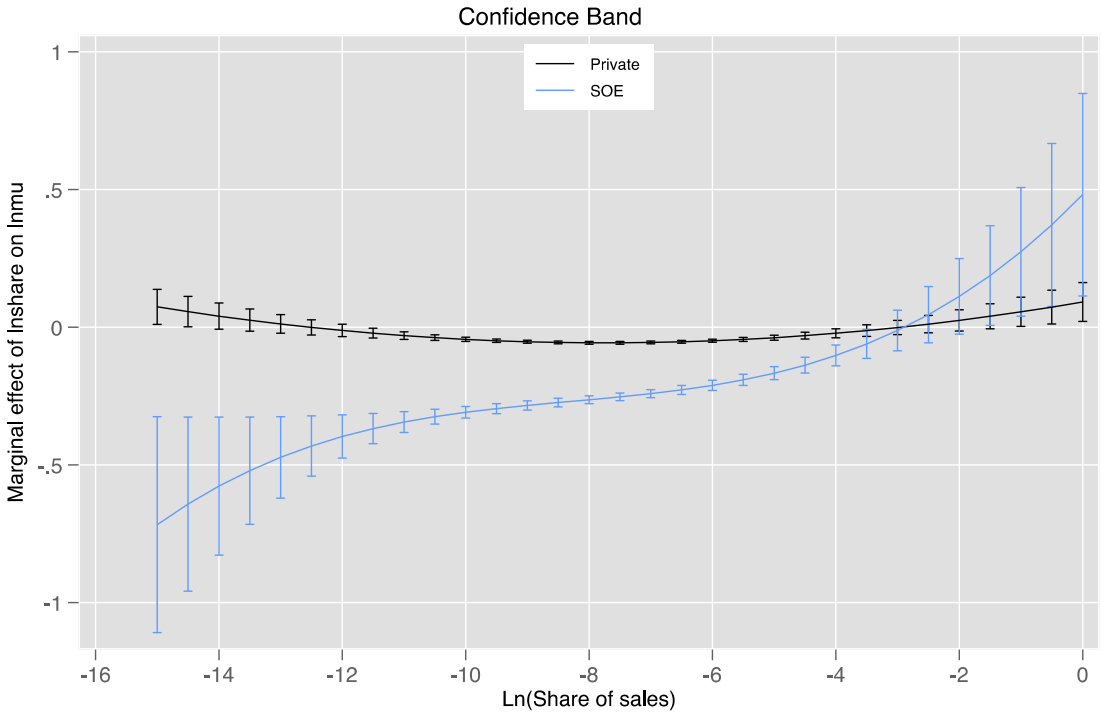


Table 10.6 further devolves the models in table 10.5, and figure 10.3 estimates the difference of marginal effects of SOEs and publicly listed firms when considering the 3rd model.

Table 10.6 Regression with interactions between size and SOEs on Markup

	Dependent variable:		
	Ln(Markup)		
	b/se		
	(1)	(2)	(3)
	b/se	b/se	b/se
soe=1	0.0216	0.3587***	0.4201**
	(0.035)	(0.104)	(0.200)
ln(Share of Sales)	-0.0622***	-0.0815***	0.0578
	(0.003)	(0.015)	(0.048)
soe=1*ln(Share of Sales)	0.0380***	0.1414***	0.2059**
	(0.004)	(0.028)	(0.084)
Share of Sales		-0.0012	0.0178***
		(0.001)	(0.006)
soe=1*Share of Sales		0.0075***	0.0214*
		(0.002)	(0.012)
Share of Sales^2			0.0008***
			(0.000)
soe=1 * Share of Sales^2			0.0008
			(0.001)
Constant	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
R2	0.2705	0.2726	0.2748
R2-adjusted	0.2702	0.2722	0.2745
N	61351	61351	61351
Significance codes: *p<0.10, **p<0.5, ***p<0.01			

Figure 10.3 Marginal effect of size by private firms and SOEs



The size has a larger negative marginal effect on the markup for SOEs up until share of sales of approximately 5 % and the confidence band indicates high uncertainty in the projections for these levels. Firms with above 5 % share of sales account for 0.5 % of the sample. The SOEs seem to impart extract lower markups because they have a lower marginal effect of size increases than the private firms, illustrated in table figure 10.3. The public firms have a strong linear relation while the SOEs have more of a polynomial relationship. It further illustrates that the large SOEs extract higher markups than the public large firms at about 13 % of share of sales.