The Growth of Firms, Markets and Rents: Evidence from China

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Abstract

The evidence for whether China become more competitive following its accession to the World Trade Organization (WTO) is mixed. Using recent methods for estimating markups and profit shares, this paper documents that Chinese manufacturing firms on average collected more rents after the accession because the rate of net entry of firms lagged the rapid growth of the domestic market. While the selection on large productive firms drove the rise in the aggregate markups in the United States (De Loecker et al, 2020), these competitive forces played a secondary role in China.

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1 Introduction

During the latter half of the 1990s and the aughts, China enacted reforms promoting competition between its domestic firms. The property rights of private businesses were strengthened (Li et al, 2008); measures were taken to reduce internal product and labor mobility costs (Tombe and Zhu, 2019); and Chinese firms competed with foreign firms after China joined the World Trade Organization (WTO) in 2001.[1] Consistent with the view that domestic markets became more competitive, Brandt et al (2012) document a robust net entry of firms and an impressive growth in firm-level productivity during 1998-2007; and, after China acceded to the WTO, Brandt et al (2017) show that domestic manufacturing firms cut markups, and Lu and Yu (2015) show that these markups became less dispersed.

However, there is also evidence that domestic markets were distorted because state-owned enterprises (SOEs) received concessions from the government. Bai et al (2004) and Barwick et al (2021) document that provincial governments blocked local sales of non-local goods to protect their SOEs. Brandt et al (2020) show that the entry of non-state firms was blocked in prefectures where SOEs had large market shares. And Harrison et al (2019) show that SOEs in the manufacturing sector enjoyed lower interest rates loans and more government subsidies than private firms.

Figure 1 illustrates rents in the manufacturing sector and provides a visualization of competition before and after the WTO accession. Rents are measured with markups estimated from the production approach (De Loecker and Warzynski, 2012; Brandt et al, 2017). In Panel A (Panel B), materials (materials and labor material) are the flexible inputs for deriving markups over material costs (material and labor costs). Figure 1 shows that output weighted or simple mean markups increased using either estimator.

This paper develops and tests the hypothesis that market competition weakened after the accession because net entry of firms was sluggish compared to the rapid expansion of the domestic market. The theory of imperfect market competition generally predicts that robust net entry of firms drives down rents while an increase in market size can increase rents (see Bresnahan and Reiss, 1988 and 1991; Schaumans and Verboven, 2015).[2] Six years after China acceded to the WTO, its

[1] China formally acceded in December of 2001. Because the United States granted China the "Permanent Normal Trade Relations" status in October 2000, in this paper as of 2001 China was de jure part of the WTO. See Pierce and Schott (2016) and Handley and Limão (2017) and the discussion below.

[2] Bresnahan and Reiss (1991) proposed the idea of a demand entry threshold to infer the effects of entry on markups. The demand entry threshold is a measure of the market size required to support a given number of firms.

domestic manufacturing markets expanded as firms found new export markets and became more connected with global supply chains. Table 1 shows that the 127-percent domestic manufacturing market expansion was faster than the 75-percent rate of net entry. Figure 2 highlights that there is a negative unconditional association between the growth in rents and the growth in the number of firms across industries.

Testing this hypothesis, however, is challenging for several reasons. First, there is potential reverse causality because higher rents encourage domestic entry (Melitz, 2003). Second, higher rents might limit market expansion as foreign importers and supply chains seek out competitive partners. Finally, there may be bias from omitted variables, such as external financial dependence and capital requirements, that could be correlated with markups, net entry, and market expansion. To address these identification issues, we use sources of exogenous variation for net entry and market expansion. Regarding net entry, we instrument it with US trade uncertainty, measured as the difference between Smoot-Hawley and WTO tariff rates (Pierce and Schott, 2016; Handley and Limão, 2017). Following the enactment of the US Trade Act of 1974, the US government generally granted Chinese exporters tariff rates that WTO members paid. However, the US government could always renege and impose much higher Smoot-Hawley tariff rates. Thus, Chinese exporters to the United States operated with potential trade uncertainty. Trade uncertainty was eliminated when the United States granted China "Permanent Normal Trade Relations" (PNTR) status in October 2000, just before China's official accession to the WTO in December 2001. Pierce and Schott (2016) and Handley and Limão (2017) find that sectors with the highest trade uncertainty rates had the largest increase in exports to the United States and the fastest net entry of firms after the WTO entry.

Regarding market expansion, as a first pass, we use the growth in real output at the industry level. The idea is that a firm's choice of markups would not affect the expansion of its market because an average firm's market share was small: 0.1-percent and 0.05-percent in 2001 and 2007, respectively. However, there are several potential concerns. First, firms in the top 5-percent of the distribution of real output had market shares of 0.4-percent and 0.2-percent in 2001 and 2007, and this may not be negligible. Second, the removal of trade uncertainty could also affect market size and firm entry simultaneously, which would affect the exclusion restriction of trade uncertainty

The concept is developed primarily because markups were rarely observed for local service markets. Schaumans and Verboven (2015) generalize the demand entry threshold by allowing product differentiation.

for net entry. Additionally, the effect of markups could also influence market size: for example, it might encourage incumbent domestic firms to expand operations. Finally, industry-level differences in trade uncertainty can reflect differences in other factors such as dependence on external finance, capital requirements, and political connections that can affect firm markups directly and not exclusively through firm entry. Thus, in robustness checks, we include a broad set of industry-level control variables and instrument for market expansion with the revealed comparative advantage index of the advanced countries in 1998. In fact, the elimination of trade uncertainty can only partially explain the cross-industry variation in market expansion. This is because China promoted industries that relied on imports to produce more for the domestic market after the accession. Kee and Tang (2016) show that the substitution of domestic for imported materials by individual processing exporters caused China's domestic content in exports to increase.[3] The substitution of domestic production for imported goods, as well as China's policies for protecting its advanced industries, contributed to the rapid growth of domestic markets for Chinese manufacturers.

In our baseline estimates, the change in market competition during 2001-2007 is measured using markups from the production approach (De Loecker and Warzynski, 2012; Brandt et al, 2017) and profit shares in value added (Barkai, 2020); and we instrument for net entry using US trade uncertainty and control for market expansion. We find that markups and profits shares in the average industry increase during 2001-2007: markups over material costs, markups over material and labor costs, and markups over material, labor, and capital costs increased by 2.7, 4.2, and 4.8 percentage points, respectively; and, economic and accounting profit shares increased by 14.6 and 8.7 percentage points.

Consistent with our expectations from theory, rents are negatively associated with an increase in net entry and positively associated with an increase in market size. These effects are estimated at the 1-percent confidence level for all measures of rents except markups over material costs.[4] For example, markups over material and labor costs grow by 4.2 percentage points conditional on average market expansion and average net entry. And, one-standard-deviation increases in the instrumented net entry and market expansion are associated with a 4.9 percentage point decline

[3]Tang et al (2020) show that SOEs played an important role in China's domestic segment of global value chains even though many had been privatized since 1995.

[4]When we use material markups, the net entry is statistically significant at the 5-percent level, and market expansion at the 10-percent level. We will discuss why material markups tend to underestimate the growth of rents in the theoretical section below.

and a 3.9 percentage point increase in markups over material and labor costs.

This paper contributes to the debate over whether or not China became more competitive after it acceded to the WTO (e.g., Brandt et al, 2012; Lu and Yu, 2015; Brandt et al, 2017). Beyond China, the paper contributes to a literature that examines the impact of privatization and liberalization in post-socialist transition economies. Konings et al (2005) use data from Bulgarian and Romanian manufacturing firms and show that privatization is associated with higher markups, and liberalization is associated with lower markups. Baccini et al (2019) examine how firms in Vietman responded to the WTO accession in 2007. While the accession was associated with a higher probability of exit, lower markups, and substantial increases in productivity for private firms, these competitive effects were missing for SOEs.

Finally, the paper provides a comparative analysis of market power. In their analysis of the United States during 1980-2016, De Loecker et al (2020) find that the sales-weighted aggregate markups increased substantially. Consistent with Autor et al (2020), De Loecker et al (2020) find that the competitive selection on large and highly productive superstar firms that charged high markups drove the rise in market power. In contrast, markups in Chinese manufacturing increased across a broad set of firms and industries, indicating that a rapid market expansion relative to sluggish net entry enabled firms to raise markups regardless of their size. The effect of market share reallocation existed in Chinese manufacturing, but its contribution to the growth of weighted markups was relatively small.

The next section explains how we derive markups and profit shares. Section 3 provides an overview of the data; section 4 contains the empirical results; and section 5 concludes.

2 Measuring Rents

This section discusses five measures of rents and their potential caveats.

2.1 Markups

A firm i in an industry j is assumed to be a price taker in its input markets and faces a firm-specific downward-sloping residual demand function.[5] At time t, the firm uses a production function, $F_{it}(\cdot)$,

[5]See Appendix I for a brief theoretical discussion of the impact of market expansion and net entry on markups.

that converts materials (M_{it}), labor (L_{it}), and capital (K_{it}) into real output (Q_{it}):

$$Q_{it} = \Omega_{it} F_{it}(M_{it}, L_{it}, K_{it})$$

where the marginal product of each input is diminishing, and Ω_{it} represents firm-specific and time-varying productivity.

Following the production approach from De Loecker and Warzynski (2012), the firm's markups can be estimated using its first-order conditions by minimizing its variable costs:

$$\mathcal{L} = p_{it} M_{it} + w_{it} L_{it} + r_{it} K_{it} + \lambda_{it}[Q_{it} - \Omega_{it} F_{it}(M_{it}, L_{it}, K_{it})]$$

where material prices (p_{it}), wages (w_{it}), and capital service prices (r_{it}) are strictly positive, exogenous, and firm-specific. The firm's marginal cost is the Lagrange multiplier (λ_{it}).

In their study of the impact of China's entry into the WTO, Brandt et al (2017) estimate markups using the production approach. They assume that materials are the only variable input. They also assume that each firm in an industry shares the same Cobb-Douglas production function that places no restrictions on returns to scale, and each firm has Hicks-neutral productivity (Ω_{it}):

$$Q_{it} = \Omega_{it} M_{it}^{\alpha_j^M} L_{it}^{\alpha_j^L} K_{it}^{\alpha_j^K} .$$

In the equation above, the output elasticities (α_j^M, α_j^L, and α_j^K) are the same for each firm in industry j and constant over the period. Using the first-order condition for materials, markups over material costs are derived by dividing the output price (P_{it}) by its marginal costs (λ_{it}^M), which is equivalent to the estimated output elasticity of materials divided by the firm's payments to materials as a share of its revenues:

$$\mu_{it}^M = \frac{P_{it}}{\lambda_{it}^M} = \frac{\alpha_j^M P_{it} Q_{it}}{p_{it} M_{it}} \tag{1}$$

where markups are derived using revenues ($P_{it}Q_{it}$) and material costs ($p_{it}M_{it}$) in firm-level balance sheet data and the estimated output elasticity of materials at the industry level (α_j^M).[6]

Because estimating markups from equation (1) assumes that capital and labor are not variable,

[6]See Appendix III for our estimation strategy of revenue-based production functions.

a firm can only respond to a positive demand shock by using more materials. This restrictive assumption could suppress the growth of rents. To better understand the measure of markups, consider its marginal costs to produce the targeted level of output (Q_{it}) in equation (1), which is the material price divided by the marginal product of materials:

$$\lambda_{it}^{M} = \frac{p_{it}}{MP_{it}^{M}} \quad \text{and} \quad MP_{it}^{M} = \alpha_j^{M} \frac{Q_{it}}{M_{it}}$$

where the marginal product of materials is diminishing with real output.

China's domestic markets expanded rapidly during 2001-2007. In this case of a prolonged demand shock, markups from equation (1) could overestimate the growth in marginal costs and underestimate the growth in rents because the marginal product of materials declines as firms can only use more materials to produce more.[7]

Over a six-year period, firms can reduce costs by changing their mix of materials, labor, and capital. There are, however, several concerns with including capital when we estimate rents. First, the cost minimization problem above ignores the adjustment costs of capital (Cooper and Haltiwanger, 2006). And we need to estimate capital costs from the opportunity costs of holding capital assets (Hall and Jorgenson, 1967). Thus, our baseline measure of markups from the production approach is derived under the assumption that materials and labor are variable inputs. Using the first-order conditions of materials and labor, we can derive markups over material and labor costs from the output elasticity of the variable inputs divided by the sum of material and labor costs as a share of its revenues:

$$\mu_{it}^{ML} = \frac{\alpha_j^{ML} P_{it} Q_{it}}{p_{it} M_{it} + w_{it} L_{it}}. \tag{2}$$

Since we assume that materials and labor are flexible inputs, the assumption implies that firms can still adjust between materials and labor freely to reduce marginal costs. In this setup, the output elasticity of the aggregate of materials and labor (α_j^{ML}) is constant, which is derived from the sum of estimated output elasticities of materials and labor.

Next, we assume materials, labor, and capital are variable inputs over the six-year period. Using

[7] See Nishioka and Tanaka (2023) who use Japanese semiconductor producers and examine how material markups changed over the US dot-com bubble collapse in 2000. Consistent with the theoretical prediction, they show that the negative demand shock suppressed their marginal costs and increased their markups. Intuitively, the bubble collapse should have reduced markups because of the decline in semiconductor demand; however, markups derived from materials increased by 5.9 percentage points from 2000 to 2002.

the first-order conditions of materials, labor, and capital, we can derive markups over total costs from the industry-specific scale elasticity divided by its payments to materials, labor, and capital as a share of its revenues (Diewert and Fox, 2008):

$$\mu_{it}^{MLK} = \frac{\alpha_j^{MLK} P_{it} Q_{it}}{p_{it} M_{it} + w_{it} L_{it} + r_{it} K_{it}}. \tag{3}$$

We derive the scale elasticity from the sum of estimated output elasticities of materials, labor, and capital. The additional data necessary to derive markups from equation (3) are capital costs, which are computed from the opportunity costs of holding capital assets as developed in Hall and Jorgenson (1967).[8] When we assume that the scale elasticity is unity, markups from equation (3) are identical to markups from the cost share approach (Foster et al, 2001; and Foster et al, 2006).

2.2 Profit Shares

We next follow Barkai (2020) and derive profit shares in value added.[9] A firm's value added (VA_{it}) is its revenues minus spending on materials, which is equivalent to the sum of economic profits, labor costs, and capital costs. Labor and capital shares are computed as $s_{it}^L = w_{it} L_{it} / VA_{it}$ and $s_{it}^K = r_{it} K_{it} / VA_{it}$; and, economic profit share equals one minus labor and capital shares:

$$s_{it} = 1 - (s_{it}^L + s_{it}^K). \tag{4}$$

We also use accounting profits in the data set and compute accounting profit share in value added:

$$s_{it} = \frac{\pi_{it}}{VA_{it}} \tag{5}$$

where π_{it} denotes accounting profits.

We expect that accounting profits are lower because they deduct taxes and other expenses from economic profits.

[8] While firm-level capital assets cannot be divided into distinct asset categories such as buildings versus equipment, we can construct firm-specific required rates of return on capital service using detailed firm-level data on debts and assets. Intuitively, a firm that relies heavily on banks to acquire capital goods has a higher required return, and a firm that finances its investment primarily from corporate bonds and retained earnings has a lower required return. Appendix II provides more details.

[9] De Loecker et al (2020) measure rents using profit shares as a share of sales and these are available upon request.

3 Data

3.1 Overview

We use the data from the Chinese Annual Surveys of Industrial Production (ASIP), which cover all SOEs and private firms with total annual sales exceeding 5 million RMB per year or roughly 612,000 US dollars. Table 1 shows that there were 120,217 firms in 2001 and 253,904 firms in 2007, of which 56,210 firms were survivors that operated in both 2001 and 2007. Thus, there were 64,007 exiters that operated in 2001 and exited by 2007, and 197,694 entrants that did not operate in 2001 and entered by 2007.

A comparison of the chemical fertilizers and textile goods suggests that rents increased more rapidly in industries that had stronger state interference.[10] There is evidence that the state protected chemical fertilizers much more than textile goods. Chemical fertilizer firms received concessions from the state, including tax exemptions, subsidies on capital and intermediate goods, increases in tariff rates on imported final goods,[11] preferential loans, and debt forgiveness. However, after China acceded to the WTO, the state reduced its interference in the textile industry. For example, prior to 1992, producers of textile goods were heavily regulated and required to obtain permits from the Department of Textile Industry (DTI). However, the DTI lost all of its authority by 2002 (Shen, 2008). The textile industry became competitive, and the most efficient firms gained market shares both in domestic and foreign markets.[12] Consistent with the view that the state protects industries in which it has a strong presence, the revenue shares of state ownership were 62.5-percent in chemical fertilizers and 11-percent in textiles in 2001 (see Table 2).

Table 2 illustrates that rents, measured with markups over material and labor costs, in chemical fertilizers and textile goods increased by 8.8 versus 1.3 percentage points during 2001-2007. Figure 3 Panel A shows that the 34.5-percent rate of net entry in chemical fertilizers was much slower than the 91.4-percent rate in textiles, whereas Panel B shows that markets expanded rapidly in both industries after the accession (115-percent for chemical fertilizers and 145-percent for textile goods).

[10] The chemical fertilizers industry is 262, and the textile goods industry is 175 in the 3-digit Chinese industry classification.

[11] The simple average of applied tariff rates across 4-digit sub-industries within the chemical fertilizers industry increased from 5.1-percent in 1998 to 11.1-percent in 2007. China used import tariff rate quotas to protect domestic producers.

[12] See Khandelwal et al (2013) who find that advanced countries' reduction of textile quotas in January 2005 caused a reallocation of market shares to the most productive firms in China.

Thus, the figure suggests that rents grew more rapidly in chemical fertilizers where the market expansion was marginally weaker and where the net entry rate was substantially slower. Consistent with the argument that the removal of US trade uncertainty spurs net entry, the reduction of trade uncertainty costs was 7.5 times larger in textiles versus chemical fertilizers (see Table 2).[13]

3.2 Concentration and Competition

De Loecker et al (2020) find that between-firm effects where high-markup firms gained market shares drove the increase in aggregate (sales-weighted) markups in the United States. To get a sense of whether such competitive selection drove the evolution of rents in Chinese, we provide additional evidence from the chemical fertilizers and textiles goods industries.

The market concentration indices in the bottom two rows in Table 2 suggest that competition was much stiffer in textiles. The Herfindahl-Hirschman Index (HHI) for an industry is the sum of the square of the market share of each firm. When competition stiffens so that the number of firms increases and their market shares are similar, HHI declines and approaches zero; and when competition weakens so that a small group of firms gain market shares, the HHI increases and hits an upper bound of 10,000 in a pure monopoly market. Figure 3 shows that textile firms increased from 1,498 in 2001 to 3,736 in 2007 (see Table 2). In a scenario where all firms have equal market shares, the HHI should have declined by around 60-percent.[14] The HHI, however, declined only minimally in the industry from 34.8 in 2001 to 34.5 in 2007, suggesting that large firms gained market shares. Consistent with this view, the market share of the top 10 firms in textiles increased from 12.8-percent to 13.7-percent. And the HHI and the share of the top 10 firms increased for chemical fertilizers, suggesting that competitive selection may have driven the increase in rents.

These two traditional measures of competition, however, are derived from the "relative" market share of each firm and do not account for the expansion of markets, which is so important in China after the accession. Thus, to quantify the role of competitive selection more rigorously, we follow Melitz and Polanec (2015) and decompose the growth in the weighted (sales-weighted) markups

[13]Table A2 in the Appendix shows the correlations between net entry and market expansion, net entry and the revenue share of SOEs and, net entry and US trade uncertainty are 0.78, -0.19 and 0.295, respectively

[14]From 10,000 $\times$ 1/1,498 = 6.68 in 2001 to 10,000 $\times$ 1/3,736 = 2.68 in 2007.

into the between-firm and within-firm effects as well as the exit and entry effects:

$$\Delta\mu_j = \Delta cov_j^s + \Delta\bar{\mu}_j^s + w_{j,01}^x(\mu_{j,01}^s - \mu_{j,01}^x) + w_{j,07}^e(\mu_{j,07}^e - \mu_{j,07}^s)$$

where $\Delta\mu_j$ is the weighted markup change using the entire sample of firms in industry j, Δcov_j^s is the change in the covariance between markups (μ_{it}) and the market share (w_{it}) in the survivor sample,[15] $\Delta\bar{\mu}_j^s$ is the change in the mean of firm-level markups across survivor firms, $w_{j,01}^x$ ($w_{j,07}^e$) is the aggregate market share of the exiters (the entrants) in the full sample in 2001 (2007), and μ_{jt}^x, μ_{jt}^e, and μ_{jt}^s are the weighted mean markups of the exiters, the entrants, and the survivors in year t, respectively.

In this setup, aggregate markups can increase through two channels: (1) if firm entry is sluggish and the size of the market expands, there are within-firm effects where firms increase their markups without competing for market shares; and (2) if there is a market expansion and robust net firm entry, market shares are competitively reallocated to large, productive firms and this should be reflected in the between-firm and the entry and exit effects.

Table 3 reports the results from markups over material and labor costs. The table shows that within-firm effects account for a 5.5 percentage point increase in chemical fertilizers, which is roughly 70-percent of the overall 8.2 percentage point increase. Even in the textile goods industry where competition intensified, the 1.2 percentage point between-firm effect is only slightly greater than the 1.1 percentage point within-firm effect.

Because firms producing chemical fertilizers, for example, do not compete with those producing textile goods, it is controversial to use a Melitz-Polanec decomposition for all firms. Nevertheless, Table 3 reports this decomposition and suggests that 50-percent of the 4.6 percentage point increase in aggregate markups stems from the within-firm effects.

4 Market Expansion, Net Entry and Rents

In this section, we test the hypothesis that sluggish net entry versus rapid market expansion drove the increase in rents in China following the accession. We first use industry-level data and use US trade uncertainty in 1998 as an instrument for net entry. In robustness checks, we also instrument

[15] A higher positive value of the change in the covariance indicates that survivors with higher markups gain higher market shares.

for market expansion using the revealed comparative advantage index of the advanced countries in 1998. Finally, we provide evidence from market- and firm-level data.

4.1 Empirical Strategy

The baseline outcome variable is the change in mean rents in industry j during 2001-2007:

$$\Delta\bar{\mu}_j = \bar{\mu}_{j,2007} - \bar{\mu}_{j,2001}$$

where $\bar{\mu}_{jt}$ is the unweighted mean value of firm-level markups in industry j in year t.

Table 4 contains summary statistics. The five measures of the change in mean industry rents (i.e., markups over material costs, markups over material and labor costs, markups over material, labor, and capital costs, economic profit shares, and accounting profit shares) increase by 2.9, 4.3, 4.8, 14.3, and 8.8 percentage points, respectively.[16] Because the dependent variable is the change in the mean across all firms in an industry, we follow empirical convention (e.g., Solon et al, 2013) and use weighted least squares in the regression analysis.[17] We use the change in unweighted (versus weighted) means because we want to examine the impact of net entry and market expansion on an "average" firm in each industry.

The second-stage specification is

$$\Delta\bar{\mu}_j = \gamma_1 + \gamma_2\Delta\ln N_j + \gamma_3\Delta\ln Q_j + \varepsilon_j \tag{6}$$

where $\Delta\ln N_j$ and $\Delta\ln Q_j$ denote net entry (log change in the number of firms) and market expansion (log change in market size) in industry j, respectively.

Our expectations from theory are that (1) $\gamma_2 < 0$: net entry is negatively associated with the growth in markups; and (2) $\gamma_3 > 0$: market expansion is positively associated with the growth in markups. Notably, Table 4 shows that in an average industry, the 129.8-percent growth of the market was much more rapid than the 69.8-percent rate of net entry. And, the ratio of the standard deviation to average for market growth of 31.4-percent (0.404/1.298) is much less than the 56.3-percent ratio (0.393/0.698) for net entry. Thus, there was more variation in net entry across

[16]Table A3 in the Appendix reports the correlations between the five rent variables.
[17]We use the number of firms in 1998 as weights.

industries.

Estimating equation (6) consistently requires that industry-level net entry and market expansion are exogenous for each firm. Regarding market expansion, our assumption is that a firm would not perceive that it would affect the expansion of its market because in general market shares of any firm were negligible. For example, the average firm's market share was 0.1-percent in 2001 and 0.05-percent in 2007. And, in the 95th percentile of the distribution, a firm had a market share of 0.4-percent and 0.2-percent in 2001 and 2007. Nonetheless, at the industry level, market expansion may not be an exogenous variable for rents: for example, the removal of trade uncertainty might also affect industry-level market expansion. To address this concern, in the next section, we use the revealed comparative advantage of the advanced countries as an instrument for industry-level market expansion.

To overcome potential two-way causality and omitted variable bias, we use the US trade uncertainty variable, measured as the difference between Smoot-Hawley and WTO tariff rates in 1998, as an instrument for net entry.[18]

The first-stage specification is

$$\Delta \ln N_j = \delta_1 + \delta_2 TU_j + \delta_3 \Delta \ln Q_j + \varepsilon_j \tag{7}$$

where TU_j and $\Delta \ln Q_j$ denote trade uncertainty and market expansion.

As noted in Pierce and Schott (2016, p.1635-36), the US government set high tariff rates on exports from China and other non-market economies as part of the Smoot-Hawley Act in 1930. However, following the enactment of the Trade Act of 1974, the President of the United States could waive the Smoot-Hawley tariffs and grant Chinese exporters the tariffs applied to the WTO members, subject to annual review and approval by Congress. While these favorable tariffs were enacted annually, Chinese exporters were uncertain whether they would end up paying the lower WTO tariffs or the higher Smoot-Hawley tariffs because the US House of Representatives frequently voted against renewal during 1990-2001. Pierce and Schott (2016, p.1636-37) document that after China joined the WTO, the threat that the United States would impose higher Smoot-Hawley tariffs was eliminated. Because firms in industries that had the highest tariff spread enjoyed the strongest

[18]We use the concordances from the United Nations and those in Dean and Lovely (2010) to map Harmonized System codes into to Chinese three-digit industries. Note that cross-industry variation in trade uncertainty is highly correlated only with Smoot-Hawley tariff rates (Pierce and Schott, 2016).

reductions in expected costs, our expectation is that trade uncertainty is positively associated with net entry ($\delta_2 > 0$).

The analysis is conducted at the industry level. Throughout the paper, standard errors are clustered at the industry level. We report the Montiel Olea and Pflueger (2013) effective F statistic for a weak instrument and the Kleibergen and Paap (2006) Lagrange Multiplier (LM) test for weak- or under-identification.

4.2 Baseline Results

Table 5 reports the first- and second-stage results for the five measures of changes in industry-level rents. For ease of exposition, the trade uncertainty, market expansion, and net entry variables are standardized so that their means are zero and their standard deviations are one. Column (1) reports the first-stage results, which are equivalent across the five rent outcome variables. Consistent with our expectations, trade uncertainty and market expansion are positively and statistically significantly associated with net entry at the 1-percent confidence level. A one-standard-deviation increase in market size causes net entry to increase by 73-percent, and a one-standard-deviation higher value of trade uncertainty causes net entry to increase by 24-percent. The Montiel Olea and Pflueger (2013) effective F statistic indicates that trade uncertainty is not a weak instrument at the 10-percent confidence level, and the Kleibergen-Paap (2006) LM test indicates that trade uncertainty is not under-identified at the 1-percent confidence level.

The second-stage TSLS results are consistent with theoretical predictions from models of imperfect competition.[19] Market expansion is positively and statistically significantly associated, and net entry is negatively and statistically significantly associated with the growth in rents: columns (2)-(6) indicate that a one-standard-deviation increase in the instrumented net entry is associated with 2.5, 4.9, 5.4, 15.6, and 9.0 percentage point declines, and a one-standard-deviation increase in market size is associated with 1.8, 3.9, 4.4, 13, and 6.8 percentage point increases in the five measures of changes in rents, respectively. The estimated coefficients indicate that acceding to the WTO without an increase in rents would require one standard deviation above the average rate of net entry.[20]

[19] The corresponding ordinary least squares (OLS) results are reported Table A4 in the Appendix. We find that the coefficients on net entry are smaller when we use the OLS method.

[20] In an average industry, markups over material and labor costs increased by 4.2 percentage points (see column (3) in Table 5). Since the normalized market expansion is 0 for an average industry, a rate of net entry that is

When we use material markups, market expansion is only weakly associated with growth in rents at the 10-percent confidence level. The weak association, however, is consistent with our previous discussion, indicating that this measure can understate the growth in rents after a firm experiences a positive demand shock. This is because material markups exclude the possibility of cost-saving substitutions between materials, labor, and capital. And if such substitutions occur, the growth rate of marginal costs would be overestimated, and the growth in rents would be underestimated.

4.3 Robustness Checks

Table 6 reports robustness checks where the growth of markups over material and labor costs is the outcome variable. We first examine whether there are omitted variables that could create a spurious correlation between trade uncertainty and the error term in the baseline TSLS specification. We consider potential omitted variables, including industry-level measures on external finance dependence and capital requirements from Rajan and Zingales (1998). We also use three variables for China's protectionist policies from Brandt et al (2017): China's non-tariff barriers, FDI restrictions, and effective rate of protection (the difference between output and input tariff rates). Columns (1) and (2) in Table 6 contain our findings. The first-stage results indicate that the regression coefficients for trade uncertainty and market expansion change only negligibly, and all the additional controls are statistically insignificant. The second-stage results indicate that the coefficients on the instrumented net entry and market expansion are almost unchanged, and only the dependence on external finance is noisily significant.

In the baseline specification, we assume that a firm's choice of markups would not affect its market expansion and treat it as an included exogenous variable. Because, as previously discussed, there are potential concerns about the assumption that market expansion at the industry level is exogenous, we instrument for market expansion using Balassa's (1965) revealed comparative advantage index of the five advanced countries (France, Germany, Japan, the UK, and the US) in the world trade from 209 countries in 1998:

$$RCA_j = \frac{\sum_{c \in A} EX_{cj} / \sum_j \sum_{c \in A} EX_{cj}}{\sum_c EX_{cj} / \sum_j \sum_c EX_{cj}}$$

one standard deviation above average reduces the growth in markups by 4.9 percentage points and this would make the growth in markups roughly constant. This means a 109-percent net entry rate (i.e., one standard deviation (39.3-percent) above average (69.8-percent)) would be required.

where EX_{cj} is country c's export value of industry j in 1998 from the product-level global trade database (BACI),[21] and A represents the set of the five advanced countries.

The idea is that new export opportunities created by the elimination of trade uncertainty and also the emergence of China's comparatively disadvantaged industries that had previously imported goods from advanced countries (e.g., chemicals and machinery) drove the growth in China's industrial sectors after the accession. We use the following two specifications for the first stage:

$$\Delta \ln N_j = \delta_1^N + \delta_2^N TU_j + \delta_3^N RCA_j + X_j + \varepsilon_j \tag{8}$$

$$\Delta \ln Q_j = \delta_1^Q + \delta_2^Q TU_j + \delta_3^Q RCA_j + X_j + \varepsilon_j \tag{9}$$

where we include the five control variables discussed above (X_j).

The first-stage results are reported in columns (3) and (4) in Table 6. The results in column (3) indicate that trade uncertainty is a source of exogenous variation for net entry while revealed comparative advantage is not. The results in column (4) indicate that, consistent with our expectations, both trade uncertainty and revealed comparative advantage capture the variation in market expansion.[22] Importantly, the coefficient for the revealed comparative advantage is positively and statistically significantly associated with market expansion. Because there is a strong negative correlation (-0.533) between the revealed comparative advantage indices for China and the advanced countries, the findings indicate that the accession led to a growth of China's comparative disadvantaged industries such as chemicals, automobiles, and machinery. The coefficients for the instrumented net entry and instrumented market expansion in the second stage reported in column (5) are similar to the baseline results in Table 5 column (3) that contain coefficients for the instrumented net entry and actual market expansion, indicating that overall market expansion was plausibly exogenous for changes in average rents.[23]

If the exclusion restriction holds, then trade uncertainty should not be correlated with the error term in the second stage. To check for the validity of the exclusion restriction, columns (6) and (7) in Table 6 contain results for a TSLS setup where the log of the capital-to-labor ratio in 1998 is the

[21] See Gaulier and Zignago (2010). We use the concordances from the United Nations and those in Dean and Lovely (2010) to map Harmonized System codes into Chinese three-digit industries.

[22] Figure A1 in the Appendix illustrates that there is no correlation between the trade uncertainty and revealed comparative advantage variables.

[23] Table A5 in the Appendix reports the second-stage results from the five rent variables.

excluded instrument and trade uncertainty becomes an included instrument. The idea is that net entry of firms could be slower in industries that require more capital investment. However, the first stage results, the Montiel Olea and Pflueger (2013) effective F statistic, and the Kleibergen and Paap (2006) Lagrange Multiplier (LM) test all indicate that we cannot reject the null hypothesis of a weak instrument. And, consistent with the view that trade uncertainty satisfies the exclusion restriction, its coefficient in the second stage is close to zero and is statistically insignificant.

4.4 Market- and Firm-level Results

This section contains a more granular analysis, including the samples of 3,217 markets (from the 136 industries and 31 provinces), 13,768 markets (from the 136 industries and 340 prefectures), and 52,048 survivor firms.

Table 7 reports the results when we use the change in markups over material and labor costs as the outcome variable. Columns (1) and (2) report the results from the markets defined as the interaction of industries and provinces, and columns (3) and (4) report the results from markets defined as the interaction of industries and prefectures. The results indicate that our first- and second-stage baseline results in Table 5 columns (1) and (3) are robust: net entry causes markups to fall, and market expansion causes markups to increase; and, these effects are statistically significant at the 1-percent confidence level.

We also conduct a firm-level analysis. The sample contains only survivor firms because the dependent variable is the growth of markups at the firm level. Survivors are likely not representative of the full sample of firms: they were 93-percent larger than exiters in 2001 and 235-percent larger than entrants in 2007 suggesting they may have had advantages, including advanced technologies and political connections that enabled them to secure rents. Thus, our expectation is that survivors would have a weaker response (as measured by their reduction in rents) following the accession.

Columns (5) and (6) in Table 7 report first- and second-stage results from survivor firms. We control for three firm-level indicator variables measured in 2001: a firm's export status; its state-owned status; and whether or not it is a large employer. A large employer is in the top 1-percent of employers in the prefectural labor market and can potentially exert monopsony power. The first-stage results for net entry conducted at the industry level are reported in column (5). And, importantly, the growth of net entry was slowed down by the presence of SOEs and accelerated by the presence of exporters. This suggests that entry was blocked in industries where SOEs were pervasive (e.g., Bai et al, 2004; Barwick et al, 2021; Brandt et al, 2020). Wages could be cheaper and markups could be higher for large employers if they exercise potential monopsony power to markdown (Brooks et al, 2021). However, the local monopsony variable is not statistically significant, and this perhaps is the case because large firms are over-represented in our sample of survivors.

The second-stage results reported in column (6) are consistent with the results from the industry-level analysis in Table 5 in terms of statistical significance and direction of impact; however, the absolute value of the coefficients for the instrumented net entry and market expansion are smaller. A one-standard-deviation increase in market size is associated with a 0.8 percentage point increase in markups and a one-standard-deviation increase in the instrumented net entry is associated with a 1 percentage point decline. Importantly, even after controlling for the instrumented net entry and market expansion, SOEs had a faster growth of markups while exporters had a slower growth of markups.

5 Conclusions

We have documented the rise in market power in China during a period when they embraced economic reforms and had acceded to the World Trade Organization. Our paper, however, suggests that there was a variation in market power across industries. Importantly, in industries where trade uncertainty was substantially eliminated, the accession sparked a rapid entry of firms which, in turn, stiffened domestic market competition.

De Loecker et al (2020) find that there was a rise in markups in the United States driven by the selection on large and productive firms that charge relatively high markups. While sales-weighted markups increased and consumers paid higher prices, the most productive firms gained market share and the less productive firms shrank or exited, and competition between firms stiffened. However, in China, there was no such selection on the most productive firms, and the increase in prices and markups was broadly shared among firms that remained in the market.

Advocates of globalization argued that China's accession to the WTO would provide incentives for China to embrace market economies and perhaps more inclusive political institutions. The findings in this paper cast doubt on this argument. Competitive economies select on the most productive firms; and, following trade liberalization, competitive economies select sectors that have comparative advantages in the global economy. The accession enabled China to expand the size of the production capacity of its competitive sectors and also of sectors that exhibited comparative disadvantages. All sectors and firms shared in the gain in market size and rents from globalization but market competition did not emerge.

Appendix

I. Market Expansion, Net Entry, and Markups

We explore the theoretical associations between market expansion, net entry, and markups using a firm-level residual inverse demand function. Consider the following linear function for firm i:

$$P_i = a_i - bQ_i$$

where the firm's output price (P_i) depends on its output (Q_i) and market size (a_i).

For ease of exposition, we assume that firms in the industry share the same marginal costs (λ) and face the same slope of their residual demand functions. When the firm maximizes its profit using its residual demand, its optimal price, quantity, and markup are

$$Q_i^* = \frac{a_i - \lambda}{2b}, \quad P_i^* = \frac{a_i + \lambda}{2}, \quad \text{and} \quad \frac{P_i^*}{\lambda} = \frac{1}{1 - 1/\eta_i}$$

where the price elasticity of the residual demand is

$$\eta_i = \frac{a_i + \lambda}{a_i - \lambda}.$$

In this setup, a firm will sell goods in the market only if a firm's market size, a_i, exceeds its marginal costs, λ. And, in this case, its price exceeds its marginal cost, and the firm charges a markup.

When the market size of an industry expands, and there is no net entry of firms, then the average incumbent firm's market size, a_i, increases. Because this makes their residual demands more inelastic, the average incumbent firm increases its markup. And, when there is net entry of firms and no increase in the industry's market size, then a larger number of firms share the same market, and the average incumbent firm's market size decreases. Because this would make their residual demands more elastic, the average incumbent firm cuts its markup.

Importantly, this model indicates that firms with small residual demands tend to charge small markups, and those with large residual demands tend to charge large markups. Thus, when a local government protects its SOE by blocking the entry of private firms and the sales of non-local firms, the SOE would have a larger residual demand (a higher value of a_i), retain a larger market share (a higher value of Q_i^*), and charge a larger markup.

II. Capital Costs

We follow Hall and Jorgenson (1967) and estimate the firm-level required rate of return on capital services using the opportunity costs of holding capital assets. This approach has applied mainly in macroeconomic studies including Caballero and Lyons (1992) and Barkai (2020).

We derive capital stock using the method in Brandt et al (2012). To calculate a firm's opportunity cost of holding capital assets, we first follow Jorgenson and Griliches (1967) and compute its required rate of return on capital services (r_{pt}) from

$$r_{pt}K_{it} = P_{pt}K_{it}(i^B + \delta - \Delta P_p/P_p) \tag{10}$$

where i^B is the risk-free (bonds) interest rate, δ is the depreciation rate to compute capital stock, and $\Delta P_p/P_p$ is the province-level average rate of appreciation for capital goods over the period.

The opportunity cost in province p equals the interest rate that could be collected when the capital stock is traded in for a risk-free asset, $P_{pt}K_{it}i^B$, plus the avoided net depreciation in assets, $P_{pt}K_{it}(\delta - \Delta P_p/P_p)$, which equals the current value of the capital stock time its depreciation net of appreciation.

To compute capital costs from equation (10), we would ideally have data on detailed capital assets such as buildings versus machines as in Barkai's (2020) application to the US industry-level data. However, they are not available for Chinese firms. Thus, we apply equation (10) for each firm's real aggregate capital stock. By setting the risk-free (bonds) interest rate to 2.5-percent, and the depreciation rate to 9-percent, $i^B + \delta - \Delta P_p/P_p$ is around 8-percent. This estimate is similar to Hsieh and Klenow (2009) who assume that $i^B + \delta - \Delta P/P$ is 10-percent.

Next, we follow Hall and Jorgenson (1967) and compute an alternative measure for capital costs that accounts for firm-level debt and equity financing and the business income tax. In particular, this measure is implementable because we have the firm-level debt-equity ratio, which generates firm-specific required rates of capital returns:

$$r_{it}K_{it} = P_{pt}K_{it}\left(i_{it} + \delta - \Delta P_p/P_p\right)\frac{1 - z_{it}}{1 - \tau} \tag{11}$$

where the corporate tax rate (τ) is 33.3-percent over the sample period, the weighted average interest rate is $i_{it} = b_{it}i^L + (1-\tau)(1-b_{it})\, i^B$ where b_{it} is the firm- and time-specific debt to asset ratio, and i^L is the bank loan interest rate (5.9-percent), and the present value of depreciation deductions on investment is $z_{it} = \delta\tau/(i_{it} + \delta)$.

We find that the required rates of capital returns are on average higher when we use Hall and Jorgenson's method in equation (11) than when we use Jorgenson and Grilliches's method in equation (10); and the estimates using Hsieh and Klenow's (2009) assumptions are in the middle. The required rates of capital returns from equation (11) are our baseline estimates for the user costs of capital.

III. Estimating Output Elasticities

We follow an approach proposed by De Loecker et al (2016) and estimate output elasticities and unobserved input price parameters at the industry level. We follow Brandt et al (2017) and estimate Cobb-Douglas production functions that allow variable returns to scale. While De Loecker et al (2016) propose to control for input price variations across firms using information on firm-level output prices by assuming producers of more expensive products use more expensive inputs, we do not observe the direct measure of output or input prices at the firm level. Thus, we follow their intuition and approximate unobserved input prices using a firm's export and ownership status as well as its domestic market share. Because we do not have firm-level output prices, it is crucial to have detailed deflators. We use the deflators from Brandt et al (2017) who develop an output deflator at the most detailed industry level possible.

To estimate production functions, we follow the timing assumption in Ackerberg et al (2015) that firms need more time to optimize labor and install capital than purchase materials. It follows from this timing assumption that a firm's demand for materials depends on its productivity and the predetermined amounts of labor and the current stock of capital. We also follow De Loecker et al (2016) and handle unobserved input price biases with an exporter dummy (d_{it}^{ex}), an SOE dummy (d_{it}^{soe}), and the domestic market share (ms_{it}):

$$m_{it} = h_t\left(\omega_{it}, l_{it}, k_{it}, d_{it}^{ex}, d_{it}^{soe}, ms_{it}\right)$$

where lowercase variables are logged variables (e.g., $l_{it} = \ln(L_{it})$).

Following Ackerberg et al (2015), we assume the above equation can be inverted with log productivity:

$$\omega_{it} = h_t^{-1}\left(m_{it}, l_{it}, k_{it}, d_{it}^{ex}, d_{it}^{soe}, ms_{it}\right).$$

We then approximate log real output (q_{it}) with the second order polynomial function of the three inputs and that interacted with the three variables for input price biases and separate the predicted value ($\hat{\Phi}_t$) from the idiosyncratic error term (ϵ_{it}):

$$q_{it} \approx \Phi_t\left(m_{it}, l_{it}, k_{it}, d_{it}^{ex}, d_{it}^{soe}, ms_{it}\right) + \epsilon_{it}. \tag{12}$$

Next, we compute the corresponding value of productivity for any combination of parameters. The parameter we need to estimate has a constant term and output elasticities (α_j^M, α_j^L, and α_j^K) and, also unobserved input price biases, the interactions of the three variables with m_{it} (β_j^{ex}, β_j^{soe}, and β_j^{ms}). This enables us to express the log of productivity as the predicted log output minus the logged contribution of three inputs:

$$\bar{\omega}_{it} = \hat{\Phi}_t - \left(c_j + \bar{\alpha}_j^M m_{it} + \bar{\alpha}_j^L l_{it} + \bar{\alpha}_j^K k_{it} + \bar{\beta}_j^{ex} m_{it} d_{it}^{ex} + \bar{\beta}_j^{soe} m_{it} d_{it}^{soe} + \bar{\beta}_j^{ms} m_{it} ms_{it}\right).$$

Our generalized method of moments (GMM) procedure assumes that firm-level innovations to productivity (ζ_{it}) do not correlate with the predetermined choices of inputs. To recover ζ_{it}, we assume that productivity for any set of parameters follows a first-order Markov process:

$$\bar{\omega}_{it} = \gamma_0 + \gamma_1 \bar{\omega}_{i,t-1} + \zeta_{it}.$$

From the equation above, we can recover the innovation to productivity (ζ_{it}) for a given set of parameters. Since the innovation to productivity (ζ_{it}) cannot be correlated with the current choice of capital and the lagged choices of materials and labor, we use the following moment condition to estimate the parameters:

$$E\left[\zeta_{it} \mathbf{Y}_{it}\right] = 0 \tag{13}$$

where $\mathbf{Y}_{it} = \{k_{it},\ l_{i,t-1},\ m_{i,t-1},\ d_{i,t-1}^{ex} m_{i,t-1},\ d_{i,t-1}^{soe} m_{i,t-1},\ ms_{i,t-1} m_{i,t-1}\}$.

Table A1 reports the estimated parameters at the 2-digit or 3-digit industry level. We find that

Chinese firms use materials intensively. The mean output elasticity of labor is 0.09 (0.085), and the mean output elasticity of materials is 0.859 (0.874) at the 2-digit (3-digit) level. We follow Brandt et al (2017) and use the 2-digit estimates to derive production markups.

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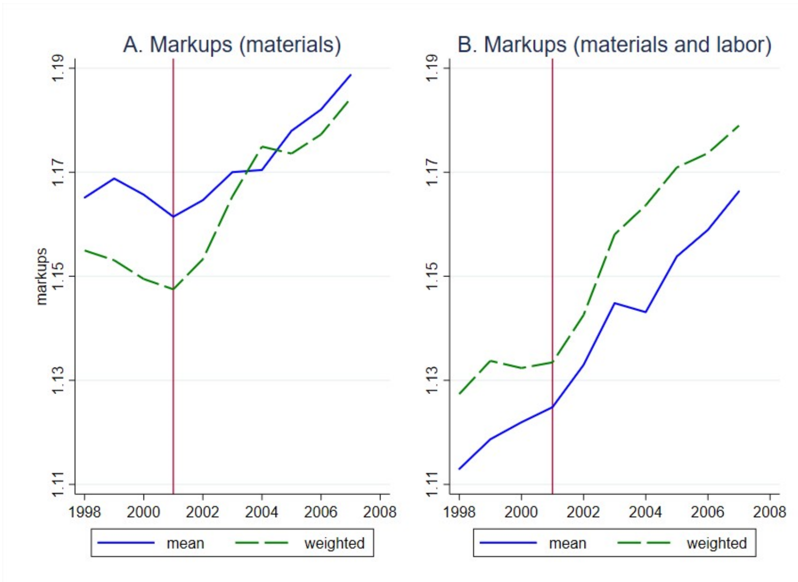
Figures and Tables

Fig 1. Markup trends



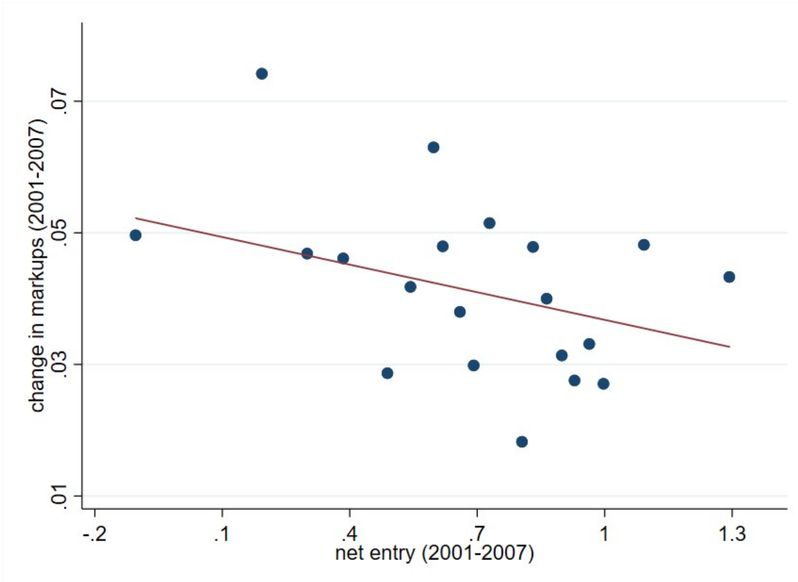
Notes: (1) Markups are computed using the production approach in Brandt et al (2017), which uses the De Loecker and Warzynski (2012) method. (2) We assume that materials (materials and labor) are flexible inputs to derive markups over material costs in Panel A (material and labor costs in Panel B). (3) Each year, firms in the top and bottom 2.5% of the markup distribution are dropped as outliers. (4) The vertical line in 2001 is the year China joined the WTO.

Table 1. Market expansion and net entry

	Number of firms			Market size		
	2001	2007	Net entry	2001	2007	Market expansion
	(1)	(2)	(3)	(4)	(5)	(6)
All firms	120,217	253,904	0.748	7,043	25,085	1.270
Survivors	56,210	56,210	0.000	4,432	12,236	1.015
Exiters and entrants	64,007	197,694	1.128	2,611	12,849	1.593

Notes: (1) Market expansion is the change in log real output from 2001 to 2007, and net entry is the change in log number of firms from 2001 to 2007. (2) We use industry-level deflators from Brandt et al (2017) to derive market size in 2001 and 2007 (real output in billions).

Fig 2. Markup growth and net entry at the industry level



Notes: (1) The binned scatterplot and the fitted line are used to visualize the unconditional relationships between the mean change in markups over material and labor costs and the change in the log number of firms at the industry level. The figures group 136 industries into 20 weighted bins. (2) The slope of the fitted line from 136 industries is -0.014 (the standard error is 0.007). (3) We use the number of firms in 1998 at the industry level as weights.

Table 2. Summary statistics for selected industries

	Chemical fertilizers			Textile goods		
	2001	2007	change	2001	2007	change
	(1)	(2)	(3)	(4)	(5)	(6)
Firm-level rent variables (means)						
Markups over material costs	1.270	1.336	0.066	1.091	1.096	0.005
Markups over material and labor costs	1.181	1.269	0.088	1.100	1.114	0.013
Markups over material, labor and capital costs	1.139	1.236	0.097	1.108	1.130	0.022
Economic profit shares	0.332	0.605	0.273	0.382	0.500	0.118
Accounting profit shares	0.027	0.167	0.140	0.083	0.151	0.068
Industry-level variables						
Number of firms	1,249	1,764	0.345	1,498	3,736	0.914
Market size (billion RMB)	78	248	1.152	47	199	1.454
Revenue share of SOEs (%)	62.5	38.8	-23.6	10.6	2.8	-7.8
US trade uncertainty	0.061	0.061	-	0.457	0.457	-
Concentration indices						
Herfindahl-Hirschman index	46.7	65.3	18.5	34.8	34.5	-0.3
Market share of the top 10 firms (%)	14.1	18.0	3.9	12.8	13.7	0.9

Notes: (1) The chemical fertilizers industry is 262, and the textile goods industry is 175 in the 3-digit Chinese industry classification. (2) See Section 2 for our rent variables. We report unweighted means for rent variables in 2001 and 2007 and changes in unweighted means. (3) SOE revenue shares are derived from the share of SOEs in industry-level gross output. The definition of SOEs is from Hsieh and Song (2015, pp.301-302). (4) Trade uncertainty is from Pierce and Schott (2016). (5) The Herfindahl-Hirschman Index (HHI) is calculated from the sum of the square of the output share (percentage) of each firm in an industry. (5) "Change" reports the log difference between the 2001 and 2007 values for market size and the number of firms. Otherwise, "change" reports the difference between the 2001 and 2007 values.

Fig 3. Real output and number of firms for selected industries

Notes: (1) See Table 2. (2) The vertical line in 2001 is the year China joined the WTO.

Table 3. Melitz and Polanec (2015) decompositions

	Survivors			Exiters and entrants			Total
	Between	Within	(1)+(2)	Exit	Entry	(4)+(5)	(3)+(6)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Selected industries							
Chemical fertilizers	0.016	0.055	0.071	0.009	0.002	0.011	0.082
Textile goods	0.012	0.011	0.023	-0.002	0.001	-0.002	0.022
All industries	0.008	0.022	0.030	0.011	0.005	0.016	0.046

Notes: (1) Melitz and Polanec (2015) decompositions for weighted mean markups (over material and labor costs) are reported. (2) Markups are weighted by their gross output. (3) We drop the top and bottom 2.5% of the sample for each year as outliers.

Table 4. Summary statistics

	Mean			s.d.		
	2001	2007	change	2001	2007	change
	(1)	(2)	(3)	(4)	(5)	(6)
Rent variables						
Markups over material costs	1.145	1.174	0.029	0.113	0.120	0.024
Markups over material and labor costs	1.119	1.162	0.043	0.130	0.133	0.027
Markups over material, labor and capital costs	1.122	1.170	0.048	0.080	0.084	0.028
Economic profit shares	0.362	0.505	0.143	0.105	0.094	0.088
Accounting profit shares	0.083	0.171	0.088	0.045	0.026	0.046
Explanatory variables						
Number of firms	884	1,867	0.698	840	1,921	0.393
Market size (billion RMB)	52	184	1.287	61	232	0.404
Revenue share of SOEs (%)	22.1	13.0	-9.1	20.4	16.3	9.5
US trade uncertainty	0.280	0.280	-	0.119	0.119	-
Concentration indices						
Herfindahl-Hirschman index	172.0	152.3	-19.7	153.0	241.3	225.7
Market share of the top 10 firms (%)	28.7	24.3	-4.4	13.9	13.3	8.6

Notes: (1) See Table 2 for definitions of the variables. (2) We derive unconditional means across firms for each industry for rent variables. We then report means and standard deviations across 136 industries for 2001 values, 2007 values, and changes from 2001 to 2007.

Table 5. Determinants of rent growth over 2001-2007

Stage:	First	Second				
Dependent variable:	Net entry	Δ Markups			Δ Profit shares	
		M	M and L	M, L and K	Economic	Accounting
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.013	0.027***	0.042***	0.048***	0.146***	0.087***
	(0.048)	(0.003)	(0.003)	(0.003)	(0.008)	(0.005)
Net entry		-0.025**	-0.049***	-0.054***	-0.156***	-0.090***
		(0.012)	(0.012)	(0.012)	(0.033)	(0.018)
Market expansion	0.739***	0.018*	0.039***	0.044***	0.130***	0.068***
	(0.059)	(0.010)	(0.010)	(0.010)	(0.029)	(0.015)
US trade uncertainty	0.238***					
	(0.047)					
First-stage R-squared	0.657					
Effective F statistic	31.2					
Kleibergen-Paap test P-value	0.001					
Observations	136					

Notes: (1) This table reports two-stage least squares (TSLS) estimates for the impact of net entry and market expansion on the growth in each rent variable at the industry level. We use the number of firms in 1998 as weights. The first-stage dependent variable is net entry. US trade uncertainty, market expansion, and net entry are normalized so that their means are zero and standard deviations are one. (2) Point estimates and standard errors are related to the impact of left-hand side variables for the six-year period (2001-2007). (3) Standard errors that are clustered at the industry level are in the parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% confidence level, respectively. (4) The Montiel Olea and Pflueger (2013) effective F statistic is used in testing for a weak instrument. The 5% and 10% TSLS critical values are 37.4 and 23.1. We also report the Kleibergen and Paap (2006) LM test for weak- or under-identification.

Table 6. Robustness checks

Testing:	Omitted variables		Endogeneity of market expansion			Inclusive variable	
Stage:	First	Second	First		Second	First	Second
Dependent variable:	Net entry	Δ Markups	Net entry	Market expansion	Δ Markups	Net entry	Δ Markups
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	-0.110	0.053*	0.314	0.617	0.050*	0.012	0.042***
	(0.508)	(0.028)	(0.619)	(0.559)	(0.030)	(0.048)	(0.004)
Net entry		-0.046***			-0.049***		-0.073
		(0.012)			(0.013)		(0.074)
Market expansion	0.750***	0.037***			0.044**	0.739***	0.057
	(0.059)	(0.010)			(0.018)	(0.058)	(0.054)
US trade uncertainty	0.233***		0.379***	0.202***		0.216***	0.006
	(0.048)		(0.070)	(0.074)		(0.052)	(0.018)
US external dependence	0.195	0.024**	0.071	-0.293	0.025*		
	(0.264)	(0.012)	(0.496)	(0.530)	(0.013)		
US capital expenditures	-0.718	-0.127	-1.298	-0.663	-0.126		
	(1.621)	(0.083)	(2.064)	(1.600)	(0.087)		
Non-tariff barriers	0.481	0.014	0.255	-0.295	0.017		
	(0.372)	(0.023)	(0.409)	(0.303)	(0.025)		
FDI restriction	-0.205	0.005	-0.235	-0.079	0.004		
	(0.202)	(0.011)	(0.314)	(0.374)	(0.012)		
Effective rate of protection	0.043	0.002	0.037	0.009	0.002		
	(0.041)	(0.002)	(0.070)	(0.065)	(0.003)		
Comparative advantage index			0.081	0.216***			
			(0.089)	(0.078)			
ln (K/L)						-0.049	
						(0.049)	
First-stage R-squared	0.672		0.195	0.118		0.660	
Effective F statistic	23.0			-		0.6	
Kleibergen-Paap test P-value	0.001			0.005		0.305	
Observations	136			136		136	

Notes: (1) We use markups over material and labor costs throughout the table. See column (3) in Table 5 for the baseline second-stage results. (2) Columns (1) and (2) report the results when we include additional industry-level control variables. US external finance dependence and capital expenditures indices are from Rajan and Zingales (1998). China's trade-related policy variables are from Brandt et al (2017). (3) Columns (3) through (5) report the results when we additionally instrument market expansion. The excluded instrumental variable for market expansion is the revealed comparative advantage index from the advanced countries (France, Germany, Japan, the United Kingdom, and the United States) in 1998. Chinese domestic markets for high-tech industries expanded by substituting imports with domestic production. (4) Columns (6) and (7) report the results when we use the normalized log capital to labor ratio in 1998 as an excluded instrument variable for net entry and the trade uncertainty as an included variable.

Table 7. Results from markets and firms

Sample:	Province × Industry		Prefecture × Industry		Survivor firms	
Stage:	First	Second	First	Second	First	Second
Dependent variable:	Net entry	Δ Markups	Net entry	Δ Markups	Net entry	Δ Markups
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.179***	0.052***	0.121***	0.048***	-0.020	0.023***
	(0.030)	(0.003)	(0.028)	(0.002)	(0.070)	(0.002)
Net entry		-0.053***		-0.052***		-0.010**
		(0.012)		(0.010)		(0.005)
Market expansion	0.821***	0.060***	0.798***	0.062***	0.676***	0.008**
	(0.036)	(0.011)	(0.028)	(0.009)	(0.053)	(0.004)
US trade uncertainty	0.170***		0.179***		0.311***	
	(0.027)		(0.024)		(0.058)	
Exporters					0.150***	-0.007***
					(0.047)	(0.003)
SOEs					-0.136***	0.020***
					(0.037)	(0.004)
Top 1% employers					-0.002	-0.006
					(0.059)	(0.006)
First-stage R-squared	0.459		0.410		0.651	
Effective F statistic	73.6		120.8		29.3	
Kleibergen-Paap test P-value	0.000		0.000		0.000	
Observations	3,217		13,768		52,048	

Notes: (1) We use markups over material and labor costs throughout the table. See column (3) in Table 5 for the baseline second-stage results. (2) Columns (1) and (2) report the results from 3,271 markets defined as industries × provinces. Columns (3) and (4) report the results from 13,768 markets defined as industries × prefectures. Columns (5) and (6) report the firm-level results from the sample of 52,048 survivor firms. (3) The first-stage dependent variable is the change in net entry in each market for columns (1) and (3) and the change in net entry in each industry for column (5). The second-stage dependent variable is the change in the mean value of markups across all firms in each market for columns (2) and (4) and the change in the value of markups for each survivor for column (6). (4) We use the number of firms in 1998 at the market level as weights for columns (1) through (4). We do not use weights for firm-level results in columns (5) and (6).

Appendix Tables

Table A1. Estimated output elasticities

	2-digit industries			3-digit industries		
	Mean	s.d.	% (>0)	Mean	s.d.	% (>0)
	(1)	(2)	(3)	(4)	(5)	(6)
Output elasticities						
α^L (labor)	0.090	0.090	1.000	0.085	0.165	1.000
α^K (capital)	0.039	0.068	0.893	0.032	0.059	0.912
α^M (material)	0.859	0.103	1.000	0.874	0.125	1.000
Scale elasticity	0.988	0.066	1.000	0.991	0.104	1.000
Input price biases						
β^{SOE} (SOE dummy)	0.048	0.222	0.321	0.051	0.245	0.537
β^{EXP} (exporter dummy)	0.000	0.019	0.857	0.008	0.046	0.831
β^{ms} (log domestic market share)	0.007	0.010	0.857	0.004	0.014	0.735

Notes: (1) We use the method in De Loecker et al (2016). See Appendix III. (2) We follow Brandt et al (2017) and use 2-digit estimates to derive markups.

Table A2. Cross-industry correlation matrix across entry variables

	(1)	(2)	(3)	(4)
(1) Net entry	1.000	0.783	-0.192	0.295
(2) Market expansion	0.783	1.000	-0.073	0.191
(3) Revenue share of SOEs	-0.192	-0.073	1.000	-0.242
(4) US trade uncertainty	0.295	0.191	-0.242	1.000

Notes: (1) See Table 2 for definitions of the variables. (2) We use the log change from 2001 to 2007 for net entry and market expansion, the 2001 values for the SOE shares, and the 1998 values for US trade uncertainty.

Table A3. Cross-firm correlation matrix across six measures of rents

	(1)	(2)	(3)	(4)	(5)
(1) Δ Markups over material costs	1.000	0.599	0.520	0.166	0.361
(2) Δ Markups over material and labor costs	0.599	1.000	0.951	0.756	0.593
(3) Δ Markups over material, labor and capital costs	0.520	0.951	1.000	0.853	0.643
(4) Δ Economic profit shares	0.166	0.756	0.853	1.000	0.706
(5) Δ Accounting profit shares	0.361	0.593	0.643	0.706	1.000

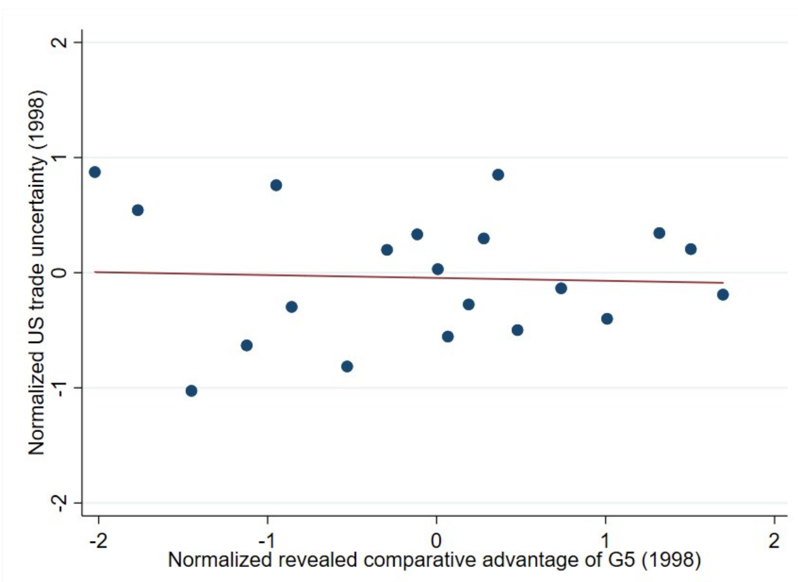
Notes: See Section 2 for definitions of the rent variables.

Table A4. OLS results for determinants of rent growth

Dependent variable:	Δ Markups			Δ Profit shares	
	M	M and L	M, L and K	Economic	Accounting
	(1)	(2)	(3)	(4)	(5)
Constant	0.027***	0.041***	0.047***	0.145***	0.087***
	(0.002)	(0.002)	(0.003)	(0.008)	(0.004)
Net entry	-0.004	-0.014***	-0.018***	-0.066***	-0.033***
	(0.003)	(0.004)	(0.004)	(0.015)	(0.007)
Market expansion	0.001	0.011***	0.015***	0.058***	0.023***
	(0.004)	(0.004)	(0.004)	(0.014)	(0.006)
R-squared	0.015	0.105	0.157	0.216	0.199

Notes: This table reports ordinary least squares (OLS) estimates of the effects of net entry and market expansion on the change in rent at the industry level. We use the number of firms in 1998 at the industry level as weights. See Table 5 for corresponding TSLS results.

Fig A1. Scatter plot of US trade uncertainty and the RCA index in 1998



Notes: (1) The binned scatterplot and the fitted line are used to visualize the unconditional relationships between the US trade uncertainty in 1998 and the revealed comparative advantage index from the five advanced countries (France, Germany, Japan, the United Kingdom, and the United States) in 1998 at the industry level. The figures group the 136 Chinese industries into 20 weighted bins. (2) The slope of the fitted line from 136 industries is -0.025 (the standard error is 0.160).

Table A5. Results when net entry and market expansion are both instrumented

Dependent variable:	Δ Markups			Δ Profit shares	
	M	M and L	M, L and K	Economic	Accounting
	(1)	(2)	(3)	(4)	(5)
Constant	0.057**	0.050*	0.050	0.110	0.079
	(0.028)	(0.030)	(0.034)	(0.110)	(0.054)
Net entry	-0.006	-0.049***	-0.058***	-0.191***	-0.098***
	(0.010)	(0.013)	(0.014)	(0.043)	(0.020)
Market expansion	-0.017	0.044**	0.055***	0.209***	0.085***
	(0.015)	(0.018)	(0.019)	(0.057)	(0.027)
US external dependence	-0.005	0.025*	0.025	0.063	0.008
	(0.021)	(0.013)	(0.016)	(0.060)	(0.025)
US capital expenditures	-0.045	-0.126	-0.122	-0.282	-0.070
	(0.094)	(0.087)	(0.098)	(0.319)	(0.154)
Non-tariff barriers	-0.014	0.017	0.023	0.114	0.038
	(0.014)	(0.025)	(0.030)	(0.090)	(0.046)
FDI restriction	-0.004	0.004	0.003	-0.009	-0.011
	(0.009)	(0.012)	(0.014)	(0.049)	(0.022)
Effective rate of protection	0.004	0.002	0.002	0.003	0.009**
	(0.003)	(0.003)	(0.003)	(0.007)	(0.004)

Notes: See columns (3) and (4) in Table 6 for the first-stage results and column (5) in Table 6 for the second-stage results from markups over material and labor costs.