

Barriers to Entry and Regional Economic Growth in China*

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April 2025

Abstract

Labor productivity in manufacturing differs starkly across regions in China. We document that productivity, wages, and start-up rates of non-state firms have nevertheless experienced rapid unconditional regional convergence after 1995. To analyze these patterns, we construct a Hopenhayn (1992) model that incorporates location-specific capital wedges, output wedges, and entry barriers. Using Chinese Industry Census data we estimate these wedges and examine their role in explaining differences in performance and growth across prefectures. Entry barriers explain most of the differences. We investigate the empirical covariates of these entry barriers and find that changes in barriers are causally related to changes in the size of the state sector: a smaller state sector leads to lower entry barriers.

JEL Classification: O11, O14, O16, O40, O53, P25, R13, D22, D24, E24.

Keywords: Chinese economic growth; SOEs; firm entry; entry barriers; capital wedges; output wedges; SOE reform.

*This version: April 9, 2025. We thank Tommaso Porzio, Paulina Restrepo-Echavarria, Hsuan-Li Su, Aleh Tsyvinski and seminar and conference participants at ABFER Singapore, Asian Meeting of the Econometric Society, ASSA Annual Meeting, Bank of Finland Conference on China's Financial Markets and the Global Economy, Barcelona GSE Summer Forum, Beijing Conference on Business Cycles/Financial Markets/ and Monetary Policy, Beijing Conference on Deepening Economic Reforms, Beijing University 3rd International Conference on New Structural Economics, Canadian Economics Association Meeting, Cornell, Emory, FGV Sao Paulo School of Economics, Glasgow, Guelph, Hawaii, IAES Conference, IMF, Kent, Leuven, Mannheim 3rd Workshop on the Spacial Dimensions of the Labour Market, McMaster, Minneapolis Fed, MIT Sloan, Montreal Workshop on Markets with Frictions, NBER Chinese Economy Working Group, Notre Dame, Oslo, Rochester, Society for Economic Dynamics Meeting, Sichuan University, Stockholm School of Economics Conference on Industrial Upgrading and Urbanization, St. Andrews Workshop on Structural Transformation, Tsinghua, UBC, University of Toronto/Bank of Canada Conference on the Chinese Economy, Vienna Macro, Western Economics Anniversary Conference, Wharton, Wisconsin-Madison, World Bank, and Yale. Storesletten acknowledges financial support from the Norwegian Research Council (grant 316301) and from the European Research Council (grant agreement FP7/324085). Brandt and Kambourov acknowledge financial support from the Social Sciences and Humanities Research Council grants #435-2015-0987 and #435-2014-0815, respectively.

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1 Introduction

Since the onset of economic reform in the late 1970s, China has gone from one of the poorest economies in the world to being a middle-income country. The main source of this growth has been the expansion of the non-state sector (Zhu (2012)), especially in manufacturing. While the non-state sector has experienced rapid expansion at the national level, the growth has been highly uneven with significant differences across regions and localities. By the mid-1990s, this was reflected in sizeable local differences in productivity, wages, and the number and size of non-state enterprises (NSOE). Subsequently, differences between localities in the non-state sector began to disappear and from the mid-1990s China experienced a remarkably rapid economic convergence between localities, not only in value added per worker in non-state firms, but also in TFP, capital per worker, and wage rates. Moreover, the performance of non-state firms improved significantly more in areas where employment in state-owned firms declined faster.

The purpose of this paper is to examine the initial dispersion and subsequent convergence in the performance of the non-state sector through the lens of a macroeconomic model where the distribution and selection of firms matter for productive efficiency. In particular, we use this framework as an accounting device to determine which factors drove the initial dispersion across locations and the subsequent convergence. The theoretical framework is motivated by the empirical observation that the creation and selection of new firms in China's non-state sector have been the most important source of productivity and output growth in the manufacturing sector (Brandt, Van Biesebroeck and Zhang (2012)).

A number of factors might be responsible for differences in new firm creation and growth between regions, including human capital differences and distortions, taxes, and subsidies imposed by local governments (cf. Huang (2003)). To quantify the role of various channels we construct a Hopenhayn (1992) model, extended to allow three distortions. Following Hsieh and Klenow (2009) we allow for capital and output wedges. These wedges are prefecture-specific. In addition, we introduce a novel entry barrier which may differ across locations. This entry barrier takes the form of a probability that potential entrepreneurs will be allowed to operate firms. We solve the general equilibrium model analytically and show that the model aggregates. Namely, the underlying wedges can be derived using data on average wage rates and aggregate allocations of output, capital, and employment in a prefecture. Thus, by construction these wedges can account for the observed aggregate allocations in a given prefecture.

We measure the theoretical wedges using firm-level data from the Chinese Industrial Census (CIC) for 1995, 2004, and 2008. We construct data on value added, employment, capital, and average wage rates for each prefecture in China by aggregating the firm-level data. Focusing on aggregate allocations and distortions at the prefectural level – as opposed to the firm level – makes the analysis robust to measurement error at the firm level. To our knowledge our paper is the first to quantify distortions driving regional growth in China. The CIC data have some clear advantages. First, national account data are not available at the prefectural level. Second, the CIC data allow us to study theoretical predictions about the number of firm entrants and the distribution of age and productivity across firms since these data cover the entire manufacturing industry, not only large firms.

We use this framework to explore what factors/wedges are most important for accounting for the aggregate differences and convergence across prefectures in China. The central finding of our paper is that the entry barrier is the main driver of both the initial (1995) dispersion and the subsequent convergence in wages and TFP across locations in China. Thus, the influence of capital or output market distortions, which in the Chinese context have also been identified as important (Hsieh and Klenow (2009); Song, Storesletten and Zilibotti (2011)) seems to be secondary for explaining the

regional convergence of the non-state sectors in China. Instead, we conclude that local variations in the entry barriers are responsible for the regional economic heterogeneity and convergence.

We study the measured entry barriers in greater detail and show, in the spirit of Cheremukhin, Golosov, Guriev and Tsyvinski (2017, 2024), that these theoretical distortions can be tied to auxiliary empirical evidence for distortions. In particular, our measured entry barriers match up closely with measures of the formal costs of starting a business in China reported in the World Bank (2008) “Doing Business in China 2008” for provincial capitals in China. We can also tie aggregate wage growth directly to entry barriers. In a dynamic extension of our model we show that lower entry barriers should be associated with more firm entry, higher selection, lower firm age and higher wages. We document that higher regional wage growth is associated with significantly lower firm age and more firm entry. Note that other drivers of wages – besides entry barriers – should affect incumbents and entrants equally, and should therefore not affect the age distribution of firms and firm entry. Thus, the external evidence provides validation both for our estimates of the entry barriers and for the main mechanism of our paper, i.e., that regional growth is driven by entry barriers and selection.

Then, using prefecture-level information – beyond data on the aggregate allocations in the non-state manufacturing sector – we investigate the empirical drivers of the wedges. We are able to link systematically the size of these entry barriers and their changes to the size of China’s state-owned enterprise (SOE) sector, and to several variables reflecting local fiscal capacity. In the mid-1990s, entry barriers were sizeably larger in localities with a larger SOE presence. In almost every dimension – the rate of start-up of new firms, size of firms, TFP, and wages – we find that new NSOE firms are weaker where SOEs are more dominant. However, after the mid-1990s the fortune turned to the better for prefectures which originally had a large state sector: on average, output per worker, TFP, wages, and capital per worker in non-state firms grew faster in these prefectures than elsewhere. This process is related to the fact that these same locations experienced large reductions in entry barriers because of large reductions in state employment.

Our results on the effect of the state sector are robust to potential concerns about endogeneity, omitted variables, and measurement error. We address such concerns with a Bartik (1991) instrumental variable approach. In a major policy change in 1997, the Chinese government allowed SOEs to be crowded out by non-state firms in some but not all industrial sectors. Interacting the initial local sectoral distribution of SOEs with the industry-specific decline in SOE employment at the national level predicts very accurately the reduction in local SOE employment. Using the 1995 SOE distribution as a Bartik instrument we find that the 1995-2004 reduction in SOE employment is systematically related to the reduction in entry barriers: larger predicted declines in SOE employment are associated with larger reductions in entry barriers. To study the link between entry barriers and SOE employment in the cross-section we apply an alternative instrumental variable approach that exploits various lagged instruments. The results confirm the findings using the Bartik instrument.

To motivate the empirical link between observed entry barriers and the size of the SOE sector, we develop a simple political economy model of local governments’ incentives to influence the three wedges. In the model, local authorities face pressure to protect state-owned firms. Since non-state firms compete for resources with SOEs, the government uses these wedges to distort NSOEs’ behavior in order to help SOEs. If local cadres care about the profits of local entrepreneurs, then restricting NSOE entry provides the best trade-off between ensuring that SOEs remain sufficiently competitive and supporting the NSOE profits.

Finally, we extend the benchmark model to allow for firm-specific capital and output wedges as in Restuccia and Rogerson (2008). We reestimate the model and find that the entry barriers continue to account for most of the regional convergence in wages and TFP. Moreover, the entry

barriers estimated from the extended model are highly correlated with those of the benchmark model.

Our paper makes a number of contributions. First, we provide an analytical framework that can be used as an accounting device to identify distortions that inhibit or stimulate growth in a development context. Second, we use this framework to provide new insights for understanding growth dynamics in China. We identify new firm behavior and the removal of barriers to entry as the main driver of regional wages and TFP growth. Third, we document an important set of new empirical facts on regional economic development in China, emphasizing the strong unconditional β -convergence in wages, TFP, labor productivity, and capital per worker across regions after the mid-1990s. Fourth, we study the empirical determinants of the prefecture-specific barriers to entry. Our Bartik IV approach reveals a novel and important channel: SOEs cause larger entry barriers for non-state firms. This finding points to an important additional benefit of the reforms of the state-owned sector of the late 1990s: as SOEs were scaled back, the entry barriers for private firms came down. This in turn paved the way for the subsequent rapid economic growth.

Our paper builds on and contributes to several literatures. There exists an extensive literature analyzing China's economic rise. At the aggregate level, productivity growth has been identified as the most important source of Chinese growth (Zhu (2012)). Especially important in this context is the rapid growth in TFP in the non-agricultural sector (Cheremukhin, Golosov, Guriev and Tsyvinski (2015)), and within non-agriculture, the non-state sector (Brandt and Zhu (2010)). Cheremukhin et al. (2015) attribute 62% of the growth in GDP in China between 1978-2012 to productivity growth in non-agriculture. The downsizing of the state sector in the mid-to-late 1990s and a reallocation of resources to the non-state sector has been singled out in the literature for its role in the improvement of TFP in the non-agricultural sector (Hsieh and Klenow (2009), Song et al. (2011), and Hsieh and Song (2015)). But even more important to TFP growth in non-agriculture is the contribution of new and better non-state firms, which enjoyed a significant premium over incumbent firms (Brandt et. al., 2012 and 2017). Our analysis explicitly links these gains in the manufacturing sector to the fall in local entry barriers for new firms – which we find is also tied to restructuring of the state sector – and the ensuing convergence in productivity across regions.

Our model and results are in line with this literature. In particular, we find that TFP is the primary driver of both growth and convergence. Moreover, aggregate TFP is determined by the establishment of new non-state firms, and this process is the main focus of our theory. Our message is that local TFP growth can be linked to changes in local entry barriers for new firms.

Our paper builds on the literature using wedge analysis to infer sources of distortions for understanding economic growth (see e.g., Chari, Kehoe and McGrattan (2007) and, in a developing economy context, Cheremukhin et al. (2017, 2024)). A large literature emphasizes distortions and misallocation of resources for understanding cross-country differences in economic development (see e.g. Restuccia and Rogerson (2008) and Hsieh and Klenow (2009)). This literature identifies a number of distortions that may be important, including implicit taxes on capital, labor, and output. In the Chinese context the literature has emphasized both capital market distortions (Hsieh and Klenow (2009), Song et al. (2011), Brandt and Zhu (2010)) and labor market distortions (Tombe and Zhu (2019)). We incorporate such distortions in our analysis. Similar to Poschke (2010), Barseghyan and DiCecio (2011), and Asturias, Hur, Kehoe and Ruhl (2023), we also emphasize the role of entry barriers for new firms in accounting for TFP differences, although we focus on regional convergence in China while they focus on dispersion across countries.

Finally, our paper contributes to the large macroeconomic literature studying growth and convergence across countries and regions (Barro and Sala-i-Martin (1991); Mankiw, Romer and Weil (1992); Gennaioli, La Porta, Lopez De Silanes and Shleifer (2014)).

The rest of the paper is organized as follows. Section 2 documents the empirical economic

development across more than 300 prefectures. Section 3 lays out a version of the Hopenhayn (1992) model extended to incorporate a novel entry barrier. Section 4 uses the entry barrier model to measure the distortions across prefectures and Section 5 provides external validation that entry barriers and firm selection matter for regional growth rates. Section 6 quantifies the role of wedges for growth and convergence. Section 7 studies the empirical drivers of the prefecture-specific measured entry barriers while Section 8 studies an extension of the model that allows for firm heterogeneity in wedges. Section 9 concludes.

2 Empirical Evidence

2.1 Data description

Chinese Industrial Census. Our main data source is the 1995, 2004, and the 2008 Chinese Industrial Census (CIC) carried out by China’s National Bureau of Statistics (NBS).¹ The CIC covers all of the manufacturing sector² and provides firm-level data on gross output, value added, employment, the gross capital stock, depreciation, total wage bill, as well as information on firm year of establishment, ownership type, and main sector of business. For these three years, we have firm-level records on 0.53, 1.37 and 2.08 million firms, respectively.³

In order to make these data comparable across the three census years, we have addressed a number of issues related to changes that occurred in China’s industrial classification system, ownership categories, and prefecture boundaries. We draw on concordances described in Brandt et al. (2012) and Brandt and Morrow (2017) for ownership types and industrial sectors and extend the concordance on prefecture boundaries in Baum-Snow, Brandt, Henderson, Turner and Zhang (2017) to cover all prefectures. We also utilize deflators developed by Brandt et al. (2012) and Brandt and Rawski (2008) for the purposes of constructing real measures of industrial output and estimates of the real capital stock (see Online Appendix A).

Using the CIC data on firm type by ownership, we identify non-state-owned firms as all firms other than those listed as state-owned, state solely-funded limited liability companies, or shareholding companies. We have experimented with alternative definitions of NSOEs. In general, our results – both in the cross-section and over time – are robust to these alternative definitions.⁴

2.2 Regional dispersion and convergence

We start by documenting the initial dispersion and subsequent unconditional convergence across locations in a set of key economic variables: the average wage per worker, aggregate value added per worker, aggregate capital per worker, and aggregate TFP, all measured at the prefecture level.

Figure 1 and Table 1 document the dispersion across prefectures in 1995 and the dynamics of the aggregate variables between 1995 and 2004. Each panel is a scatter plot of the level of a variable (on a log scale on the x-axis) against the growth in the variable over the 1995-2004 period. Figure B-1 in Online Appendix B documents the corresponding statistics for the 1995-2008 period.

The first observation is that there is large dispersion across prefectures in these aggregate outcomes. Second, there was substantial convergence in labor productivity between 1995 and 2004. The negative slope of the regression line in the top left panel implies that the growth in labor

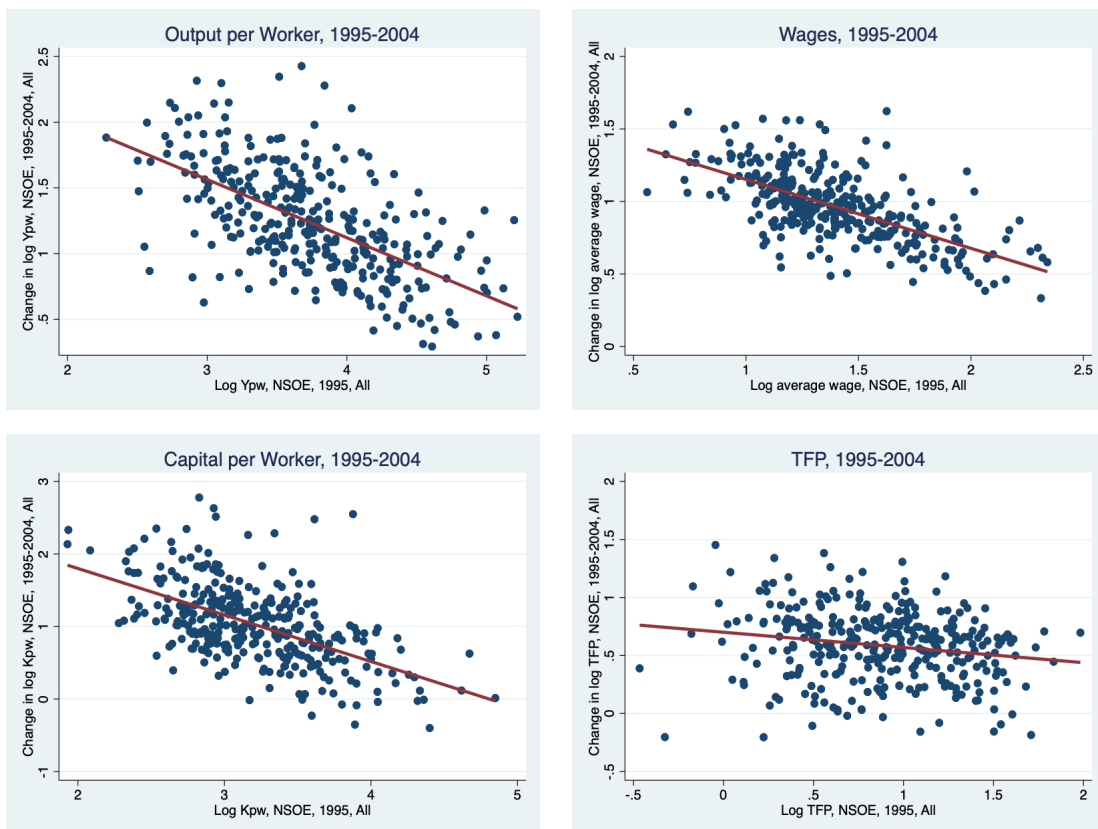
¹We also draw on firm-level data collected by the NBS for 1992 on all independent accounting units (0.39 million), which covers a slightly smaller subset of firms than the CIC.

²The 2004 and 2008 CIC also provide data for the service sector, but unfortunately similar information was not reported in 1995.

³The firm-level records are not exhaustive, but cover upwards of 90 percent of industrial activity.

⁴See Online Appendix A for details.

Figure 1: Convergence in the NSOE Sector, 1995-2004.



Notes: Each dot represents a prefecture, and the solid red line is the fitted regression line. The top and bottom 1% observations in each panel are dropped.

Table 1: Dispersion and Rates of Unconditional Convergence.

	labor productivity $\frac{Y}{N}$	wage rate w	capital per worker $\frac{K}{N}$	Aggr. TFP Z
Annualized rate of β -convergence 1995-2004	6.5%	7.2%	11.4%	2.6%
Annualized rate of β -convergence 1995-2008	6.4%	8.9%	23.6%	2.9%
90-10 ratio in 1995	4.4	2.3	3.6	3.1
90-10 ratio in 2004	3.0	1.8	3.1	3.9
90-10 ratio in 2008	3.2	2.1	3.9	4.3

Notes: The table reports the annualized rates of unconditional β -convergence and the cross-sectional dispersion in aggregate outcomes across prefectures in China. The annualized β -convergence coefficient between times t_0 and $t_0 + T$ for variable x is estimated from the regression $(\frac{1}{T}) \ln \left(\frac{x_{p,t_0+T}}{x_{p,t_0}} \right) = a - \frac{1}{T} (1 - e^{-\beta T}) \ln(x_{p,t_0}) + \varepsilon_{pt_0}$, where ε_{pt_0} is an error term. The top and bottom 1% observations for each variable are dropped. To guarantee convergence the top and bottom 2% observations of in the 1995-2008 change in capital per worker are dropped.

productivity over this period was larger in prefectures with low initial labor productivity. The annualized rate of unconditional β -convergence was around 6.5% (cf. Table 1), implying that it only takes slightly more than 10 years to cut the difference in labor productivity between any two prefectures by half.

To put this rate of convergence in perspective, we compare it with the rate of convergence in GDP per capita across regions in other countries. Using data from 1,528 regions from 83

countries, Gennaioli et al. (2014) document that the speed of within-country per capita income convergence—conditional on a set of controls—has been about 2 percent per year. This is similar to what Barro and Sala-i-Martin (1991) found for convergence across states in the US (1880-1988). By this metric, regional convergence in labor productivity in China’s non-state manufacturing sectors was exceptional, both from a historical and international perspective.

Consider now the dynamics of wages per worker in non-state manufacturing, documented in the top right panel of Figure 1. Wages per worker in the non-state sector measure the annual average earnings per worker. The 1995 dispersion across prefectures in the average wage per worker is large, albeit less dispersed than labor productivity. The annualized rate of β -convergence was also large—at 7.2 percent—suggesting that it took slightly more than 9 years to reduce average wage differences between two prefectures by half.

The regional dispersion in capital per worker in non-state manufacturing firms is documented in the bottom left panel of Figure 1. Both the initial 1995 regional dispersion and the rate of convergence are large, with an annualized β -convergence of around 11 percent.

The bottom right panel of Figure 1 documents the convergence and dispersion across prefectures in aggregate TFP. We calculate the growth in aggregate TFP as the weighted average growth in the Solow residual across industries. In particular, we calculate the Solow residual in each industry, Z_j , in line with standard growth accounting. Namely, Z_j is the residual from a sector-specific production function that takes total capital and labor (used in the industry and prefecture) as inputs; $Y = ZF(K, N)$, where Y , K , and N are, respectively, production, capital, and labor in industry j . This assumes a constant returns to scale Cobb-Douglas production function, $Y = ZK^{\alpha_j}N^{1-\alpha_j}$, with industry-specific shares (α_j). The Solow residual is computed for each (2-digit) industry in a prefecture in a particular year. In order to compute the growth in aggregate TFP for a particular prefecture j , we first compute the change in $\ln Z_j$ for each (2-digit) industry and then aggregate up the industry-specific growth rates using as weights the relative share – averaged across 1995 and 2004 – of the composite input $K^\alpha N^{1-\alpha}$ of each industry in that prefecture. The 1995 dispersion in aggregate TFP across prefectures is very large, with a 90-10 ratio of 3.1. Aggregate TFP exhibits regional annualized convergence between 1995 and 2004 of about 3 percent.⁵

Finally, we note that between 1995 and 2004 the β -convergence is so strong that even the cross-sectional dispersion in all variables except TFP fell: Table 1 shows that the dispersion is lower in 2004 than in 1995 for all variables except TFP, indicating σ -convergence across prefectures. However, after 2004 the overall cross-sectional dispersion in labor productivity, wages and capital per worker, and TFP increased. In the presence of shocks, the dispersion in, for example, productivity can increase even if there is β -convergence (see Barro and Sala-i-Martin (1991) for a discussion).

Co-movements between TFP, wages, and new firm entry. Table 2 documents the correlation matrix in levels and growth for these variables. We define the *entry rate* Γ of new private firms in a prefecture as the share of employment in *new* NSOE firms, i.e., firms established during the last two years, relative to total employment in manufacturing in the prefecture. We interpret this statistic as a measure of firm entry. As is clear from Table 2, all variables are positively correlated. This holds true in the cross section in 1995 as well as in changes over the 1995-2004 or 1995-2008 periods. This positive correlation will be important for identifying the key forces driving the differential performance of the non-state sectors across prefectures.

⁵We show below that our unconditional convergence results are robust to adding a set of controls, including province-level fixed effects. When controls are included, the rate of (conditional) convergence is larger for TFP and wages and slightly lower for output per worker and capital per worker. See Section 7.2 for details.

Table 2: Comovements in Wages, TFP, and Firm Entry.

	1995			1995-2004			1995-2008			
	$\ln W$	$\ln TFP$	$\ln \Gamma$	$\Delta \ln W$	$\Delta \ln TFP$	$\Delta \ln \Gamma$	$\Delta \ln W$	$\Delta \ln TFP$	$\Delta \ln \Gamma$	
$\ln W$	1.00			$\Delta \ln W$	1.00		1.00			
$\ln TFP$	0.42	1.00		$\Delta \ln TFP$	0.18	1.00	0.14	1.00		
$\ln \Gamma$	0.26	0.40	1.00	$\Delta \ln \Gamma$	0.24	0.09	1.00	0.25	0.12	1.00

Notes: The table reports the correlations between log wages, log TFP, and log firm entry in 1995 as well as the correlations between the changes in log wages, log TFP, and log firm entry in 1995-2004 or 1995-2008.

2.3 The size of state sector and non-state sector performance

Earlier research documents that the growth of non-state firms is correlated with the presence of SOEs. Brandt, Hsieh and Zhu (2008), for example, show that across provinces the growth in non-state nonagricultural output is negatively correlated with the initial size of the state sector, measured by the 1978 share of aggregate value added in non-agriculture produced by state-owned firms. Motivated by this evidence, we now document that in our data the performance of non-state firms is also related to the size of the state sector.

We start by analyzing the performance of non-state firms (NSOE) in the 1995 cross section of prefectures. We continue to focus on average wages, labor productivity, capital per worker, and TFP for non-state firms. We also document entry rates of new NSOEs for each prefecture. In order to illustrate the correlation with the size of the state sector, we sort prefectures according to the local preponderance of state firms. We let s_p denote the size of the state sector in prefecture p , measured by the fraction of output in manufacturing produced by state firms. Our results are essentially the same if we use the fraction of workers employed by state firms as our measure of the size of the state sector.

Wages, TFP, value added per worker, and capital per worker for NSOE entrants.

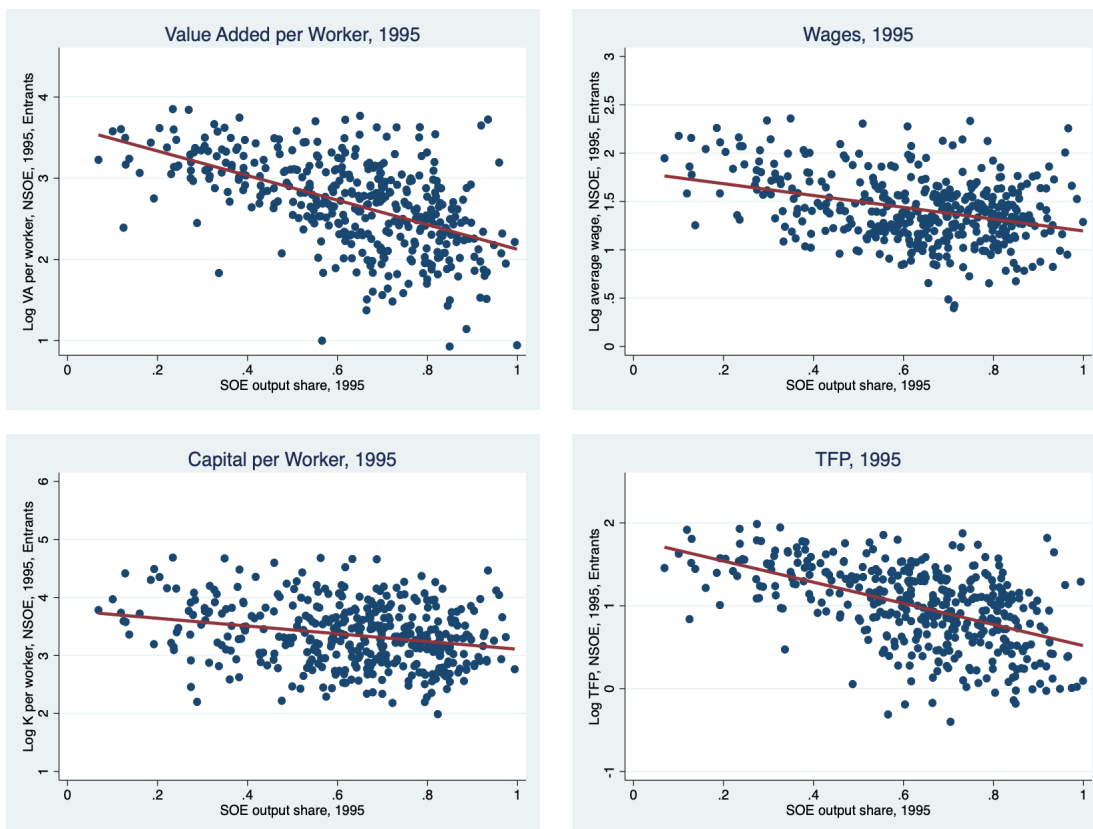
Figure 2 documents aggregate outcomes for NSOE firms across prefectures. We report these facts for new firms – defined as firms established between 1993 and 1995 – since firm creation will be a central focus in our theory below. The figure reveals that new entrants in prefectures with a larger state presence in 1995 (high s_p prefectures) pay lower wages, have lower TFP, lower value added per worker, and less capital per worker.^{6,7}

On the basis of OLS regressions, the SOE output share in 1995 accounts for 29% of the variation in value added per worker, 12% of the variation in wages across prefectures, 6% of the variation in capital per worker, and 27% of the variation in aggregate TFP.

⁶Figure B-2 in Online Appendix B shows that the same patterns hold up for all non-state firms, i.e., when also including incumbent NSOE firms.

⁷One concern is that the negative relationship between the size of the state sector and productivity in the non-state sectors is a product of unobserved heterogeneity at the prefecture level. State owned enterprises might be located in more “backward” prefectures where endowments of human capital are lower. In regressions in Section 7.1 we add a set of control variables, including average human capital and the employment share of agriculture. The results are robust to these controls.

Figure 2: Characteristics of NSOE Entrants in 1995.



Notes: Each dot represents a prefecture, and the solid red line is the fitted regression line. The 1995 SOE output share in a prefecture is on the horizontal axis. The top and bottom 1% observations in each panel are dropped.

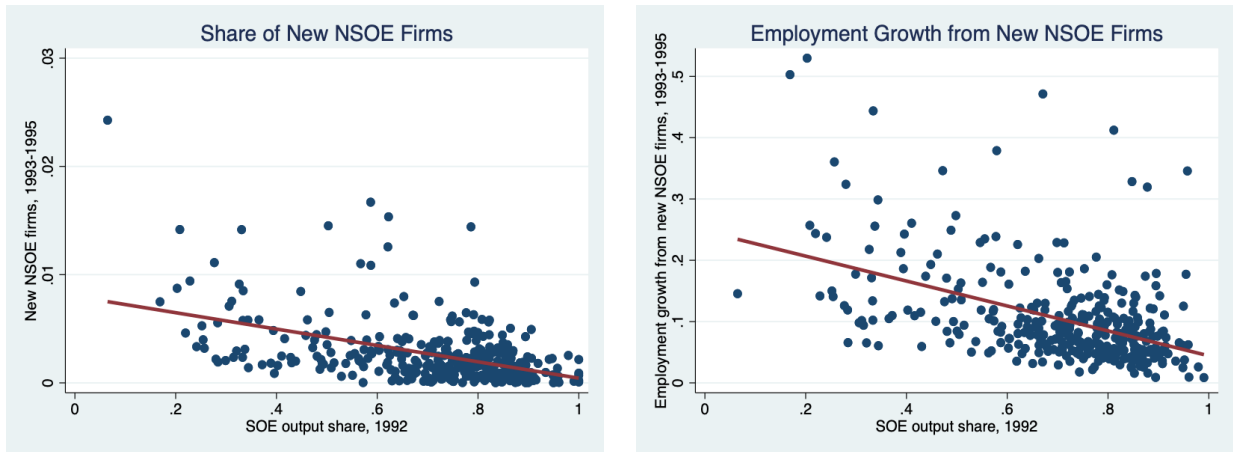
Firm entry in the NSOE sector. Prefectures with high s_p also have substantially lower entry of NSOE firms. The left panel in Figure 3 plots the number of new firms in a prefecture as a share of all new firms at the national level. Clearly, most of the new NSOE entrants were established in prefectures in which the state sector was less prominent in 1992. The right panel in Figure 3 measures 1995 employment in new NSOE firms as a fraction of total employment in that prefecture in 1992. Again, most of new NSOE employment originates in prefectures that had a low s_p in 1992.

To summarize, the 1995 CIC cross-section reveals that in prefectures with high s_p , there were relatively fewer NSOE entrants and NSOE entrants were weaker in multiple dimensions – they paid lower wages and had lower total factor productivity, lower value added per worker, and lower capital per worker. The same relationship between the size of the state sector and the performance of the non-state sector also holds in terms of observed changes between 1995 and 2004, as reported in Figure B-3 in Online Appendix B: In prefectures with a larger decline in the share of the state sector, the non-state sector experienced a larger increase in its value added per worker, TFP, wages, and capital per worker.

In the next section, we develop a model to identify the main forces – in terms of prefecture-level wedges and distortions – that are behind the regional convergence and the relationship between the performance of the non-state sector and the state sector.⁸

⁸As we will see, these wedges and distortions are strongly correlated with the size of the state sector. Clearly, interpreting these correlations is not straightforward due to potential econometric issues such as endogeneity, mea-

Figure 3: NSOE Firm Entry during 1993-1995.



Notes: Each dot represents a prefecture, and the solid red line is the fitted regression line.

3 A Hopenhayn Model of Heterogeneous Entrepreneurs

This section lays out a theory of private (non-state) firms across locations. The purpose is to derive predictions about aggregate firm performance in each location.

The economy consists of a set of locations. Each location is a small open economy where labor is location specific and supplied inelastically. Capital can be allocated freely across locations and commands an exogenous common rental rate $(r + \delta)$. In the main analysis we take the labor supply offered to private firms in location j , N_j , as exogenous.⁹

Firms produce a homogeneous good with decreasing returns to scale. The production function is Cobb-Douglas,

$$y_i = z_i^{1-\eta} (k_i^{1-\alpha} n_i^\alpha)^\eta, \quad (1)$$

where y_i is the firm's value added, k_i is the firm's capital stock, n_i is the firm's employment, and z_i is the firm's total factor productivity. The parameter $\eta \in (0, 1)$ captures the decreasing returns. We allow the parameter $\alpha \in (0, 1)$ to differ across locations, reflecting heterogeneity in the technological labor income share $\alpha\eta$. Firms pay workers a location-specific wage rate w . In addition, firms face standard distortions on output and capital given by τ_y and τ_k .¹⁰ These wedges are common for all firms in the location.¹¹ There is a fixed cost ν for operating a firm. This cost is constant across all locations.

Following a long tradition in the misallocation literature, the model is static, comprising two stages: a firm entry stage and a production stage. Each location has a measure M_j of potential entrepreneurs. Each potential entrepreneur can operate one firm which is endowed with a produc-

surement error, and omitted variable bias. We tackle these issues in Section 7 and show that there is indeed a causal link between the size of the state sector in a prefecture and the distortions and the performance of its non-state sector.

⁹In Section 7.3 we extend the model to incorporate a second type of firms – state firms – which compete with private firms for local workers.

¹⁰We interpret these wedges as implicit taxes, where these taxes are not recorded as costs and thus do not affect the measured value added y_i . Moreover, following Hsieh and Klenow (2009), we abstract from labor wedges. Our analysis differs from Hsieh and Klenow (2009), however, in that we allow wage rates to differ across locations.

¹¹Section 8 extends the analysis to allow for firm-specific capital and output wedges. As we shall see, our quantitative findings and the main message of the paper remain robust to this extension.

tivity z . The distribution of productivities of potential entrepreneurs is given by a p.d.f. $f(z)$. We assume that z is Pareto distributed, i.e., that $f(z) = \xi \underline{z} z^{-\xi-1}$, where $\xi > 1$ and $\underline{z} \geq 1$. The parameter \underline{z} is a lower bound for the TFP distribution of potential entrepreneurs: $z \in [\underline{z}^{1/\xi}, \infty)$. The Pareto assumption is made for analytical convenience. We show in Section 5.3 that the upper tail of the TFP distribution in China is approximately Pareto distributed.

A key source of heterogeneity across locations is that they differ in the *effective* number of potential entrepreneurs. In particular, we assume that a location-specific fraction ψ of entrepreneurs who want to produce will not obtain a license to operate and will therefore be prevented from entering. We refer to the fraction of potential entrepreneurs who have the option to operate, $(1 - \psi)$, as the *gross entry barrier*.¹² This entry barrier can be interpreted as a lottery over licenses. It is important that this barrier is independent of the firm's productivity. As we shall see below, this feature will induce negative selection of firms entering locations with a large ψ .

3.1 The Firm problem

We start by analyzing the production stage and then study the entry decision. For convenience we drop the firm subscript i . Firms maximize profits and take as given the wedges and prices. The firms' objective, conditional on operating, is given by:

$$\Pi = \max_{k,n} \{(1 - \tau_y) y - wn - (1 + \tau_k)(r + \delta) k\}. \quad (2)$$

Using the firm's first-order conditions, the optimal choices are given by,

$$\begin{aligned} y^* &= z \cdot \bar{y}(\tau_y, \tau_k, r, w) \\ k^* &= z(1 - \alpha)\eta \frac{(1 - \tau_y)}{(1 + \tau_k)(r + \delta)} \cdot \bar{y}(\tau_y, \tau_k, r, w) \\ n^* &= z\alpha\eta \frac{(1 - \tau_y)}{w} \cdot \bar{y}(\tau_y, \tau_k, r, w) \\ \Pi^* &= (1 - \tau_y)(1 - \eta) z \cdot \bar{y}(\tau_y, \tau_k, r, w), \end{aligned} \quad (3)$$

where

$$\bar{y}(\tau_y, \tau_k, r, w) \equiv [(1 - \tau_y)\eta]^{\frac{\eta}{1-\eta}} \left(\frac{(1 - \alpha)}{(1 + \tau_k)(r + \delta)} \right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha}{w} \right)^{\frac{\alpha\eta}{1-\eta}}.$$

Given the vector of distortions and prices (τ_y, τ_k, r, w) , there exists a cutoff $z^* = z^*(\tau_y, \tau_k, r, w)$ such that all potential entrepreneurs with $z \geq z^*$ will choose to operate firms. Given the profit function Π , this cutoff z^* is determined by the condition $\nu = (1 - \tau_y)(1 - \eta) \cdot z^* \cdot \bar{y}(\tau_y, \tau_k, r, w)$, implying

$$z^* = \frac{\nu}{(1 - \tau_y)^{\frac{1}{1-\eta}} \eta^{\frac{\eta}{1-\eta}} (1 - \eta)} \left(\left(\frac{(1 + \tau_k)(r + \delta)}{1 - \alpha} \right)^{1-\alpha} \left(\frac{w}{\alpha} \right)^\alpha \right)^{\frac{\eta}{1-\eta}}. \quad (4)$$

¹²Hopenhayn (1992) proposes an alternative model of entry barriers with an infinite supply of potential entrepreneurs. Each entrepreneur who considers entering must first pay a fixed cost of obtaining a stochastic draw of firm TFP and the cost is incurred before the TFP is realized. The predictions of our model differ qualitatively from Hopenhayn (1992) in the effect of labor supply N_j . In Hopenhayn (1992) changes in N_j have no effects on allocations and wages. We show below that in our model an increase in labor supply will lower equilibrium wages and TFP.

3.2 Equilibrium

We now solve for the equilibrium wage w and the associated aggregate output, capital stock, and measured aggregate TFP in each location. Market clearing in the labor market requires that

$$M(1 - \psi) \int_{z^*}^{\infty} n(z) f(z) dz = N, \quad (5)$$

where M is the number of potential entrepreneurs. Note that the equilibrium allocations and prices can be determined separately for each location, given the wedges and location-specific set of workers and potential entrepreneurs (N_j, M_j) . The reason is that capital is fully mobile and the locations produce a homogeneous good. Differences across locations are therefore determined entirely by differences in wedges and (N_j, M_j) . Our analysis takes the wedges and (N_j, M_j) as exogenous and abstract from endogenous migration decisions of workers and entrepreneurs. However, we will take migration and population growth into account in the quantitative analysis insofar as they influence the realized empirical distribution of (N_j, M_j) . We discuss below how endogenizing migration decisions would affect our analysis.

Imposing labor market clearing and optimal firm behavior (equations (3)-(4)), we can solve analytically for the equilibrium wage as a function of the distortions. We state this as a proposition.

Proposition 1 *The equilibrium wage in a location is given by*

$$\begin{aligned} \ln w &= \mu(1 - \eta) \ln \left[(1 - \psi) z \frac{M}{N} \right] \\ &\quad + \mu \xi \ln(1 - \tau_y) - \mu(1 - \alpha) \xi \eta \ln[(1 + \tau_k)(r + \delta)] + \Omega(\alpha, \eta, \xi, \nu), \end{aligned} \quad (6)$$

where $\mu \equiv 1/(1 - \eta + \xi\alpha\eta) > 0$ and the term $\Omega(\alpha, \eta, \xi)$ is defined in Online Appendix C. The equilibrium wage is falling in N/M , τ_y , τ_k , and ψ .

Our empirical analysis focuses on wages, aggregate TFP, and new firm entry. We treat these objects as summary statistics that we study through the lens of our model. Section 2.2 documents regional convergence in wages and aggregate TFP where TFP is defined as the Solow residual, in line with standard growth accounting. We now calculate the Solow residual in a way that is theoretically consistent with our model.¹³ Using the equilibrium wage w to calculate z^* and aggregating over firms' optimal choices allows us to determine the implied Solow residual as a function of the wedges,

$$\begin{aligned} \ln Z &= \mu\alpha\eta(1 - \eta) \ln \left[(1 - \psi) z \frac{M}{N} \right] - \mu(1 - \eta) \ln(1 - \tau_y) \\ &\quad + \mu(1 - \eta) [1 + (\xi - 1)\alpha\eta] \ln[(1 + \tau_k)(r + \delta)] + \hat{\Omega}(\alpha, \eta, \xi, \nu). \end{aligned} \quad (7)$$

Note that aggregate TFP is increasing in τ_k , τ_y , and M and decreasing in ψ and N . Moreover, the term $\hat{\Omega}(\alpha, \eta, \xi, \nu)$, defined in Online Appendix C, does not interact with the wedges.

Let the measure of firms entering the location be denoted $\Gamma = Pr(z \geq z^*)$. The theoretical prediction for firm entry Γ is given by

$$\begin{aligned} \ln \Gamma &= \ln \left[M(1 - \psi) \int_{z^*}^{\infty} z \xi z^{-\xi-1} dz \right] \\ &= \mu(1 - \eta) \ln \left[(1 - \psi) z M \right] + \mu\alpha\eta\xi \ln(N) \\ &\quad + \mu\xi \ln(1 - \tau_y) - \mu\xi\eta(1 - \alpha) \ln[(1 + \tau_k)(r + \delta)] + \tilde{\Omega}(\alpha, \eta, \xi, \nu), \end{aligned} \quad (8)$$

¹³In growth accounting, the Solow residual is calculated by imposing an aggregate Cobb-Douglas production function with constant returns to scale with a weight equal to the empirical labor-income share on labor and a weight of one minus the labor share on capital. To calculate this object in our model, we impose a weight $\alpha\eta$ on labor and a residual weight $1 - \alpha\eta$ on capital, defining the Solow residual as $\ln Z \equiv \ln Y - \alpha\eta \ln N - (1 - \alpha\eta) \ln K$.

where the term $\tilde{\Omega}(\alpha, \eta, \xi, \nu)$ is independent of the wedges (see Online Appendix C for derivation). It follows immediately that the number of firm entrants is falling in τ_y , τ_k , and ψ and rising in N and M .

Comparative statics on wages, TFP, and firm entry. The analytical characterizations above allow us to study how the endogenous outcomes we study in the empirical analysis – namely wage rates, firm entry, and the Solow residual – react to changes in the wedges and the N/M ratio. Consider, first, the entry barrier. A larger ψ will lower the number of potential entrants. If the productivity cutoff z^* is held constant, there will be fewer entrants and less demand for labor. To clear the labor market the wage must fall in order to induce each firm to hire more workers and to attract more entrants. The TFP cutoff z^* falls in response to the lower wages: firms with lower productivity are able to operate since labor is cheaper. This induces negative selection which in turn lowers the aggregate TFP. The result is that an increase in the entry barrier ψ will lower firm entry, wages, and aggregate TFP. Thus, aggregate TFP, firm entry, and wage rates all move in the same direction in response to movements in ψ (cf. Table 3).

Table 3: Comparative statics of varying the wedges (τ_y, τ_k, ψ) and aggregate labor supply per potential entrepreneur, N/M .

	$(1 - \tau_y)$	$(1 + \tau_k)$	$(1 - \psi)$	N/M
wage rate w	+	-	+	-
Solow residual Z	-	+	+	-
Entry Γ	+	-	+	+

Consider now the effect of changing the labor supply per potential entrepreneur, N/M . A larger N or a lower M requires a lower equilibrium wage in order to clear the labor market. The lower wage induces a lower TFP cutoff z^* which in turn implies both more firm entry and a lower aggregate TFP due to negative selection. Thus, a larger labor supply N and fewer potential entrepreneurs M cause lower aggregate TFP, a lower wage rate, and more firm entry (cf. Table 3).

Finally, increasing τ_y and τ_k will lower profits and distort the optimal firm size and optimal use of capital in the firm, making it less attractive for potential entrepreneurs to enter. This will increase the cutoff z^* and lower firm entry and demand for workers, which in turn lowers the equilibrium wage. However, larger τ_y and τ_k will increase the Solow residual, which is our measure of aggregate TFP.

4 Measuring the Wedges

We now use the benchmark model to impute the wedges using data from the Industrial Census. The purpose is to study the drivers of the correlation structure and the regional convergence of economic performance documented in Section 2.

4.1 Log gross output and capital wedges

Following Hsieh and Klenow (2009) we use the first-order conditions for k_i and n_i from the firm's problem (2) to identify the wedges τ_y and τ_k :

$$\begin{aligned} 1 - \tau_y &= \frac{1}{\alpha\eta} \frac{w_i n_i}{y_i}, \\ 1 + \tau_k &= \frac{1 - \alpha}{\alpha} \cdot \frac{w_i n_i}{(r + \delta) k_i}. \end{aligned} \quad (9)$$

In our main analysis we abstract from dispersion in firm-specific wedges within prefectures. This choice makes the analysis robust to measurement error in the firm-level data.¹⁴ In Section 8 we extend the analysis to allow firm-specific wedges.

Using equation (9) we compute the gross output wedge and the gross capital wedge in a given prefecture. In deriving the wedges, we take into account that the technological labor-income share differs across industries and that the industrial structure differs across prefectures. Let $Y_{j,p} = \sum_{i \in (j,p)} y_i$ be the total value added for all firms in industry j in prefecture p , and let $Y_p = \sum_{j=1}^J Y_{j,p}$ be the total value added in prefecture p . The gross output wedge in prefecture p , Δ_p^y , is measured as the average labor-income share for each firm in that prefecture, weighted by the firm's relative value added:

$$\Delta_p^y = \sum_{j=1}^J \left(\frac{1}{\alpha_j \eta} \sum_{i \in (j,p)} \frac{w_i n_i}{y_i} \frac{y_i}{Y_{j,p}} \right) \frac{Y_{j,p}}{Y_p}, \quad (10)$$

where $\alpha_j \eta$ is the technological labor share of industry j .

Similarly, the gross capital wedge in prefecture p , Δ_p^k , is computed as the weighted average wage bill per unit of capital for each firm in that prefecture, weighted by the firm's relative capital stock. Let $K_{j,p} = \sum_{i \in (j,p)} k_i$ be the total capital for all firms in industry j in prefecture p , and let $K_p = \sum_{j=1}^J K_{j,p}$ be the total capital in prefecture p . The gross capital wedge Δ_p^k is then:

$$\Delta_p^k = \sum_{j=1}^J \left(\frac{1 - \alpha_j}{\alpha_j} \sum_{i \in (j,p)} \frac{w_i n_i}{k_i} \frac{k_i}{K_{j,p}} \right) \frac{K_{j,p}}{K_p}. \quad (11)$$

Finally, we calculate $\eta\alpha$ in each prefecture as the weighted average of the technological labor income shares, weighted by the value added of each industry, $\eta\alpha(p) = \sum_{j=1}^J (\eta\alpha)_j Y_{j,p} / Y_p$.

For each firm in the Chinese Industrial Census we have data on the wage bill ($w_i n_i$), on the firm's value added (y_i), and on the firm's capital stock (k_i).¹⁵ We use the information on the labor shares of 2-digit industries ($\eta\alpha_j$) used in Hsieh and Klenow (2009) and a decreasing returns to scale parameter of $\eta = 0.85$ as in Restuccia and Rogerson (2008). The main results of our paper are not sensitive to this parameter.

Table 4 reports the mean and standard deviation of the gross wedges. Over time, the average gross output wedge is falling and the average gross capital wedge is rising. This implies that τ_y and τ_k are both rising, indicating that the average distortions are increasing for non-state manufacturing firms during this period. The increase in average τ_y is driven by the labor-income share falling over

¹⁴Bils, Klenow and Ruane (2021) argue that measuring firm-level distortions is highly sensitive to measurement error in firm-level data. To address this issue they assume that the distortions are constant over time, using a balanced panel of firms. This approach is not feasible for us because our focus is precisely on changes in distortions over time. Besides, many firms cannot be linked over time in our data because of changes in the assignment of firm IDs.

¹⁵See Online Appendix A for a discussion of the procedure to construct the real capital stock at the firm level.

time while the increase in τ_k is driven by the wage bill per unit of capital increasing over time (see equations (10)-(11) and columns (1) and (4) of Table 4). These patterns are qualitatively consistent with Bai, Hsieh and Qian (2006). Using national accounts data they document that the labor-income share is falling for the economy as a whole over this period. They also find that the return to capital in secondary industries increases slightly between 1995 and 2004. Over the 1995-2008 time period, the dispersion across prefectures in the gross output wedge fell while the dispersion in the gross capital wedge slightly increased (columns (3) and (6) in Table 4).

Table 4: Moments for Wedges

	$\frac{WN}{Y}$	Output wedge τ_y		$\frac{WN}{K}$	Capital wedge τ_k		Entry barrier $\ln(1 - \psi)$	
		avg. Δ_y	std($\ln \Delta_y$)		avg. Δ_k	std($\ln \Delta_k$)	avg. $\ln(1 - \psi)$	std($\ln(1 - \psi)$)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1995	0.28	1.00	0.32	0.15	1.00	0.36	-6.00	3.3
2004	0.22	0.79	0.26	0.17	1.16	0.28	-3.87	2.9
2008	0.21	0.76	0.37	0.20	1.33	0.45	-2.93	2.5

Notes: The table reports mean and standard deviation of gross wedges and entry barriers across prefectures. The means for the gross output and capital wedges are normalized to unity in 1995. The entries in columns (1) and (4) refer to ratios calculated using aggregated data on the wage bill WN , capital K , and value added Y at the national level for non-state manufacturing firms. Data source: Chinese Industry Census.

Figure 4 reports scatter plots of the wedges against the SOE output share s in each prefecture in 1995.¹⁶ Online Appendix B reports corresponding plots for 2004 and 2008. The gross output wedge (left panel of Figure 4) is increasing in s , implying that non-SOE firms in high- s prefectures tend to receive subsidies while non-SOE firms in the low- s prefectures tend to be taxed in 1995. The gross capital wedge (right panel of Figure 4) is slightly increasing with s .

A gross output wedge, Δ_p^y , that is strongly increasing with s implies that we should observe higher wages for non-SOE firms in the high- s prefectures compared to the low- s prefectures. This pattern is the exact opposite of the empirical evidence presented in Figure 2. The fact that the capital wedge is slightly increasing in s is a force for wages to fall in s . However, the effect of τ_y dominates. This suggests that the capital and output wedges cannot on their own account for the main cross-sectional patterns of wages.

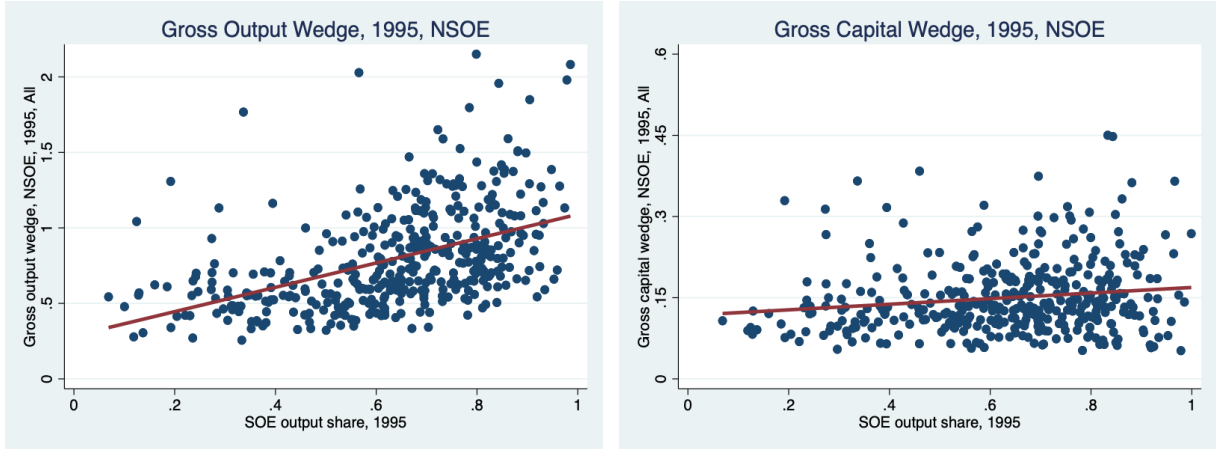
4.2 Measuring labor supply and potential entrepreneurs

Evaluating w , Z , and Γ in equations (6)-(8) requires that we measure the number of workers in the non-state sector per potential entrepreneur, N/M . This ratio can be affected by migration, structural change, and SOE employment. In particular, migration can affect both the number of manufacturing workers (through worker migration) and the number of potential entrepreneurs (through migrants starting new firms). To address this issue we present empirical data on migration of workers and entrepreneurs and lay out a model that allows us to measure N/M in light of these data.

Data from the Chinese Population Census allow us to identify migrants, i.e., individuals who are living and working in a location other than the one in which they have their Hukou (household registration), and the occupation of each individual that is working. Entrepreneur is not an

¹⁶We compute the wedges using data on all firms. The results based on the sample of new entrants are very similar and are provided in Online Appendix B.

Figure 4: Gross Output and Gross Capital Wedges, 1995, All Firms, NSOE Sector.



Notes: Each dot represents a prefecture. The left (right) panel plots the gross output (capital) wedge in the NSOE sector in 1995. The SOE output share in 1995 in each prefecture is on the horizontal axis. The top and bottom 1% observations in each panel are dropped.

occupational category, and we use Chief Executive Officer (CEO) as a proxy. We believe this is a good approximation because the owner of a firm is in most cases also the CEO. The vast majority of firms in China are controlled by an individual with more than 50% of the equity. In 2010 this number was 7 million out of 8 million firms. From now on we refer to CEOs as entrepreneurs.

Table 5 reports the shares of manufacturing workers and entrepreneurs who are migrants. Note first that migrants are prevalent, accounting for more than one fifth of the entrepreneurs and almost one third of the manufacturing workers in 2010. Moreover, the shares of migrant workers and entrepreneurs are increasing over time. Second, and most importantly, the migration rates of workers and entrepreneurs are positively correlated (see column (3) of Table 5). This shows that locations that attract many migrant workers also attract many migrant entrepreneurs.¹⁷

Table 5: Migrant workers and entrepreneurs

	(1)	(2)	(3)
	$m_n \equiv \frac{\text{migrant workers}}{\text{total workers}}$	$m_e \equiv \frac{\text{migrant entrepreneurs}}{\text{total entrepreneurs}}$	$\text{corr}(m_n, m_e)$
1990	0.055	0.024	0.524
2000	0.249	0.115	0.484
2010	0.304	0.220	0.340

Notes: The table reports the share of workers and entrepreneurs who are migrants. Columns (1)-(2) show the aggregate shares of migrants. Column (3) reports the correlation between the worker migrant share and the entrepreneur migrant share across counties in China. Source: China Census. See Online Appendix A for details about measurements.

To measure M in light of migration and SOE employment, we make the following assumptions. First, we assume that every local (non-migrant) manufacturing worker is a potential entrepreneur, i.e., $M_D = N_D$. Second, we observe that the migrant share is lower for entrepreneurs than for

¹⁷Migration rates are also positively correlated with wages. Thus, both workers and entrepreneurs tend to move to locations with higher wages.

workers. This suggests that migrants may have a lower entrepreneurial potential than locals have. To capture this effect we assume that the effective number of potential migrant entrepreneurs is given by $M_I = \kappa N_I$, where κ denotes the entrepreneurial potential of migrants. We allow κ to vary across prefectures. Assuming that non-migrant and migrant entrepreneurs draw from the same distribution of potential TFP, the effective number of potential entrepreneurs is given by $M = M_D + M_I$. Finally, we measure the number of workers employed by non-state (NSOE) firms, N , as the total number of manufacturing workers net of SOE employment N_S , i.e., $N = N_D + N_I - N_S$.¹⁸

The effective number of non-state workers per potential entrepreneur, N/M , can then be expressed as follows (see Online Appendix A for a derivation),

$$\frac{N}{M} = \underbrace{\left(1 - \frac{N_{SOE}}{N_D + N_I}\right)}_{\text{NSOE share}} \underbrace{\frac{1 - m_e}{1 - m_n}}_{\text{non-migrant ratio}} \quad (12)$$

Namely, the ratio N/M – which we measure for each prefecture and each year – is the product of the share of manufacturing workers employed in the NSOE sector times the non-migrant ratio $(1 - m_e)/(1 - m_n)$, i.e., the share of locals among the entrepreneurs over the share of locals among the workers.

4.3 Log gross entry barrier, $\ln(1 - \psi)$

The theoretical framework outlined in Section 3 allows us to measure the entry barrier for each prefecture. Using the expression for the equilibrium wage in a prefecture (6), we derive an analytical expression for the log gross entry barrier in a prefecture:

$$\begin{aligned} \ln(1 - \psi_p) = & \frac{1 - \eta + \xi\alpha\eta}{1 - \eta} \ln w_p - \frac{\xi}{1 - \eta} \ln \Delta_p^y + \frac{\xi\eta(1 - \alpha)}{1 - \eta} \ln \Delta_p^k \\ & + \ln(N_p/M_p) + \bar{\Omega}(\alpha(p), \eta, \xi, \underline{z}, \nu), \end{aligned} \quad (13)$$

where $\bar{\Omega} = -\left(\frac{1 - \eta + \xi\alpha\eta}{1 - \eta}\right) \ln \alpha - \frac{(1 - \alpha)\xi\eta}{(1 - \eta)} \ln(1 - \alpha) - \ln \underline{z} + (1 - \xi) \ln(1 - \eta) + \ln\left(\frac{\xi - 1}{\xi} \nu^{\xi - 1}\right) - \left(\frac{1 - \eta + \xi\eta}{1 - \eta}\right) \ln \eta$. The barrier ψ_p can then be identified using data on the average wage in each prefecture w_p , combined with our measures of Δ_p^y , Δ_p^k , and $\eta\alpha(p)$.

The remaining parameters, which are common across all prefectures, are chosen as follows. We set the Pareto parameter for the firm TFP distribution to $\xi = 1.06$. This is the same tail coefficient as that of the size distribution of U.S. firms (Luttmer (2007)).¹⁹

We normalize the fixed cost of operating a firm, ν , so that the smallest optimal size for a firm with TFP at the threshold $z = z^*$ is one worker: $n^*(z^*) = 1$. Moreover, we set the lower bound for the distribution of potential TFP, \underline{z} , so that the prefecture with the lowest barrier is normalized to zero ($\psi_p = 0$).

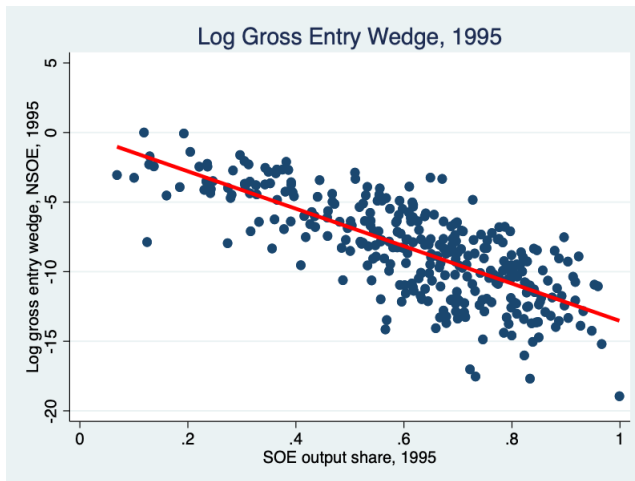
Finally, using equation (13), we compute the log gross entry barrier $\ln(1 - \psi_p)$ for all prefectures in the economy. Table 4 reports the moments for the entry barriers. The average $\ln(1 - \psi)$ is increasing and the dispersion across prefectures is falling over time. This indicates that the average and the dispersion in the barrier ψ are falling over time.

Figures 5 and 6 plot ψ against the 1995 output share of SOE firms s . The figures reveal a strong negative relationship between the entry barrier $1 - \psi$ and the SOE share s : a higher barrier ψ is associated with a larger s . This relationship becomes less pronounced over time.

¹⁸Here, we introduce the class of SOE workers merely for measurement purposes. In Section 7.3 we study a model extension that incorporates SOE workers explicitly in the labor market.

¹⁹Note that in an undistorted version of our economy the tail coefficient for the size distribution of firms would be equal to this value of ξ . The main results of our paper are not sensitive to this parameter.

Figure 5: Log Gross Entry Barriers, $\ln(1 - \psi)$, 1995.



Notes: Each dot represents a prefecture. The figure plots the log gross entry barrier in the NSOE sector in 1995, and the solid red line is the fitted regression line. The 1995 SOE output share in a prefecture is on the horizontal axis.

Figure 6: Log Gross Entry Barriers, $\ln(1 - \psi)$, 2004 and 2008.



Notes: Each dot represents a prefecture. The left (right) panel plots the log gross entry barrier in the NSOE sector in 2004 (2008), and the dotted blue line is the corresponding fitted regression line. The solid red line is the fitted regression line for the log gross entry barrier in 1995. The 1995 SOE output share in a prefecture is on the horizontal axis.

5 Validation of the Entry Barriers and the Selection Mechanism

Our accounting framework has three distortions – our novel “entry barrier” ψ plus two wedges that are standard in the literature (τ_k and τ_y). This section provides external validation of the entry barriers and motivates why we focus on ψ operating through a mechanism of entry and selection.

In principle, the distortion ψ could have a broader interpretation than an “entry barrier,” capturing other factors affecting TFP and wages such as human capital or agglomeration. To see this, note that the terms $(1 - \psi)$ and \underline{z} enter multiplicatively in equations (6)-(7). Thus, in our

benchmark model, variation in z has the same effect on wages, aggregate TFP, and firm entry as variation in the entry barrier $(1 - \psi)$.²⁰ As a result, our benchmark static model cannot distinguish between selection through entry barriers and proportional TFP shifts in accounting for local growth.

We argue that the empirical variation captured by ψ is tightly related to firm entry. This motivates why we find it fruitful to focus on the interpretation of the distortion as an entry barrier and to attribute variation in $(1 - \psi)z$ across prefectures to differences in the entry barriers. We provide three pieces of evidence that the entry barriers we impute through our benchmark model capture actual barriers to entry for private firms. First, our measure is highly correlated with those of the World Bank’s “Doing Business in China 2008” report. Second, we develop a dynamic extension of our model that overcomes the identification problem in our static benchmark model. The extended model illustrates that lower entry barriers simultaneously lead to lower average age for new firms, a higher fraction of employment in new firms, and higher wages – something that we observe in the data. In contrast, differences in firms’ productivity distributions across prefectures would not give rise to negative correlation between wage growth and age of new firms. Finally, we study the actual firm productivity distributions in high-wage and low-wage prefectures and find that they are consistent with our model of entry and selection.

5.1 Direct evidence: The 2008 costs of starting a business in China

The “Doing Business in China 2008” report produced by the World Bank (2008) provides various measures of the extent to which government regulations affect private business activity. The report outlines differences in these regulations in the capital cities of 26 Chinese provinces and 4 centrally administered municipalities. We focus on the reported indicators relating to how easy it is to start a business: (i) a rank computed in the report based on all available information on how easy it is to start a business; (ii) the number of days it usually takes to start a business; and (iii) the cost of starting a business, as a percent of GDP per capita. The results, reported in Figure 7, indicate that localities with higher measured entry barriers in our analysis in 2008 are the same localities where the report finds high costs of starting a business. The correlations of our entry barrier $\ln(1 - \psi)$ with each of the World Bank’s three measures of start-up costs are respectively -0.78, -0.69, and -0.66 (with an adjusted R^2 of 0.60, 0.45, and 0.41), implying that the correlation with ψ is positive for all measures, and largest for the measure which incorporates all information. These results provide valuable external validation for our estimates and are a strong indication of the importance of cross-prefecture variation in entry barriers in China.

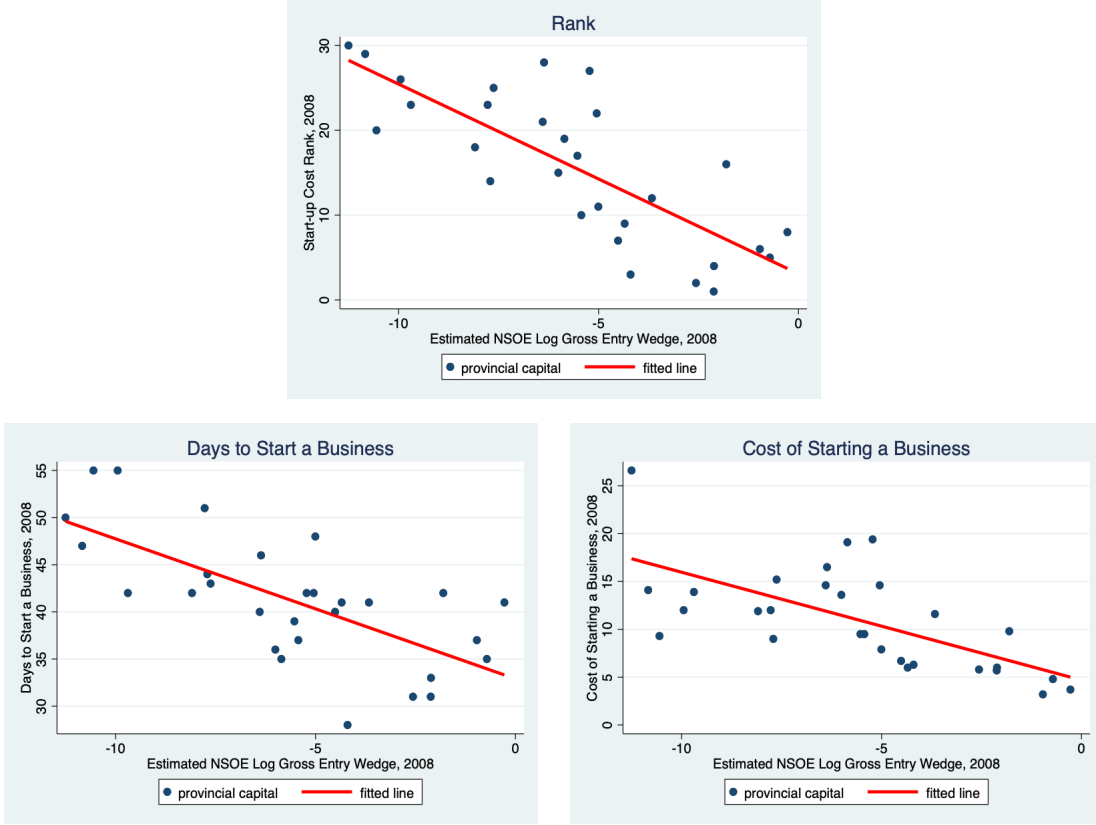
5.2 A dynamic extension: wage growth and changes in entry barriers

We now develop a dynamic extension to our model which allows us to distinguish between entry barriers and other drivers of aggregate outcomes.

Assume that there are two periods. The first period is the same as in the static model in Section 3.1. All firms and potential entrepreneurs in the first period survive until the second period. Moreover, the licence to operate is permanent, and any entrepreneur with an option to operate in the first period may continue to do so in the second period. For simplicity we assume that the entrepreneurs’ z is constant over time. In the second period a new cohort of potential entrepreneurs is born. Their TFPs are drawn from the same distribution $f(z)$. Moreover, the economy faces a new set of wedges $\{\psi_2, \tau_{y2}, \tau_{k2}\}$ where the entry barrier ψ_2 applies to the entry

²⁰This equivalence is due to the Pareto distribution assumption: In our static setting, shifting the distribution of potential entrepreneurs down, i.e., lower z , is equivalent to lowering the effective number of potential entrepreneurs $(1 - \psi)M$.

Figure 7: “Doing Business in China” and Entry Barriers, 2008.



Notes: Each dot represents a provincial capital city or a centrally administered municipality. Each panel shows a scatter plot of the estimated log gross entry barrier $\ln(1 - \psi)$ against a World Bank measure of the cost of doing business in China in 2008: rank (top panel), days to start a business (bottom left panel), and cost of starting a business (bottom right panel). The solid red line is the fitted regression line.

of new entrepreneurs while the capital and output wedges τ_{y2} and τ_{k2} apply to all firms in period 2. Finally, we extend the model by introducing an aggregate TFP shifter Z_t that multiplies the firm-specific TFP for all firms in a location. Conditional on operating in period t , the firms’ labor demand function is given by $Z_t \cdot n^*(\tau_{yt}, \tau_{kt}, w_t)$, where the function n^* is defined in equation (3).

The operating cost ν has to be paid every period. Therefore, incumbents and new potential entrants are symmetric in the second period in the sense that their age does not matter and the only relevant state variable for firms is their TFP parameter z . It follows that incumbents and new potential entrants have the same TFP threshold z_2^* for operating in the second period. To simplify the exposition we abstract from migration of entrepreneurs, keeping the measure of new potential entrants constant at M . The effective number of potential entrepreneurs in the first period is then $M_1 = (1 - \psi_1) M$. Since all potential entrepreneurs have the same z_2^* , the effective measure of potential entrepreneurs in the second period is the sum of incumbents plus new potential entrants, $M_2 = (1 - \psi_2) M + (1 - \psi_1) M$.

This result allows us to characterize how the age distribution of firms changes over time: the growth in average firm age A_t is one plus the share of incumbents in period 2,

$$\frac{A_2}{A_1} = 1 + \frac{1 - \psi_1}{(1 - \psi_1) + (1 - \psi_2)}. \quad (14)$$

Thus, the higher the barrier ψ_2 in period 2, the higher will the average firm age be. Note that changes in other variables such as the wedges and the TFP shifter will have no effect on the average age. The reason is that the entry barrier ψ_2 affects new entrants but not incumbents, whereas the other factors (Z_2 , N_2 , τ_{k2} , and τ_{y2}) affect new and old firms in a symmetric way.

To solve for the equilibrium wage in period $t = 2$, we impose labor market clearing in the second period and apply a version of the argument in Proposition 1,

$$\begin{aligned} \ln w_2 = & \mu(1 - \eta) \ln \left[Z_2^\xi \cdot z \frac{(1 - \psi_2) M + (1 - \psi_1) M}{N_2} \right] \\ & + \mu\xi \ln(1 - \tau_{y2}) - \mu(1 - \alpha) \xi \eta \ln[(1 + \tau_{k2})(r + \delta)] + \Omega(\alpha, \eta, \xi, \nu). \end{aligned}$$

The resulting wage growth between periods 1 and 2 is then given by

$$\begin{aligned} \ln w_2 - \ln w_1 = & \mu(1 - \eta) \left[\xi \ln \left(\frac{Z_2}{Z_1} \right) - \ln \left(\frac{N_2}{N_1} \right) + \ln \left(1 + \frac{1 - \psi_2}{1 - \psi_1} \right) \right] \\ & + \mu\xi \ln \left(\frac{1 - \tau_{y2}}{1 - \tau_{y1}} \right) - \mu(1 - \alpha) \xi \eta \ln \left(\frac{1 + \tau_{k2}}{1 + \tau_{k1}} \right). \end{aligned} \quad (15)$$

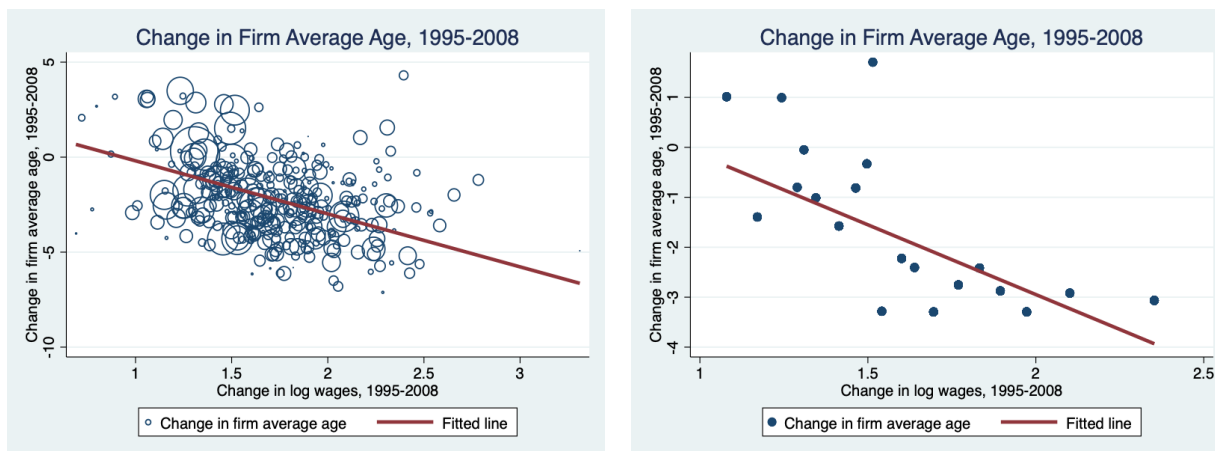
We are interested in identifying the role of changes in the entry barrier versus changes in the other factors. First, equation (15) shows that wage growth can be driven by general TFP growth Z_2/Z_1 , labor force growth N_2/N_1 , changes in the capital and output wedges $(1 + \tau_{k2})/(1 + \tau_{k1})$ and $(1 - \tau_{y2})/(1 - \tau_{y1})$, and changes in the entry barriers $(1 - \psi_2)/(1 - \psi_1)$. Thus, as we discussed above, using data on wages and wage growth alone is insufficient to identify the role of entry barriers.

Second, and more importantly, equation (14) showed that the growth in average firm age is driven only by the entry barrier. This suggests that the joint evolution of wage growth and the age distribution of firms is informative about the role of the entry barrier as a driver of wage growth: if wage growth is caused by a lower entry barrier, prefectures with higher wage growth should be associated with lower average firm age and a larger employment share in new firms. If wage growth is caused by the prefecture-wide TFP shifter, wage growth should be uncorrelated with firm age and entry. We now set out to examine this relationship empirically.

Wage growth and the average age of firms. Figure 8 reports scatter plots of changes in the average age of firms – weighted by employment – in each prefecture between 1995 and 2008 against the prefectures’ wage growth over that period. The left panel documents a clear negative relationship between wage growth and the change in the average employment-weighted age of firms. The slope of the fitted line is -2.79 (t-statistic of -5.8). The right panel groups prefectures into 20 bins sorted on aggregate wage growth. Each bin represents 5% of aggregate employment in manufacturing. The same negative relationship is observed, with a slope of the fitted line of -2.79 (t-statistic of -19.8).

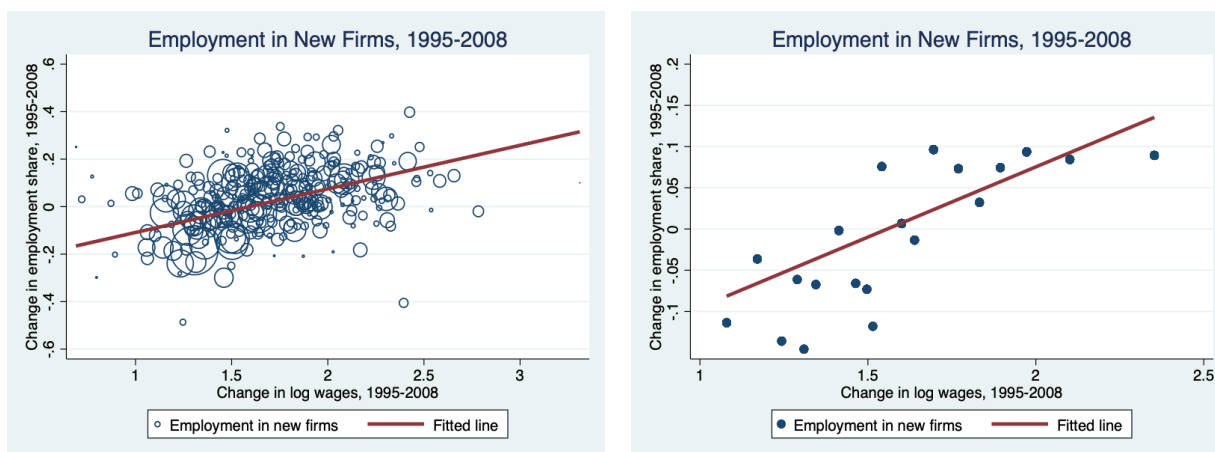
Wage growth and the employment share of new firms. Figure 9 reports scatter plots of changes in the share of employment in new firms in each prefecture between 1995 and 2008 against the prefectures’ wage growth over that period. New firms in 1995 are defined as those that were started after 1992 while new firms in 2008 are those started after 2005. The left panel documents a positive relationship between wage growth and the growth in the employment share of new firms. The slope of the fitted line is 0.18 (t-statistic of 6.7). The right panel groups all prefectures into 20 bins, based on firms’ employment size. The same positive relationship is observed, with a slope of the fitted line of 0.17 (t-statistic of 23.8).

Figure 8: Change in Firm Average Age, by Prefecture, 1995-2008



Notes: The figures plot the change in firm average age in prefecture between 1995-2008 as a function of the 1995-2008 change in log wages in a prefecture. The left panel plots the figure for every prefecture in the sample. The right panel groups prefectures into 20 bins, sorted on wage growth. Each bin represents 5% of aggregate employment.

Figure 9: Employment Share in New Firms, by Prefecture, 1995-2008



Notes: The figures plot the change in the employment share of new firms in a prefecture between 1995-2008 as a function of the 1995-2008 change in log wages in a prefecture. The left panel plots the figure for every prefecture in the sample. The right panel groups prefectures into 20 bins sorted on wage growth. Each bin represents 5% of aggregate employment.

We conclude that higher wage growth in a prefecture is associated with younger firms and a significantly larger share of employment in young firms. Moreover, Online Appendix Table B-4 shows that across prefectures, a lower measured entry barriers is significantly associated with a lower average firm age and a larger share of employment in new firms. We interpret these findings as evidence that our measured entry barriers are economically relevant and do indeed capture mechanisms associated with firm entry. This motivates why we, with some abuse of language, simply refer to ψ_t as an “entry barrier” and ignore an alternative interpretation as a prefecture-specific TFP shifter.

One could in principle have used these insights to quantitatively decompose the relative im-

portance of entry barriers (and selection) versus general TFP shifts in explaining wage growth. Such an exercise would, however, require firm-level panel data and ideally a richer model of firm dynamics than ours. Since we cannot link firms over time in our Census data, we leave this exercise for future research.

5.3 Firm productivity distributions: Evidence for the selection mechanism

Several authors have argued that if selection is relevant for growth, it would be manifested in the distribution of TFP across firms (see, e.g., Combes, Duranton, Gobillon, Puga and Roux (2012)). We now directly examine the distributions of firm TFP across locations. Our maintained assumption is that potential entrepreneurs in all locations draw their productivity from the same distribution f . As a result, aggregate wages and measured TFP can vary across locations only because of differences in the selection of entrepreneurs: a high TFP threshold z^* induces high selection of firms and, in turn, high wages and high measured aggregate TFP.

This assumption has two implications. First, the lower tail of the TFP distribution should be thinner in locations with high wages.²¹ The reason is that entrepreneurs in a high-wage location have a larger z^* , so their TFP distributions are left-truncated at a higher level of TFP. Second, when drawing from a common distribution f , the upper tail of the TFP distribution of a location should be invariant to the wage level. Therefore, even though there are fewer productive entrants in low-performing locations where z^* is low, the distribution of the most productive firms should, according to the model, be identical.

To examine these theoretical implications we compare distributions for two groups of prefectures based on their mean wages. We sort all prefectures on their average wages and classify those in the 5-25 percentiles as low-wage prefectures and classify those in the 75-95 percentiles as high-wage prefectures. Online Appendix Figure B-4 plots the entire empirical distribution of firm-specific TFP for each group of prefectures in 1995 and in 2008. We report the distribution of the log of Hicks-neutral TFP, $\log(z^{1-\eta})$. The distribution is smoothed using an Epanechnikov kernel function and reported as the log density of log firm TFP.

The figure shows that the bottom tail of the distribution is fatter in low-wage prefectures, consistent with the view that selection is an important factor in firm TFP differences across prefectures.

Online Appendix Figure B-5 examines the upper tail of the TFP distribution across the two types of prefectures in more detail by focusing on firms in the top 5% of the overall productivity distribution. The figure shows that the upper tails are similar across high- versus low-wage prefectures. This is consistent with our assumption that the distributions are the same across locations and also consistent with the mechanism in our model through which selection affects the lower tail of the firm TFP distribution but not the upper tail. Moreover, the fact that the graphs in Online Appendix Figure B-5 are approximately linear suggests that the upper tail of the empirical firm TFP distribution is close to being Pareto distributed.

²¹ As discussed above, if the TFP distribution were Pareto as our theoretical analysis assumes, a common TFP shift would have a similar implication. We made the Pareto assumption to retain analytical tractability – the alternative would be to solve the model numerically. While the lower end of the empirical TFP distribution may not be Pareto, a barrier to entry would have the same qualitative effect: places with lower barriers would have more entry, higher wages, and a higher TFP threshold. Therefore, the left tail of the TFP distribution would be thinner, independent of the distribution for new TFP draws, f . Combes et al. (2012) pursue a related approach to examine the role of selection versus agglomeration in explaining spatial productivity differences related to city size. They find that agglomeration effects are important in explaining TFP differences across cities in France, and that selection plays no role.

6 Accounting for Convergence in TFP and Wages

Our paper aims to explain the strong regional convergence in aggregate TFP and wages documented in Section 2. In this section we use our model as a measurement device to account for the convergence. The model features five possible factors causing changes over time in aggregate allocations and prices in a prefecture: the three wedges, the ratio of workers per potential entrepreneur, and the prefecture-specific production function (i.e., the weight on labor supply in the production function, $\alpha\eta$).²² The production function matters because changes in industrial structure – for example, growth in the relative preponderance of labor-intensive industries – can have consequences for the labor market and wages.

Table 6 reports the annualized rate of β -convergence for aggregate TFP and wages under various counterfactual model scenarios. The first row reports the annualized 1995-2004 and 1995-2008 rates of convergence in TFP and wages.²³ To decompose the overall rates of convergence into each of the five possible sources of change, we use equations (6) and (7) to compute counterfactual rates of convergence for prefecture-specific TFP and wages in 2004 (2008) under the assumption that only one factor changed between 1995 and 2004 (2008) and all other factors remained at their 1995 level. The five prefecture-specific factors we consider are (i) the entry barrier $1 - \psi$; (ii) the capital wedge τ_k ; (iii) the output wedge τ_y ; (iv) changes in the average labor share; and (v) the effective number of workers per potential entrepreneur N/M . The effect of N/M can be further decomposed into changes in (a) the migration of workers m_n , (b) the migration of potential entrepreneurs m_e , and (c) NSOE workers per potential entrepreneur.

The main message from the first two columns of Table 6 is that changes in the entry barrier account for essentially all the convergence in TFP. Thus, if the only change after 1995 had been the estimated changes in the entry barriers, the model would have accounted for the lion’s share of convergence. This reflects the fact that the dispersion in entry barriers fell sharply over time, and more so in areas with low initial TFP and wages.

The second most important factor is the output wedge, accounting for about one quarter of the convergence in aggregate TFP. This is because the dispersion across prefectures in the output wedge fell and τ_y increased more in areas where aggregate TFP was initially low.²⁴ The other factors play only minor quantitative roles in accounting for the convergence in aggregate TFP.

The findings for wages (the last two columns of Table 6) echo the results for aggregate TFP: the entry barrier emerges as the main factor driving the convergence of wages, accounting for two-thirds of the convergence over the 1995-2008 period and for somewhat less in the 1995-2004 period. Changes in the capital wedge and in the technological labor share also contribute to explaining parts of the convergence in wages, although these factors are quantitatively less important than the entry barrier. Note that while changes in the output wedge could explain some of the convergence

²²Our calculations take the N/M ratio as exogenous. We discuss below how our results would change if the N/M ratio were endogenous and could respond to changes in the wedges.

²³The numbers for the overall convergence are slightly different from the numbers reported in Table 1. There are two reasons for this. First, the calculations in Table 1 are based on data from the largest sample of prefectures for which we can calculate aggregate productivity (more than 300 prefectures). The calculations underlying Table 6 require additional data on migration, needed to measure N/M . This reduces the sample by around 15%. Second, since the model does not explicitly incorporate different industrial sectors, prefecture TFP is computed using equation (7) and an averaged prefecture-level labor share. In contrast, the TFP measures reported in Table 1 are obtained by averaging over TFP measures computed at the sectoral level in each prefecture. This leads to slight differences in the reported convergence in TFP, although the overall patterns remain unchanged.

²⁴To see this, consider Figures B-6 and B-7 in Online Appendix B. The figures show that the dispersion across prefectures in the measured gross output wedge $1 - \tau_y$ is decreasing over time, and it is prefectures with a large SOE sector (i.e., a large SOE share) which on average experience the largest decline in $1 - \tau_y$ and, hence the largest decline in implicit subsidies.

Table 6: Annual Rate of Convergence in TFP and Wages: 1995-2004 and 1995-2008.

Change in	TFP		Wages	
	1995-2004	1995-2008	1995-2004	1995-2008
all	0.028	0.023	0.068	0.075
$(1 - \psi)$	0.029	0.027	0.019	0.032
$(1 + \tau_k)$	-0.005	-0.004	0.015	0.019
$(1 - \tau_y)$	0.008	0.008	-0.001	-0.016
$\alpha\eta$	-0.004	-0.003	0.020	0.019
N/M	-0.001	-0.001	0.003	-0.001
- m_N	0.002	0.001	0.009	0.008
- m_e	-0.000	-0.000	-0.003	-0.004
- NSOE share	-0.002	-0.002	-0.005	-0.005

Notes: The table reports the annual rate of convergence in TFP and wages across prefectures for the 1995-2004 and 1995-2008 time periods. The β -convergence coefficient for prefectures p between times t_0 and $t_0 + T$ is estimated from the regression $(\frac{1}{T}) \ln \left(\frac{y_{p,t_0+T}}{y_{p,t_0}} \right) = a - \left(\frac{1-e^{-\beta T}}{T} \right) \ln(y_{p,t_0}) + u_{pt_0,t_0+T}$, where u_{pt_0,t_0+T} represents an average of error terms, $u_{p,t}$, between times t_0 and $t_0 + T$. Each row in the table reports what the convergence in TFP and wages would have been had only one of the listed variables changed. The row “all” allows all factors to change and captures by construction the estimated empirical convergence rate. The top and bottom 1% observations for each variable change are dropped.

in aggregate TFP, this factor contributes negatively to the convergence in wages. This reflects the fact that changes in the output wedge have opposite effects on aggregate TFP and wages (cf. Proposition 1). Recall from Table 2 that the empirical aggregate TFP and empirical wages are positively correlated, both in levels and in changes. Therefore, if the output wedge gives a positive contribution to observed convergence in TFP, it would tend to contribute negatively to observed convergence in wage rates.

Consider, next, the role of the effective labor supply N/M , which we measure as private manufacturing employment per potential entrepreneur (N/M). Recall that changes in N/M move wages and aggregate TFP in the same direction. Table 6 documents that the measured changes in N/M are not quantitatively important in accounting for convergence in TFP and wages. This means that the changes in N/M were largely uncorrelated with changes in wages and TFP. If anything, N/M provided a slightly negative contribution to convergence, suggesting that N/M must have grown slightly more (less) in places that had relatively low (high) wages and TFP in 1995.

This conclusion does not necessarily imply that the contribution of each of the components of effective labor supply per entrepreneur is small. We now decompose the contribution of N/M into components reflecting migration of workers (m_N), migration of entrepreneurs (m_e), and the employment share of non-state firms, i.e., the share of workers in manufacturing not employed by state firms (NSOE share).

Consider, first, the role of migration of workers (m_N), holding fixed all other components, including m_e and the NSOE share. As one might expect, m_N has a large effect on convergence of wages, accounting for around 10 percent of the 1995-2008 convergence. This is because workers tend to migrate from low-wage to high-wage locations. The contribution to convergence of aggregate TFP is also positive, albeit quantitatively small.

Next, consider migration of entrepreneurs: m_e has a negative contribution to convergence of wages and TFP. This is because a larger m_e lowers N/M and because migration flows of entrepreneurs tend to follow migration of workers, counteracting the effect of worker migration.

Finally, we analyze the effect of changes in the NSOE share, i.e., the share of non-state employment in manufacturing. The contribution to convergence is negative both for TFP and wages. One reason for this is that the NSOE share increased almost everywhere but more so in the places where wages and TFP were initially low. We conclude that the reason why N/M has close to zero effect on convergence is because the effects of m_N , m_e , and NSOE share tend to offset each other.

Our decomposition analysis has taken the geographical distribution of workers and potential entrepreneurs as exogenous and abstracted from possible endogeneity in N and M . In particular, the decompositions in Table 6 are performed keeping all factors – including the N/M ratio – constant at their 1995 levels and changing one factor at the time. This amounts to imposing a zero elasticity of N/M to changes in the wedges. How would our analysis change if we endogenized the process of migration and manufacturing employment? General-equilibrium effects of wedges through migration decisions could in principle affect how changes in wedges propagate to allocations and prices. For example, the effect of a lower entry barrier could be mitigated if the associated increase in wages would trigger an increase in N/M .²⁵ We believe these potential concerns are not quantitatively important because the realized movements in N/M turn out to be quantitatively unimportant for understanding regional convergence (cf. Table 6). This suggests that the elasticity of N/M to changes in the wedges must be low, possibly because better business environments attract both more workers and more potential entrepreneurs, rendering the N/M ratio approximately unchanged. We therefore conclude that our decomposition analysis of the effect of the wedges would be quantitatively and qualitatively robust to incorporating the endogenous effects of N/M .²⁶

6.1 Aggregate growth

While the focus of this paper is on regional convergence, our model also has implications for aggregate growth since the wedges and migration patterns can, by construction, account for the aggregate allocations for each prefecture. We now use the model to investigate the contribution of each of the wedges for aggregate growth. Recall that we have normalized the entry barriers so that for each year t , the prefecture with the lowest entry barrier is normalized to zero, i.e., $\min_p\{\psi_{p,t}\} = 0$. Therefore, if entry barriers were falling everywhere, which seems likely, our normalization of ψ would lead us to underestimate the role of changes in entry barriers for accounting for growth.²⁷

Table 7 reports the results. The most important driver of GDP growth is, as one might expect,

²⁵Note that our measurements of the wedges (ψ, τ_k, τ_y) would not be affected by endogenizing N/M because the measurement equations (10)-(11) and (13) explicitly incorporate data on N/M .

²⁶An alternative approach is to provide an explicit model of migration of workers, entrepreneurs, and growth in manufacturing employment. One drawback with such an approach is that we would have to do all the analysis at the province level instead of at the prefecture level. The reason is that we have data on the province of origin for workers and entrepreneurs but not prefecture-level data on origin. We would then lose significant and valuable data on variation across prefectures within provinces. We leave such an extension for future work.

²⁷A decline in entry barriers everywhere is suggested by the changing relationship between the Chinese Communist Party (CCP) and private entrepreneurs. In 2001, for example, CCP leader Jiang Zimin recommended that private entrepreneurs be allowed to join the Party. On this point, see Dickson (2003).

growth in the term \underline{z} , which reflects general TFP growth, common to all locations. The second most important driver is the dynamics of the entry barriers, accounting for one-fifth of the aggregate TFP growth and one-third of the aggregate wage growth. The other wedges play a positive but small role for growth in TFP and a negative role for growth in wages. The output wedge has a particularly large negative contribution to wages because this wedge tended to become substantially more adverse over time. We conclude that growth in wages and output are mainly associated with TFP growth which in turn is driven by growth in \underline{z} and convergence in ψ . The conclusion that aggregate GDP growth in China is primarily driven by productivity growth is in line with the finding of the broader dynamic macroeconomic literature on China, including Brandt and Zhu (2010), Cheremukhin et al. (2015), Song et al. (2011), and Tombe and Zhu (2019).

Table 7: Increase in Y, Y/N, TFP and Wages: 1995-2008.

	Y	Y/N	TFP	w
Change in log	2.35	1.89	1.13	1.47
Fraction (in percent) accounted for by:				
$(1 - \psi)$	19	24	20	31
\underline{z}	74	91	75	116
$(1 - \tau_y)$	-6	-7	5	-27
$(1 + \tau_k)$	-9	-11	6	-12
N/M	22	2	-7	-10

Notes: The table report the share of aggregate growth that can be accounted for by changes in each of the factors.

7 The Role of the State Sector

Section 6 established that the entry barrier is the most important factor for understanding the convergence in aggregate TFP and wages across prefectures in China. Earlier, we also presented evidence suggesting a strong positive relationship between the size of the SOE sector and the size of the entry barrier in a prefecture. So far, we have interpreted this as a mere correlation. In this section, we argue that there is a causal relationship between the size of the SOE sector and the entry barrier in a prefecture – a larger SOE sector in a prefecture is associated with a larger entry barrier in the cross section, and prefectures that experienced larger declines in their SOE sector shares also saw larger decreases in their entry barriers. As a consequence, the size of the state sector, through its effect on entry barriers, should influence wages, value-added per worker, TFP, and capital per worker in the non-state sector.

7.1 Entry barriers and the size of the state sector

7.1.1 The state sector in the cross-section

We start by studying the empirical covariates for the entry barrier in the cross section. Utilizing data for 1995, 2004 and 2008, we estimate equation (16) in the cross section, where $\ln(1 - \psi)_{p,t}$ is the log gross entry barrier in prefecture p in year t , $S_{p,t}$ is the employment share of the state sector in prefecture p in year t , $X_{p,t}$ is a vector of prefecture characteristics that might also influence entry barriers, and $\epsilon_{p,t}$ is an idiosyncratic error term:

$$\ln(1 - \psi)_{p,t} = \beta_0 + \beta \cdot S_{p,t} + X_{p,t}\gamma' + \epsilon_{p,t}. \quad (16)$$

Using data from the 1990 Census, we control for prefecture-level differences in educational attainment, labor force participation, and the share of workers in agriculture. In addition, for 1995 and 2004 we have information on the fiscal revenue per government worker in each prefecture. Since the number of government workers is determined exogenously – set by a centrally determined policy rule as a percentage of the registered population – differences in fiscal revenue per worker must largely reflect differences on the revenue side. Effects of these variables on the entry wedge could be working through a number of alternative channels. More fiscal resources, some of which came from SOEs, may have had the opposite effect on cadre behavior towards private firms, and made it easier for local governments to make complementary investments to support the state sector.

Estimation of equation (16) may be affected by the endogeneity of the state sector as well as measurement issues. Changes in ownership codes between 1995 and 2004 make identification of state ownership and control less precise in later years. Shareholding companies become an important new ownership type in 2004, a majority of which are state-owned and controlled. Our data only identify shareholding companies and do not separately identify those under state control, leading to a likely overestimate in the size of the state sector when all shareholding companies are classified as state-owned.

To address these concerns, we use a set of alternative instrumental variables. IV_{lag} uses as an instrument the lagged value, $S_{p,t-1}$, of the SOE employment share of prefecture p , where the lagged value refers to the SOE employment share in prefecture p , observed in the previous Chinese Industrial Census (CIC). The next two instruments exploit information on the size of the state sector in 1978, which itself heavily reflects historical factors exogenous to prefectures such as the Third Front policies under the CCP in the 1960s and early 1970s and the Kuomintang (KMT) shift of industrial capacity inland (see Naughton (1988) and Brandt, Ma and Rawski (2017)). Reflecting these policies, coastal provinces had less manufacturing activity per capita and also a smaller role of the state sector in manufacturing than the interior provinces when reforms began in the late 1970s. We construct the IV_{1978} instrument using the sample of firms in the 1995 Census that were established in or before 1978, and compute an SOE employment share for prefecture p . Because of limited firm exit between 1978 and 1995, this provides a good measure of the size of the state sector in 1978. Finally, we run the analysis at the province level and construct the IV_{prov} instrument at the province level using 1978 provincial data on SOE output shares in industry.

We report the cross-sectional results in Table 8. In the individual cross sections for 1995, 2004 and 2008, the OLS coefficient on the size of the state sector is consistently negative and highly significant, and declines slightly over time. These results suggest that prefectures with the largest (smallest) state sectors had the highest (lowest) entry barriers. Consider now the IV regressions. In all first-stage versions of the regressions the instrument is highly significant and the R^2 is high. Compared to the OLS, the IV results suggest larger effects on the size of the state sector on measured entry barriers, with the differences most pronounced in 2004, the year in which measurement issues

Table 8: The Entry Barrier in 1995, 2004, and 2008.

	$\ln(1 - \psi)$	<i>OLS</i>	<i>IV_{lag}</i>	<i>IV₁₉₇₈</i>	<i>IV_{prov}</i>
1995	<i>S</i>	-12.3*** (1.16)	-15.4*** (1.44)	-13.3*** (1.46)	-13.4*** (3.97)
	$\ln FREV$	1.44*** (0.40)	0.97** (0.42)	1.29*** (0.42)	0.91 (1.28)
	Controls	Yes	Yes	Yes	Yes
<i>First stage:</i>					
	<i>IV coefficient</i>		0.72***	0.94***	1.07***
	<i>st. error</i>		(0.03)	(0.05)	(0.18)
	<i>R²</i>		0.75	0.73	0.77
2004	<i>S</i>	-9.9*** (1.30)	-14.7*** (2.09)	-16.7*** (2.37)	-19.6*** (5.77)
	$\ln FREV$	1.61*** (0.48)	1.08** (0.52)	0.86 (0.54)	0.88 (0.85)
	Controls	Yes	Yes	Yes	Yes
<i>First stage:</i>					
	<i>IV coefficient</i>		0.62***	0.70***	0.85***
	<i>st. error</i>		(0.05)	(0.07)	(0.22)
	<i>R²</i>		0.54	0.48	0.64
2008	<i>S</i>	-11.1*** (1.35)	-11.5*** (1.56)	-15.2*** (2.33)	-8.3* (4.66)
	Controls	Yes	Yes	Yes	Yes
	<i>First stage:</i>				
	<i>IV coefficient</i>		0.88***	0.70***	1.04***
	<i>st. error</i>		(0.03)	(0.06)	(0.26)
	<i>R²</i>		0.78	0.44	0.50

Notes: The table reports the OLS and IV results from a regression of the log gross entry barrier on the SOE employment share (*S*) and fiscal revenues per government worker (*FREV*) in a prefecture in 1995. Controls include average educational attainment, agricultural employment share, and labor force participation rate in 1990. *S* is available in all years. *FREV* is available in 1995 and 2004. Standard errors are in parentheses. *** – statistically significant at 1%; ** – statistically significant at 5%; * – statistically significant at 10%.

are likely most pronounced. This is consistent with a standard attenuation bias of the OLS due to measurement error. For 1995 we also find that entry barriers were higher in prefectures in which the state sector was more profitable, and lower in prefectures in which fiscal revenue per government worker was larger. For 2004 we do not have information on SOE profitability, but find that fiscal

revenue continues to be important.

7.1.2 Changes in the size of the state sector

A potential concern for the cross-sectional results in Table 8 is that our estimates of the effect of the state sector remain contaminated by the effect of unobserved heterogeneity. There are several additional solutions. In order to eliminate any time-invariant fixed effects at the prefecture level that might be correlated with $S_{p,t}$, we can exploit the panel dimension of the data and estimate Equation (16) in first differences, or Equation (17),

$$\Delta \ln(1 - \psi)_{p,t} = \beta_0 + \beta \cdot \Delta S_{p,t} + \Delta X_{p,t} \gamma' + \Delta \epsilon_{p,t}. \quad (17)$$

Conditional on prefecture fixed effects, changes in the share of SOEs in a prefecture may still be potentially endogenous: Unobserved shocks may affect both the share of the state sector in a prefecture and entry barriers. We also cannot rule out here the influence of measurement error related to changes in ownership codes or the possibility of reverse causality, namely, that changes in entry barriers influence the employment and output of SOEs.

A Bartik instrument. To address these concerns, we take advantage of the major 1997 policy reform embedded in China’s Ninth Five-Year plan to restructure the state sector. The program was to close down loss-making state-owned firms under the slogan “Grasp the Large, Let Go of the Small” (*Zhuada Fangxiao*).²⁸ In addition to reducing the size of the state sector in terms of the number of firms and workers, a major objective of this reform was to concentrate state industry activity in sectors identified as strategic or pillar. Typically, these were more capital and skill-labor intensive sectors that were often upstream in the value chain.

We construct Bartik (1991) instruments for the changes in local SOE employment by using national-level data on the changes between 1995 and 2004 in SOE employment at the sector level.²⁹ A weighted average of changes at the national level should be a good predictor of prefecture-level changes in SOE employment, where the weights are the share of total SOE employment in a prefecture in 1995 in each sector k . The instrument we use scales the predicted percentage change in SOE employment by the share of SOEs in total manufacturing employment in 1995. This allows the impact of the policy change to be larger where the state sector is initially more prominent.³⁰

The key identifying assumption of this instrument is that the composition of local employment in the state-sector is orthogonal to the error term in Equation (17). This is plausible in light of our earlier discussion that local SOE employment and industrial composition of SOE firms in 1995 were

²⁸Some firms that were SOEs in 1995 were privatized as a consequence of this policy. However, these are minor compared to the number of *de novo* private firms that were established before 2004.

²⁹Since we do not have a similarly good IV for the changes in the size of the state sector between 2004 and 2008, we limit our analysis to the changes between 1995 and 2004.

³⁰Formally, the instrument is constructed as follows. Let the level of SOE employment at the national level in sector k and time t be given by $E_{k,t}^{soe}$. The national growth in SOE employment in sector k can then be expressed as $\mu_k^{soe} \equiv E_{k,2004}^{soe}/E_{k,1995}^{soe} - 1$. Moreover, let $E_{k,t,p}^{soe}$ denote the SOE employment in sector k in prefecture p in period t . The weights for constructing the Bartik instrument are the share of SOE employment accounted for by SOE firms in sector k in 1995, i.e., $\phi_{p,k} \equiv E_{k,1995,p}^{soe}/\sum_j E_{j,1995,p}^{soe}$, where these shares sum to unity, $\sum_k \phi_{p,k} = 1$. Finally, and let $E_{t,p}$ denote total manufacturing employment (SOE plus NSOE) and let $S_{t,p} \equiv \sum_j E_{j,t,p}^{soe}/E_{t,p}$ denote the SOE share of total manufacturing employment in period t and prefecture p . Our instrument for the change in SOE employment between 1995-2004 measured relative to the state sector’s share of total manufacturing employment in prefecture p is given by:

$$IV_p = S_{t,p} \sum_k \phi_{p,k} * \mu_k^{soe}.$$

largely a product of central government policies before 1978 and arguably random across locations. Note also that the 1997 reform was a national policy and arguably exogenous to each prefecture.

Table 9: Change in the Entry Barrier and the SOE Sector, 1995-2004.

$\Delta \ln(1 - \psi)$	<i>OLS</i>	<i>OLS</i>	<i>IV_{Bartik}</i>	<i>IV_{Bartik}</i>
ΔS	-1.58 (1.16)	-1.44 (1.28)	-7.41*** (2.61)	-8.31*** (2.87)
$\Delta \ln FREV$		1.30*** (0.40)		0.91** (0.44)
<i>First stage:</i>				
<i>IV coefficient</i>			0.61***	0.64***
<i>st. error</i>			(0.07)	(0.08)
R^2			0.21	0.24

Notes: The table reports the OLS and IV results from a regression of the change in the log gross entry barrier on the change in the SOE employment share (ΔS) and in the log fiscal revenues per government worker ($\Delta \ln FREV$) in a prefecture between 1995 and 2004. Standard errors are in parentheses. *** – statistically significant at 1%; ** – statistically significant at 5%; * – statistically significant at 10%.

In Table 9, we report the results from the fixed effects regression using the data for 1995 and 2004.³¹ Results for the simple first differences reported in columns (1) and (2) continue to indicate that the entry barriers fell more in areas where state employment declined. However, the magnitude of the effect is significantly smaller – around one sixth – than that suggested by results in Table 8. Columns (3) and (4) report Bartik instrument results, with first-stage results reported in the lower panel. Changes at the national level in sector level SOE employment are a very good predictor of changes in the share of the SOEs by prefecture. The IV coefficient on the size of the state sector is also significantly larger than the OLS FE estimates in (1) and (2), and the magnitude of the coefficient is more in line with our estimates from the cross-section. These estimates imply that the size of the state sector has a causal and economically significant negative effect on entry barriers at the prefecture level. Moreover, in prefectures where the SOE employment is predicted to fall more between 1995 and 2004, entry wedges experience an even faster decline.

7.2 The state sector and regional convergence

The previous section established that employment changes in state-owned firms cause lower entry barriers. Motivated by this evidence, we now revisit our empirical results in Table 1 on regional convergence and investigate how changes in state employment affect the observed growth rates of wages, output per worker, capital per worker, and TFP in NSOE firms. Due to the endogeneity concerns discussed above, we address this question by applying our Bartik instrument.³² We include

³¹The analysis in this section has focused on the entry barrier. However, state employment could matter also for the other wedges. In Table B-1 in the Online Appendix B we report results for the effect of the Bartik-instrumented change in SOE employment on the gross output and capital wedges. That table shows that a larger predicted reduction in SOE employment causes a reduction in τ_k and an increase in τ_y . All effects are significant.

³²Simply including the observed changes in SOE employment as an explanatory variable in the growth regressions would be subject to the same potential endogeneity and reverse causality issues as the entry-barrier regressions in

in the regression the initial level of $\log(x)$ in 1995 and province-level fixed effects.

Table 10: NSOE growth and the role of the state sector, 1995-2004

	$\Delta \ln w$	$\Delta \ln(VA/N)$	$\Delta \ln TFP$	$\Delta \ln(K/N)$
$\Delta \hat{S}_p$	-0.52*** (0.18)	-1.21*** (0.29)	-0.36 (0.26)	-1.87*** (0.39)
$\ln x_{1995}$	-0.51*** (0.04)	-0.44*** (0.05)	-0.36*** (0.06)	-0.51*** (0.07)
Province F.E.	Yes	Yes	Yes	Yes
First stage				
β_{IV}	0.83***	0.87***	0.87***	0.88***
s.e.	(0.09)	(0.09)	(0.09)	(0.09)
adj. R^2	0.38	0.36	0.36	0.36

Notes: The table reports the 1995-2004 growth in average wages, value added (VA) per worker, TFP, and log capital per worker for NSOE firms across prefectures. The role of the state sector growth is instrumented by IV_{Bartik} . Notes: Standard errors are in parentheses. *** – statistically significant at 1%; ** – statistically significant at 5%; * – statistically significant at 10%.

Table 10 contains two important results. First, the results on unconditional β -convergence across regions are robust to including instrumented changes in SOE employment and province fixed effects as explanatory variables. When these controls are included, the rate of conditional convergence is larger for TFP and wages and smaller for output per worker and capital per worker – all relative to the results in Table 1.³³ Second, and more importantly, the instrumented changes in SOE employment have strong and significant effects on regional growth rates of wages, value-added per worker, TFP, and capital per worker of non-state firms.³⁴ This establishes a causal role of SOE employment for NSOE firm performance. Namely, in prefectures where the SOE employment is predicted to fall more between 1995 and 2004, the prefecture experiences faster growth in wages, output per worker, capital per worker, and aggregate TFP.

To illustrate the quantitative magnitudes of the results in Table 10, we evaluate the effect of a one standard deviation change of the instrument, a decline of about 9 percent of total manufacturing employment. In this case, the 1995-2004 *annualized* growth in wages is predicted to increase by 0.5 percent, output per worker by 1.1 percent, aggregate TFP by 0.3 percent, and capital per worker by 1.7 percent. These effects are economically significant.

Based on this evidence, we conclude that the 1997 SOE reform was a major contributor to growth and regional convergence for private sector in China. Moreover, our results in Section 7.1

Section 7.1. Potential general-equilibrium effects of SOE layoffs on non-state firms would, if anything, run against our subsequent findings. For example, if laid-off state workers were to put downward pressure on wages in private firms, then more SOE layoffs should be associated with lower wage growth in private firms.

³³Once the controls are added, the annualized rate of convergence increases to 5.0% for TFP, up from 2.6% in Table 1. For wages, output per worker, and capital per worker the rates of convergence change to 7.9%, 6.4%, and 7.9%, respectively.

³⁴The results for aggregate TFP growth are robust to alternative weighting schemes for calculating TFP growth. In Table A-1 in Online Appendix A we show that the coefficient on the Bartik instrument is robust to using the relative share of value added Y of each industry in that prefecture and to basing the weights entirely on 1995.

suggest that a key mechanism for this was through the effect of SOEs on the entry barriers.

7.3 A political economy model of wedges

Why would the size of the state sector matter for the wedges and barriers facing non-state firms? To address this issue, this section provides a version of the benchmark model extended to incorporate the presence of SOEs alongside private firms. The purpose of the extension is to develop a simple political economy model for the determination of the wedges that can provide a theoretical motivation for the causal relationship between the observed entry barriers and the size of the SOE sector that we documented in Tables 8 and 9. We emphasize the important role played by local cadres for explaining this link.

We assume that there is a unit measure of potential SOEs with the same production function as NSOEs, eq. (1). For simplicity we abstract from wedges on output and capital for SOEs (i.e., $\tau_y^{SOE} = \tau_k^{SOE} = 0$). We model the labor market the same way as Song et al. (2011), where the SOEs hire workers in competition with the NSOE sector.³⁵ Following the analysis in Section 3, the aggregate labor demand of SOEs is then given by

$$\Lambda_{SOE} = \frac{\xi \underline{z}}{\xi - 1} \left(\frac{1 - \eta}{\nu} \right)^{\xi - 1} \left(\frac{(1 - \alpha)\eta}{r + \delta} \right)^{\xi \frac{(1 - \alpha)\eta}{1 - \eta}} \left(\frac{\alpha\eta}{w} \right)^{1 + \xi \frac{\alpha\eta}{1 - \eta}}.$$

We assume that the three wedges for private firms, (ψ, τ_y, τ_k) , are set by the local government in the prefecture. We label the decision maker as the *local cadre*. We impose two constraints on the wedges. First, they must be non-negative.³⁶ Second, local cadres set the wedges to ensure that the equilibrium state employment in the prefecture meets an exogenous target $\Lambda_{SOE} = \bar{\Lambda}_{SOE}$, which is set by higher levels of government and can differ between prefectures.³⁷

Note that an increase in any of the wedges will increase SOE employment. The cadre therefore faces a trade off between the various wedges when meeting the hiring requirement. To see this, note that market clearing requires that non-state labor demand is $N = 1 - \bar{\Lambda}_{SOE}$ (where aggregate labor supply has been normalized to unity). Substituting NSOE labor demand and the equilibrium wage rate into this market-clearing condition yields a condition linking the wedges to the hiring requirement,

$$\frac{1 - \bar{\Lambda}_{SOE}}{\bar{\Lambda}_{SOE}} \frac{1}{(1 - \psi)} = (1 - \tau_y)^{\frac{\xi}{1 - \eta}} \left(\frac{1}{1 + \tau_k} \right)^{\xi \frac{(1 - \alpha)\eta}{1 - \eta}}. \quad (18)$$

It follows that the (target) state employment $\bar{\Lambda}_{SOE}$ is increasing in each of the wedges, (ψ, τ_k, τ_y) . The reason is that an increase in any of the wedges lowers NSOE demand for workers and, hence, equilibrium wages. This affects SOE employment along both the extensive and the intensive margin: with lower wages less efficient SOE firms can operate (i.e., more SOE entry), and the lower wages make it optimal for each SOE firm to hire more workers.

We focus on the case where $\bar{\Lambda}_{SOE} > 1/2$ to ensure that the SOE employment constraint is relevant in the sense that state firms need to be favored relative to non-state firms in order to satisfy the SOE hiring constraint.

³⁵For simplicity we assume that SOEs and NSOEs pay the same wages. Forcing SOEs to pay an exogenous wage premium for workers would not affect the qualitative results. The key assumption is that SOEs compete with private firms for some factor in short supply, be it workers, high-skilled workers, managers, land, or other input factors.

³⁶The constraint $\psi \geq 0$ is natural. The constraints $\tau_y \geq 0$ and $\tau_k \geq 0$ can be motivated by limited government funds ruling out outright subsidies.

³⁷See, for example, Brandt and Zhu (2000) and Wang (2017) for possible political economy motivations for such a requirement on state employment.

Consider now the objective of the local cadre. We assume that the cadre wants to maximize profits for an entrepreneur, conditional on obtaining a licence and their TFP, z . This captures the notion of *crony capitalism*, i.e., that the cadre may want to help a friend (crony) who is a potential NSOE entrepreneur (see e.g. Bai, Hsieh and Song (2018) for a motivation for this assumption), but that the cadre has limited policy instruments for achieving this goal. On the one hand, the cadre can subsidize the entrepreneur by choosing low capital or output wedges (although all firms will benefit from these subsidies). On the other hand, the cadre can restrict entry for anonymous potential entrepreneurs by setting a large ψ , while at the same time guaranteeing that their entrepreneur friend will be allowed to operate.

Conditional on operating the firm the entrepreneur's profits – net of the implicit taxes on capital and output – are given by:

$$\Pi(z) = \frac{z}{1-\psi} \frac{1-\bar{\Lambda}_{SOE}}{(\bar{\Lambda}_{SOE})^{\frac{1-\eta}{\xi\alpha\eta+1-\eta}}} \cdot \frac{1-\eta}{1+\mu} \left(\frac{\xi z}{\xi-1} \left(\frac{1-\eta}{\nu} \right)^{\xi-1} \left(\frac{(1-\alpha)\eta}{r+\delta} \right)^{\xi \frac{(1-\alpha)\eta}{1-\eta}} \right)^{\frac{1-\eta}{\xi\alpha\eta+1-\eta}}.$$

The profits $\Pi(z)$ are increasing in the entry barrier. The reason is that entrepreneurial talent is a scarce resource, and with fewer potential entrepreneurs the profits are higher conditional on z . However, note that the entrepreneur's expected profits are independent of the output and capital wedges. This is due to the fact that profits $\Pi(z)$ can be expressed as a function z , ψ , and the right-hand side of equation (18). Thus, conditional on ψ and $\bar{\Lambda}_{SOE}$, any combination of (τ_k, τ_y) that satisfies equation (18) will give rise to the same profits. A lower τ_k will therefore have to be offset by a higher τ_y in order to satisfy the hiring constraint, rendering profits invariant.

Under these assumptions about the local cadre's problem, we find that the optimal way to satisfy the hiring requirement is to set the capital and output wedges to zero and set ψ so as to satisfy equation (18). This implies a high correlation between SOE employment Λ_{SOE} and entry barriers ψ . We state this result as a proposition (proved in the text).

Proposition 2 *The constrained optimal choice of wedges (ψ, τ_y, τ_k) is to set $\tau_k = \tau_y = 0$ and $\psi > 0$. Moreover, an exogenous increase in $\bar{\Lambda}_{SOE}$ implies a larger entry barrier ψ .*

In the empirical analysis in Section 7.1 we introduced two Instrumental Variables for $\bar{\Lambda}_{SOE}$: lagged SOE employment and the Bartik instrument. First, the central and provincial governments may want the local government to maintain the current level of SOE employment, thereby upholding the legacy of the state sector. In this case the historical level of state employment in the prefecture should be expected to influence $\bar{\Lambda}_{SOE}$. Second, the 1997 SOE reform, which was imposed by the central government, involved large-scale reductions in state employment in industries deemed to be non-strategic from the point of view of national security. We interpret this as an exogenous reduction in $\bar{\Lambda}_{SOE}$. The implication of Proposition 2 and our choice of Instrumental Variables for the hiring constraint $\bar{\Lambda}_{SOE}$ is that the entry barrier should be larger in areas with historically higher levels of state employment and should fall more in areas where state employment was more significantly scaled back after 1997. This is consistent with the results in Tables 8 and 9.

7.3.1 Discussion: Why would SOEs matter for new private start-ups?

The political economy model of the determination of wedges above assumes that the local government faces pressure to meet an exogenous target for state employment, \bar{N}_{SOE} . We motivate this assumption as follows. Local officials, e.g. party secretaries and mayors, are appointed by higher levels of government and are tasked with multiple objectives. Much of the focus in the literature

– see e.g., Li and Zhou (2005) and Xu (2011) – is on the high-powered incentives local leaders have to promote economic growth, but equally important through the nomenklatura system is their role in supporting state-owned enterprises. The performance of SOEs is important for Communist Party and for officials at all levels. Indeed, state-owned firms themselves have multiple mandates. As a major source of employment in the cities, SOEs have been perceived as policy instruments for maintaining social stability, especially during economic downturns (Wang (2017)). Local cadres are beneficiaries of the success of SOEs in meeting the objectives of higher levels of government and of the Communist Party. SOEs are also potentially important sources of local government revenue and rents for local officials, often in the form of valuable jobs for family members and relatives as well as through highly lucrative business relationships with these same firms.

A key premise in the political economy model of this section is that the local government has access to policy instruments that may suppress the entry of private firms, and that local cadre often apply such policies, especially in areas where the state sector is prevalent. Market liberalization and easier entry for new private firms arguably pose threats to the position of the SOEs through pressures in the product market, and more importantly, through the competition for local scarce factors. Thus, by mitigating the growth of private firms, local cadre can prevent the flight of the most capable managers and workers (and other scarce factors) from the SOEs to the private sector. Whiting (2006) documents that local officials erect various forms of barriers to entry and argues that the motivation for engaging in such behavior is that they seek to protect firms owned by local governments. This behavior manifests itself in the form of making it more difficult to obtain access to land, electricity and other scarce intermediate inputs, over which local governments have some discretion and control. In addition, in newly emerging sectors, ministries have often restricted entry by issuing few licences and by allocating these licenses to SOEs (Huang (2003)). More generally, local cadre can use their discretion over granting business licenses and influence over access to critical inputs to enrich family and friends in their networks, and thus themselves.

Barriers to entry in environments in which SOEs are dominant also take more indirect forms. Suppliers to state-owned firm must typically go through a lengthy certification process. On paper, this certification is to ensure that the supplier has the capabilities to meet the requirements laid out by the SOE. However, in practice the purpose of this process is to limit the access to act as a supplier to the SOEs to firms linked through personal networks either to officials in the state sector or local government (Interviews, 2017).

8 Extension: Heterogeneity of Wedges across Firms

In the model we have analyzed so far we assumed that the capital and output wedges were the same for all firms in a prefecture. In this section we extend our benchmark model to allow capital and output wedges to be firm-specific. Namely, we assume that there is heterogeneity in τ_{ik} and τ_{iy} across firms not only across locations but also across firms within each prefecture. We maintain the assumption that all prefectures have the same distribution f of potential z . However, due to selection in participation, there will be, in equilibrium, a correlation between z and wedges among firms that choose to operate.

Each potential entrepreneur can observe both her potential TFP, z_i , and her potential wedges, $\{\tau_{ik}, \tau_{iy}\}$, before deciding to enter. As we shall see, the entry decision of the potential entrepreneur depends on the entrepreneur’s realized wedges $\{\tau_{ik}, \tau_{iy}\}$. Therefore, the equilibrium distribution of observed TFP will be correlated with the wedges, even though the distribution of potential TFP is, by assumption, independent of the wedges. In order to ensure that the problem is analytically tractable we assume that the distribution of *potential* wedges is jointly log-normal across firms in

each prefecture. Denote the density function as $g(\tau_k, \tau_y)$, and let the moments be given by:

$$\begin{aligned}
E(\ln(1 + \tau_k)) &= \ln(1 + \bar{\tau}_k) - \frac{\sigma_k}{2} \\
E(\ln(1 - \tau_y)) &= \ln(1 - \bar{\tau}_y) - \frac{\sigma_y}{2} \\
var(\ln(1 + \tau_k)) &= \sigma_k \\
var(\ln(1 - \tau_y)) &= \sigma_y \\
cov(\ln(1 + \tau_k), \ln(1 - \tau_y)) &= \sigma_{ky}.
\end{aligned} \tag{19}$$

Note that the dispersion in wedges are mean-preserving spreads, implying that $E((1 + \tau_k)) = 1 + \bar{\tau}_k$ and $E((1 - \tau_y)) = 1 - \bar{\tau}_y$. Moreover, this extended model nests our benchmark model when $\sigma_k = \sigma_y = \sigma_{ky} = 0$.

Conditional on the individual state $s_i = \{z_i, \tau_{ik}, \tau_{iy}\}$, the optimal firm choices are still given by equations (3)-(4). Note in particular that the cutoff threshold $z^*(\tau_{ik}, \tau_{iy}, r, w)$ now differs across firms. Given the distributional assumptions it is possible to solve analytically for the wage that clears the labor market and for the associated aggregate Solow residual. We summarize these results in the following proposition.

Proposition 3 *Suppose there is within-prefecture heterogeneity in capital and output wedges. The equilibrium wage in a location is then given by*

$$\begin{aligned}
\ln w &= \mu(1 - \eta) \ln \left[(1 - \psi) \bar{z} \frac{M}{N} \right] \\
&+ \mu\xi \ln(1 - \bar{\tau}^y) - \mu\xi\eta(1 - \alpha) \ln \left((1 + \bar{\tau}^k)(r + \delta) \right) + \Omega \\
&+ \mu\xi \left(\frac{\xi}{1 - \eta} - 1 \right) \frac{\sigma_y}{2} + \mu\xi\eta(1 - \alpha) \left(\frac{\xi\eta(1 - \alpha)}{1 - \eta} + 1 \right) \frac{\sigma_k}{2} - \mu\xi^2(1 - \alpha) \frac{\eta}{1 - \eta} \sigma_{ky},
\end{aligned} \tag{20}$$

Moreover, the Solow residual is given by

$$\begin{aligned}
\ln Z &= \mu\alpha\eta(1 - \eta) \ln \left[(1 - \psi) \bar{z} \frac{M}{N} \right] - \mu(1 - \eta) \ln(1 - \bar{\tau}_y) \\
&+ \mu(1 - \eta)(1 - \alpha\eta(1 - \xi)) \ln(1 + \bar{\tau}_k) + \hat{\Omega} \\
&- (\xi - (1 - \eta)) \left(\frac{1}{1 - \eta} + \mu \right) \frac{\sigma_y}{2} \\
&- [2(1 - \eta)(1 - \alpha\eta) + \alpha\xi\eta(2 - \eta(1 + \alpha))] \frac{\mu(1 - \eta + (1 - \alpha)\xi\eta)}{(1 - \eta)} \frac{\sigma_k}{2} \\
&+ ((1 - \eta)(\eta(1 - \alpha) + (\xi - 1)\alpha\eta + 1) + \alpha\eta^2(1 - \alpha)\xi) \frac{\mu\xi}{1 - \eta} \sigma_{ky}.
\end{aligned} \tag{21}$$

The Solow residual is falling in ψ , N/M , σ_y , σ_k , and $-\sigma_{ky}$, while it is increasing in $\bar{\tau}_k$ and $\bar{\tau}_y$. The equilibrium wage is falling in ψ , N/M , $\bar{\tau}_k$, and $\bar{\tau}_y$, while it is increasing in σ_y , σ_k , and $-\sigma_{ky}$.

Note first that if there is no heterogeneity in wedges (i.e., $\sigma_y = \sigma_k = \sigma_{ky} = 0$), then the equilibrium wage rate and Solow residual will be equal to their counterparts in the model without cross-sectional dispersion (cf. eq. (6) and (7)). Therefore, the qualitative effects of ψ , $\bar{\tau}_k$, and $\bar{\tau}_y$ are the same as before (see Proposition 3).

Consider now the effect of the second moments. As is clear from equation (20), a mean-preserving spread of the wedges – represented by an increase in the variance of $\ln(1 + \tau_k)$ or

$\ln(1 - \tau_y)$ – will increase the wage rate. Similarly, an increase in the correlation between τ_k and τ_y , i.e., a smaller covariance σ_{ky} , will also increase the wage rate. The reason is that larger dispersion in firm-specific wedges and a tighter link between τ_k and τ_y , will increase aggregate labor demand. On the one hand, the large firms will become larger, which obviously increases demand for workers. On the other hand, while the small firms become smaller (or drop out), this will not lower much the demand for workers since they already hired few workers.

Consider now the expression for the aggregate TFP in a prefecture (equation (21)). Note that the comparative statics of the second moments on aggregate TFP are the opposite of those on the wage rate. Namely, the aggregate TFP will *fall* in response to a mean-preserving spread in capital and output wedges (i.e., increases in the variances of $\ln(1 + \tau_k)$ and $\ln(1 - \tau_y)$). Moreover, TFP will also fall in response to a higher correlation between τ_k and τ_y (i.e., a smaller σ_{ky}).³⁸ The reason is negative selection: low-TFP firms with capital and output subsidies (i.e., negative τ_k and τ_y) will be large while high-TFP firms with large capital and output wedges will be small or maybe even induced to drop out.

We conclude that the comparative statics for the cross-sectional dispersion in τ_k and τ_y (i.e., comparative statics of $\{\sigma_y, \sigma_k, -\sigma_{ky}\}$) are qualitatively similar to the comparative statics for the prefecture-specific gross output wedge $1 - \bar{\tau}_y$ which we listed in Table 3. In particular, changes in the dispersion have opposite effects on wages and aggregate TFP.

We now revisit measurement of the wedges when incorporating cross-sectional dispersion in output and capital wedges. To this end, we must identify the wedges while taking into account the equilibrium distribution of observed allocations and wedges. Proposition 4 outlines a strategy for estimating the entry barriers based on the first and second moments of the *observed* wedges.

Proposition 4 *The parameters of the joint log-normal distribution of potential wedges, $\{\bar{\tau}_k, \bar{\tau}_y, \sigma_k, \sigma_y, \sigma_{ky}\}$, can be identified by the following cross-sectional first and second moments for observed wedges.*

$$\frac{std\{(1 + \tau_k)(r + \delta) | z \geq z^*\}}{E\{(1 + \tau_k)(r + \delta) | z \geq z^*\}} = \sqrt{\exp(\sigma_k) - 1} \quad (22)$$

$$\frac{std\{(1 - \tau_y) | z \geq z^*\}}{E\{(1 - \tau_y) | z \geq z^*\}} = \sqrt{\exp(\sigma_y) - 1} \quad (23)$$

$$\frac{cov\{(1 + \tau_k)(r + \delta), (1 - \tau_y) | z \geq z^*\}}{E\{(1 - \tau_y) | z \geq z^*\} \cdot E\{(1 + \tau_k)(r + \delta) | z \geq z^*\}} = \exp(-\sigma_{ky}) - 1 \quad (24)$$

$$E\{(1 - \tau_y) | z \geq z^*\} = \exp\left(\ln(1 - \bar{\tau}_y) + 2\frac{\xi}{1 - \eta}\frac{\sigma_y}{2} - \left(\xi(1 - \alpha)\frac{\eta}{1 - \eta}\right)\sigma_{ky}\right) \quad (25)$$

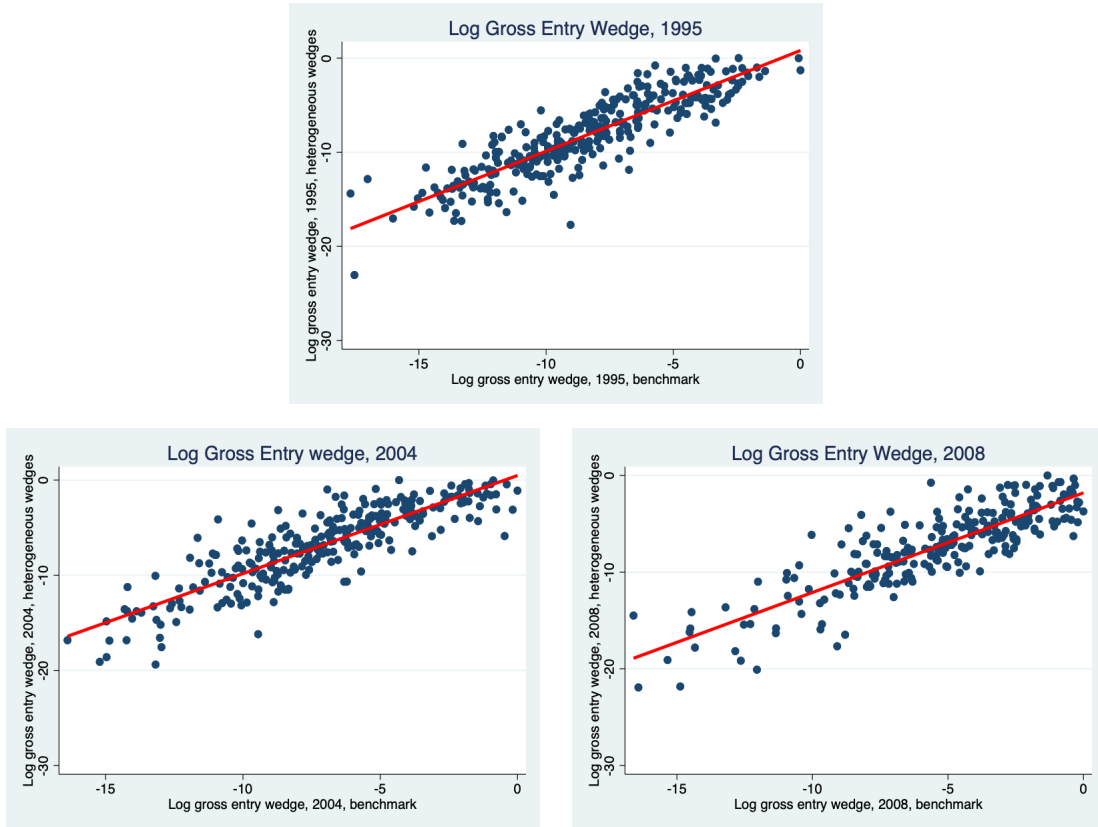
$$E\{(1 + \tau_k)(r + \delta) | z \geq z^*\} = \exp\left(\ln[(1 + \bar{\tau}_k)(r + \delta)] + 2\xi(1 - \alpha)\frac{\eta}{1 - \eta}\frac{\sigma_k}{2} - \frac{\xi}{1 - \eta}\sigma_{ky}\right) \quad (26)$$

The proposition implies that even though there is selection in which firms choose to enter (namely, firms with low τ_k and τ_y will be more likely to enter) the prefecture-specific moments for the distribution of wedges can still be identified by using a suitable empirical strategy. In particular, equations (22)-(26) show that the prefecture-specific means $\bar{\tau}_y$ and $\bar{\tau}_k$ and the variance-covariance matrix of the wedges can be identified using the coefficient of variation of the observed firms, i.e., the firms that were selected to enter.

Given the prefecture-specific moments $\{\bar{\tau}_y, \bar{\tau}_k, \sigma_y, \sigma_k, \sigma_{ky}\}$ and the wage rate w , we can identify the entry barrier ψ by inverting equation (20), as we did in Section 4. Several results are worth

³⁸The comparative statics for the Solow residual echo the theoretical finding of Hsieh and Klenow (2009). However, they did not study the comparative statics on the equilibrium wage rate.

Figure 10: Log Gross Entry Barriers, Benchmark Model and Model with Wedge Heterogeneity.



Notes: Each dot represents a prefecture. The graphs plot the log gross entry barriers in the benchmark model and in the model with heterogeneous wedges in 1995, 2004, and 2008. The solid red line is the fitted regression line.

pointing out. First, the entry barriers in the heterogeneous-wedge model are highly correlated with the entry barriers in the benchmark model. Figure 10 plots them – for 1995, 2004, and 2008 – against the entry barriers in the benchmark model. The correlation is high: 0.89 in 1995, 0.86 in 2004, and 0.86 in 2008. Moreover, the entry barriers decline over time and tend to be higher in prefectures with a high SOE output share. Second, when accounting for convergence in wages and TFP over time, as presented in Table B-2 in Online Appendix B, the entry barriers continue to account for a large share of the convergence. Overall, the dispersion in the capital wedges has no effect on wage and TFP convergence while the dispersion in the output wedges and the covariance between the output and capital wedges affect only the convergence in wages. Finally, as presented in Table B-3 in Online Appendix B, a decline in a prefecture’s SOE share over time leads to a decline in its entry barrier, with both the OLS and Bartik instruments estimates being large and negative, although the Bartik instrument results are estimated with less precision.³⁹

³⁹Due to what we perceive as severe measurement error in the data, we drop the top and bottom 20% of the firms in terms of output and capital wedges in each prefecture. Thus, although the results from the heterogeneous-wedge model are insightful, we consider our benchmark model as our preferred choice.

9 Conclusion

This paper studies regional economic growth in China. Using firm-level data from the Chinese Industrial Census, we document that China experienced a remarkable regional convergence in wages, TFP, productivity, and capital per worker in non-state manufacturing firms at the prefecture level during the period 1995 to 2008. The main aim of the paper is to analyze the factors behind the initial dispersion and subsequent regional convergence in wages and TFP. To this end we propose a tractable version of the Hopenhayn (1992) model of firm heterogeneity and new firm creation, extended to incorporate three distortions: standard capital and output wedges, common to all firms in a prefecture, and a novel entry barrier. The general equilibrium model is solved analytically. It features endogenous aggregate TFP and allows us to measure the three wedges using data on aggregate allocations for wages, output, employment, and capital.

Using the model as an accounting device, we exploit the aggregate prefecture-level data to measure these distortions for each prefecture. We document that entry barriers are salient in accounting for the regional dispersion and subsequent convergence in China after 1995. In contrast, the capital and output wedges play only a limited role in explaining the empirical regional convergence. Given the preponderance of the entry barriers in accounting for economic performance, we investigate the empirical drivers of these distortions. Based on a Bartik instrumental variable approach exploiting the major 1997 SOE reform that resulted in a large decline in the role of state-owned firms in many industries, we find that the presence of state-owned firms was a source of larger entry barriers for non-state firms. We provide a political economy model of distortions to motivate the empirical link between SOEs and entry barriers for non-state firms.

Our analysis has made a number of simplifying assumptions, often dictated by data limitations. To minimize the role of measurement error we focus on prefecture-level distortions and abstract from firm-level distortions within a prefecture. However, our main findings turn out to be robust to allowing firm-level dispersion in capital and output wedges. We have focused our analysis on geographic heterogeneity in the entry barrier but recognize that heterogeneity in the distribution of entrepreneurs – geographic differences in the quality of the pool of potential entrepreneurs – offers an alternative interpretation of the data. We leave this for future research.

Finally, a natural next step is to develop more fully a quantitative dynamic model. In combination with firm-level panel data, such an extension will help us discriminate between alternative sources of local growth and convergence such as entry barriers, agglomeration, human capital, input prices, and exposure to trade and competition. It will also be important to extend our empirical analysis beyond the manufacturing sector.

Data Availability Statement

The codes and some of the data underlying this research are available on the Zenodo website at <https://doi.org/10.5281/zenodo.14872511>. Some data cannot be made publicly available. Access can be obtained by submitting a formal application to the National Bureau of Statistics of China or through secured portals available at most of the main Chinese universities.

References

ASTURIAS, J., S. HUR, T. J. KEHOE AND K. J. RUHL, “Firm Entry and Exit and Aggregate Growth,” *American Economic Journal: Macroeconomics* 15 (January 2023), 48–105.

- BAI, C.-E., C.-T. HSIEH AND Y. QIAN, “The Return to Capital in China,” *Brookings Papers on Economic Activity* 2 (2006), 61–88.
- BAI, C.-E., C.-T. HSIEH AND Z. SONG, “Institutional Foundation of China’s Growth,” Mimeo, 2018.
- BARRO, R. J. AND X. X. SALA-I-MARTIN, “Convergence Across States and Regions,” *Brookings Papers on Economic Activity* 1 (1991), 107–182.
- BARSEGHYAN, L. AND R. DICECIO, “Entry Costs, Industry Structure, and Cross-Country Income and TFP Differences,” *Journal of Economic Theory* 146 (2011), 1828–1851.
- BARTIK, T., “Who Benefits from State and Local Economic Development Policies?,” Technical Report, W.E. Upjohn Institute, 1991.
- BAUM-SNOW, N., L. BRANDT, V. J. HENDERSON, M. A. TURNER AND Q. ZHANG, “Roads, Railroads and Decentralization of Chinese Cities,” *Review of Economics and Statistics* 99 (2017), 435–448.
- BILS, M., P. J. KLENOW AND C. RUANE, “Misallocation or Mismeasurement?,” *Journal of Monetary Economics* 124 (2021), 39–56.
- BRANDT, L., C.-T. HSIEH AND X. ZHU, “Growth and structural transformation in China,” in L. Brandt and T. Rawski, eds., *China’s Great Economic Transformation* (Cambridge, United Kingdom: Cambridge University Press, 2008).
- BRANDT, L., D. MA AND T. RAWSKI, “Industrialization in China,” in K. O’Rourke and J. Williamson, eds., *The Spread of Modern Industry to the Periphery since 1871* (New York: Oxford University Press, 2017).
- BRANDT, L. AND P. MORROW, “Tariffs and the Organization of Trade in China,” *Journal of International Economics* 104 (2017), 85–103.
- BRANDT, L. AND T. G. RAWSKI, eds., *China’s Great Economic Transformation* (Cambridge, United Kingdom: Cambridge University Press, 2008).
- BRANDT, L., J. VAN BIESEBROECK AND Y. ZHANG, “Creative Accounting or Creative Destruction? Firm-Level Productivity Growth in Chinese Manufacturing,” *Journal of Development Economics* 97 (2012), 339–351.
- BRANDT, L. AND X. ZHU, “Redistribution in a Decentralized Economy: Growth and Inflation in China under Reform,” *Journal of Political Economy* 108 (2000), 422–439.
- , “Accounting for China’s growth,” Discussion Paper no. 4764, IZA, 2010.
- CHARI, V. V., P. J. KEHOE AND E. R. MCGRATTAN, “Business Cycle Accounting,” *Econometrica* 75 (2007), 781–836.
- CHEREMUKHIN, A., M. GOLOSOV, S. GURIEV AND A. TSYVINSKI, “The Economy of People’s Republic of China from 1953,” Nber working paper no. 21397, 2015.
- , “The Industrialization and Economic Development of Russia through the Lens of a Neoclassical Growth Model,” *Review of Economic Studies* 84 (2017), 613–649.

- , “The Political Development Cycle: The Right and the Left in People’s Republic of China from 1953,” *American Economic Review* 114 (2024), 1107–1139.
- COMBES, P.-P., G. DURANTON, L. GOBILLON, D. PUGA AND S. ROUX, “The Productivity Advantages of Large Cities: Distinguishing Agglomeration From Firm Selection,” *Econometrica* 80 (2012), 2543–2594.
- DICKSON, B. J., *Red Capitalists: The Party, Private Entrepreneurs, and the Prospects of Political Change* (New York, NY: Cambridge University Press, 2003).
- GENNAIOLI, N., R. LA PORTA, F. LOPEZ DE SILANES AND A. SHLEIFER, “Growth in Regions,” *Journal of Economic Growth* 19 (2014), 259–309.
- HOPENHAYN, H., “Entry, Exit, and Firm Dynamics in Long Run Equilibrium,” *Econometrica* 60 (1992), 1127–50.
- HSIEH, C.-T. AND P. J. KLENOW, “Misallocation and Manufacturing TFP in China and India,” *Quarterly Journal of Economics* 124 (2009), 1403–1448.
- HSIEH, C.-T. AND Z. SONG, “Grasp the Large, Let Go of the Small: The Transformation of the State Sector in China,” *Brookings Papers on Economic Activity* (2015), 295–346.
- HUANG, Y., *Selling China: Foreign Direct Investment during the Reform Era* (Cambridge University Press, 2003).
- LI, H. AND L.-A. ZHOU, “Political Turnover and Economic Performance: The Incentive Role of Personnel Control in China,” *Journal of Public Economics* 89 (2005), 1743–1762.
- LUTTMER, E. G. J., “Selection, Growth, and the Size Distribution of Firms,” *The Quarterly Journal of Economics* 122 (August 2007), 1103–1144.
- MANKIW, N. G., D. ROMER AND D. N. WEIL, “A Contribution to the Empirics of Economic Growth,” *Quarterly Journal of Economics* 107 (1992), 407–437.
- NAUGHTON, B., “The Third Front: Defence Industrialization in Chinese Interior,” *The China Quarterly* 115 (1988), 351–386.
- POSCHKE, M., “The Regulation of Entry and Aggregate Productivity,” *Economic Journal* 120 (11 2010), 1175–1200.
- RESTUCCIA, D. AND R. ROGERSON, “Policy Distortions and Aggregate Productivity with Heterogeneous Establishments,” *Review of Economic Dynamics* 11 (2008), 707–720.
- SONG, Z., K. STORESLETTEN AND F. ZILIBOTTI, “Growing Like China,” *American Economic Review* 101 (2011), 202–241.
- TOMBE, T. AND X. ZHU, “Trade, Migration and Productivity: A Quantitative Analysis of China,” *American Economic Review* 109 (2019), 1843–72.
- WANG, Y., “Is China’s Rapid Growth Sustainable? A Theory of Politico-Economic Transition and State Capitalism,” Working Paper, University of Oslo, 2017.
- WHITING, S. H., *Power and Wealth in Rural China: The Political Economy of Institutional Change* (Cambridge University Press, 2006).

WORLD BANK, “Doing Business in China 2008,” Report, The World Bank Group, 2008.

XU, C., “The Fundamental Institutions of China’s Reforms and Development,” *Journal of Economic Literature* 49 (2011), 1076–1151.

ZHU, X., “Understanding China’s Growth: Past, Present, and Future,” *Journal of Economic Perspectives* 26 (2012), 103–124.