Liberalization to Inequality: How China's State-Owned Enterprise Reform Restructures the Urban Labor Market*

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August, 2023

Abstract

Large scale privatization and massive layoff can lead to a sudden increase in income inequality. In this study, we analyze the impact of the State-Owned Enterprise (SOE) reform on labor market outcomes in urban China from 1992 to 2004, exploiting cross-prefecture variation in reform exposure stemming from initial differences in employment share in the urban collective enterprises (UCEs) and SOEs. Our analysis reveals that workers in prefectures with higher exposure to the reform experienced a more rapid decline in employment and a slower increase in income, compared to those in less exposed areas. Further heterogeneous analysis confirms that individuals with lower income and lower educational attainment experienced greater loss. A back-of-the-envelope analysis estimates indicate that the reform contributed to more than 40% increase in income inequality.

Keywords: SOE Reform, Labor Market Outcomes, Income Inequality

JEL Codes: J21, J38, J40, O10

*Xu deeply thanks her main advisor Julie Cullen for her continuous guidance and support at all stages of this project. Zuo deeply thanks Elaine M. Liu and Chinhui Juhn for their support and comments. We thank Roger Gordon, Gordon Dahl, David Arnold, Ruixue Jia, Gaurav Khanna, Yu Liu, Xueyue Liu, Hongbin Li, Lingsheng Meng, Kang Zhou, Qingyang Huang and all seminar participants at the UCSD and Fudan workshop. All errors are our own.

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1 Introduction

Privatization doesn't benefit all parties in the economy equally. Most existing studies in privatization documenting aggregate efficiency improvement of privatizing debt-distressed Stated-Owned Enterprises (SOEs) (Anuatti-Neto et al., 2003; Song et al., 2011; Hsieh and Song, 2015; Berkowitz et al., 2017), with only a few examining the negative effect on workers (Olsson and Tåg, 2018; Arnold, 2022). Since state employment remains an important policy tool in developing countries (Subramanian and Megginson, 2018; Wen, 2020), it is important to investigate the efficiency-equity tradeoff during privatization, similar to what has been debated in the trade literature (Autor et al., 2013; Autor, 2014; Autor et al., 2016). We argue that while privatization improves aggregate efficiency, somebody could be relatively hurt, leading to inequality in the society.

This paper studies how the State-Owned Enterprise (SOE) reform, which has been regarded as one of the largest privatization movements in transitional economies, on individuals' labor market outcomes in urban China. It significantly liberalized the urban labor market. There are two reasons making China a compelling context to study liberalization and inequality in the labor market. First, the SOE reform is one of the most important privatization movements in China's economy. SOEs ever employed more than 60% of all workers in the urban areas.[1] In less than six years, over 35 million workers were laid-off nationally (Meng, 2000; Solinger, 2002; Hsieh and Song, 2015).[2] Second, China experienced one of the fastest increases in income inequality alongside rapid economic growth from the 1990s to the 2010s (Yang, 1999; Meng et al., 2013; Xie and Zhou, 2014; Ge and Yang, 2014; Piketty et al., 2019). Within a span of less than 20 years, the Gini coefficient in urban areas rose from less than 0.3 to over 0.5 (Xie and Zhou, 2014). It is now widely agreed among economists that the level of income inequality in China has surpassed that of the United States (Xie and Zhou, 2014; Chancel et al., 2022).

To motivate our empirical analysis, we first plot the changes in inequality across the different income distribution from 1992 to 2004, as shown in Figure 1.[3] It is clear that while middle and top income earners experienced rapid income growth, individuals at the bottom of the income distribution saw minimal change, resulting in a significant increase in income inequality. To be specific, the gap between the top 75th percentile and the bottom 25th percentile increased by four folds from 1992 to 2004. We provide causal evidence of the impact of the SOE reform on inequality. We argue that while the aggregate efficiency goes up, some people win and some people lose, leading to an increase in inequality in the society.

[1] Figure 2 shows the change of employment share in two types of SOEs from 1992 to 2009. Overall, the employment share decreased from about 65% to less than 30%.

[2] The term *xiagang* ("step down from the post"(Xie et al., 2022)) was used instead of "laying off" in China to describe someone being forced to leave his working unit, because in a socialist society it was politically sensitive to say that someone was laid off.

[3] Calculation based on the Urban Household Survey (1992-2004).

The SOE reform is often referred to as the "Breaking the Iron Rice Bowl" reform in literature (Berkowitz et al., 2017; He et al., 2018; Kong et al., 2019). It put an end to the longstanding centralized labor assignment system that had been in place for over 40 years, and introduced more market forces into the labor market. A key feature of the SOE reform is that most small and medium-size SOEs and urban collective enterprises (UCEs) were closed or privatized because they were profitable (Meng, 2000, 2012; Hsieh and Song, 2015). Figure 2 shows the decline in the share of urban workers working in these two types of enterprises from 1992 to 2009. In 1992, SOE employed more workers than UCEs and both of them played a less and less role in the labor market after 1997. In addition, nearly 20% of the working age population worked in UCEs and this number dropped to close to zero by 2009.[4]

We hypothesize that the SOE reform caused a more rapid decline in employment and a slower increase in income for prefectures more exposed to the reform, leading to inequality along with China's rapid economy growth. Actually, while China experienced a yearly 9% increase in GDP during this reform period, the employment rate declined[5].

Why does the reform lead to inequality? In fact, along with the privatization is nationwide massive layoff. Then, the question raises: who got laidoff? From the perspective of the enterprises, they sought to only retain the workers with higher productivity. Indeed, studies have shown an improvement in the efficiency of SOEs after the reform, accompanied by an increase in the SOE wage premium (Ge and Yang, 2014). This explains why people survived in the massive layoff experienced more income increase.

On the other hand, finding new employment proved challenging for those who had to leave their previous employers. One reason is that their old jobs not only provided employment but also fulfilled essential life needs such as canteens, healthcare, and childcare.[6] During that period, employment was considered a fundamental right. Consequently, it was difficult for people to shift their mindset, attain much-needed skills, and adapt to the competitive job market. Many individuals chose to live at subsistence levels, relying on severance payments from their previous employers. For those who had to forge a new path, many resorted to self-employment, such as engaging in small businesses at local farmer's markets or becoming nannies. However, these occupations typically yielded lower incomes and were often perceived as lower social status.

To investigate how SOE reform impacts workers empirically, we utilize more than ten waves of household surveys, complementing them with a comprehensive manually collected prefectural

[4]According to Hsieh and Song (2015), the share of SOEs registered as private firms increased from less than 20% in 1988 to nearly 50% by 2007.

[5]We show the declining employment rate in Figure A5.

[6]In the Chinese context, these enterprises were referred to as "units" (*Dan Wei*). Before the reform, individuals expected to spend their entire lives within their respective units, and in some cases, even pass down their jobs to their offspring after retirement.

level employment dataset. To identify the effect of the SOE reform on labor supply and income, we adopt a difference-in-differences approach and an event study strategy, utilizing both temporal and geographic variation in exposure to the reform. As indicators of reform exposure, we utilize the pre-reform employment shares of SOEs and UCEs in each prefecture.

Overall, our analysis confirms our hypothesis. To be specific, compared to a prefecture without any SOE or UCE employment, the prefecture with average pre-SOE share (0.32) has 5.3 p.p. (6%) more decline in employment; the prefecture with average pre-UCE share (0.15) has 4.9 p.p. (6%) more decline in employment. Although the overall income increased over this period, we find the reform actually led to a slower economy growth for prefectures with more exposure compared to others. Compared to a prefecture without any SOE or UCE employment, the prefecture with average pre-SOE share (0.32) has 37.2% less increase in income and the prefecture with average pre-UCE share (0.15) has 58.8% less increase in income.

Different from prior literature, our analysis distinguishes between SOE and UCE in analyzing SOE reform, highlighting the potential for divergent outcomes. SOEs have historically dominated transportation, finance, and natural resources, whereas UCEs, as smaller local entities, focused on labor-intensive manufacturing sectors and low-skilled services sectors. Furthermore, UCE workers received less severance payments and government re-entry support because of UCE's weaker political function compared with SOE. Coupled with UCE workers' lower educational attainment and social status, it renders them more susceptible to the reform. This susceptibility is underscored by our empirical findings. Higher pre-SOE shares leads to lower instances of low-status self-employment, while pre-UCE shares show the opposite trend. Additionally, our research suggests that the integration of laid-off SOE workers into UCEs could potentially compound challenges for UCE employees, further exacerbating their situation.

We further conduct some heterogenous analysis to further study how the reform leads to inequality. First, a quantile regression suggests that workers at the bottom income distribution are much more negatively affected in income than those at the medium or top income distribution. To be specific, income loss due to the SOE reform is more than two times larger for those at the bottom 20th percentile than those above 60th percentile. This provides some evidence on the unexpected large distributional consequence of the economic reform. Further heterogenous analysis reveals that younger cohort (age under 25) and workers with lower educational attainment are relatively hurt more in terms of the labor market outcome. Specifically, the negative employment effects on younger cohorts without any high school diploma is more than three times larger than those older cohorts (age above 40) with the same educational attainment, suggesting that young workers may have not prepared well to search jobs themselves in the new free labor market.

Lastly, we conduct a back-of-the-envelope analysis to quantify how much the reform contributes to the overall income inequality during this time period. Our calculation shows that the

reform explains 40% of the overall increase in inequality. People may also have interest in understanding the contribution of the SOE reform to the increase in inequality across regions and across different skill levels. We further document that this reform has contributed more than 50% increase in inequality across prefectures and more than 15% increase in inequality across different skill levels.

This paper contributes to three threads of literature. First, our paper is broadly related to the literature that study the increasing income inequality in China. Some papers find that income inequality between the top earners and the bottom earners also increased by more than 25% (Cai et al., 2008; Chen and Hamori, 2013). To explain it, some studies have documented the importance of structural change (Fleisher et al., 2010; Xie and Zhou, 2014; Alvaredo et al., 2017), geographic location (Chen and Fleisher, 1996; Démurger, 2001; Xu, 2011; Fleisher et al., 2010), wage structure (Appleton et al., 2014; Ge and Yang, 2014), rural to urban migration (Ravallion and Chen, 2007; Xie and Zhou, 2014; Sieg et al., 2023), and international trade (Han et al., 2012). In terms of structural change, (Cai et al., 2010) suggest that the sharp divergence in labor market outcomes among different groups appeared in the mid-1990s, which coincides with the SOE reform. Also, some papers have descriptively documented the sharp increase in wage inequality across many dimensions before and after the SOE reform (Meng and Zhang, 2001; Ge and Yang, 2014). Tian et al. (2022)'s paper is the closest to ours, where the authors linked the SOE reform with the labor maket outcomes. However, we are the first, to our best knowledge, to rigorously identify its causal impact. We fill the literature gap by quantifying how the SOE reform contributes to the income inequality using a causal effect.

Second, we speak to the empirical literature that discuss the privatization of SOEs in the transitional economies.[7] In the Chinese settings, past literature mostly focus on how the reform change the structure of the firms, and thus improve the aggregate efficiency (Song et al., 2011; Hsieh and Song, 2015; Berkowitz et al., 2017). This paper adds to the literature by discussing how the SOE reform affects Chinese urban labor market. Compared to previous papers (Arnold, 2022; Olsson and Tåg, 2018) that discuss the SOE's privatization in other countries, we study a much larger shock. For example, while Brazil's privatization reform decreases SOE employment from 6% to 3% (Arnold, 2022), China's SOE employment share decreases from 50% to 30% and UCE employment decreases from 17% to 5%. This big shift provides an opportunity to study the effect within each location. This big scale of reform echoes with the German Reunification, which also provides a natural experiment of ending the central planning labor assignment system in East Germany in the 1980s (Burda and Hunt, 2001, 2011; Becker et al., 2020). While papers on Germany show overall economy recession caused by the reform, our results stress on inequality.

Lastly, we are the first, to the best of our knowledge, to distinguish between SOE and UCE in

[7] Refer to Megginson and Netter (2001) for a thorough review.

studying the SOE reform. In fact, SOE and UCE behave differently in many ways in terms of the SOE reform. Although they both have political objects on social stability (Lin et al., 1998; Lin and Tan, 1999; Wen, 2020), UCEs have much less policy functions due to less state control (Jefferson et al., 1992; Bai et al., 2006; Huang et al., 2017). This leads to UCE's less generous payment and government support during the reform. Coupled with UCE workers' lower education attainment and social status, we argue they are more vulnerable during the reform. On the other hand, past literature studying the SOE reform either pool SOEs and UCEs (He et al., 2018; Kong et al., 2019), or just consider SOEs (Xie et al., 2022) in the empirical analysis. We highlight the importance of separating the two enterprises in our context.

For the rest of the paper, we discuss the reform background in Section 2 and introduce the data in Section 3. We present our main empirical strategy in Section 4 and show the results in Section 5. Section 6 presents the back-of-the-envelope analysis and Section 7 concludes.

2 Background

2.1 Centralized Labor Assignment System before 1978

From 1949 to 1978, the Chinese government established a strict central planning system to arrange labor under the ideal of absolute equality (Meng, 2000). Almost everyone works in the public sector, including the government (as civil servants), SOE, and UCE. When an individual graduated, he/she would be assigned to a work unit mainly based on his/her educational attainment and political background.[8] No individual were allowed to search for a job themselves and no work unit could choose workers independently (Meng, 2000). Furthermore, individuals were not allowed to quit or change their jobs except for promotion. These assignments were life–time employment and the wage was mostly at subsistence level.

The goal of the firms was not to maximize profit; instead, they functioned as many independent small societies. They not only provided workers with employment, but also housing and medical treatment for family members, and child care and education for workers' children (Cai et al., 2008). China has kept most formal institutions that guaranteed ideal equality during that period.

2.2 Transitional Period from 1978 to the 1990s

In the late 1970s, under Deng Xiaoping's leadership, the Chinese government embarked on a series of reforms aimed at granting firms greater autonomy and liberating them from the constraints of fixed output plans. Some private enterprises emerged during this period. Concurrently, labor

[8]Generally speaking, political background indicates the length that an individual had been in the Communist Party. Personal connection with governors also helps in getting jobs, know as "guanxi" in Chinese.

market reforms were initiated in the 1980s to introduce flexibility into the state sector, which involved relaxing the rigid lifetime employment rules that were in place under the central planning regime.

Regarding job entry, graduates in the less-centralized labor market of the time had the opportunity to independently search for jobs. They could accomplish this through interviews or by leveraging personal connections, commonly known as "Guanxi". [9] However, job assignment still prevailed in 2-year and 4-year colleges, where students would be assigned jobs to state sectors if they were unable to secure one through their own efforts.[10]

Another consequence of these gradual reforms is that the ownership of urban firms became more diverse than ever before. Some medium or small size SOEs were decentralized to be controlled by the local government; private parties or even foreign capitals were allowed to participate in these firms' daily operations (Jefferson et al., 1992, 1996; Meng, 2000; Tian, 2000). These firms are categorized as the urban collective enterprises (UCEs) in the formal statistical yearbook.

We provide details of the difference between SOEs and UCEs as follows.

First, the owner of SOE was the central government, while that of UCE was the local government or local community (Parker, 1994; Lee, 2000; Solinger, 2002).[11] SOE workers usually enjoyed higher job security, and it was a glory to work in the SOEs prior to the reform. Correspondingly, the education attainment of SOE workers was higher on average compared to the UCE workers. Further, as Bai et al. (2006) argue, SOEs owned by central government shoulder more responsibilites in maintaining the social stability, compared to UCEs owned by local governments. This distinction played a role in the divergent paths taken by SOEs and UCEs during the 1990s SOE reform.

Second, ownership differences also manifested in industry composition, with SOEs predominantly dominating sectors such as energy, telecommunications, education and transportation, as shown in Table A1. These industries were characterized as giant monopolies and more capital intensive (Jefferson, 1989; Jefferson et al., 1992). On the other hand, UCEs tended to operate in various industries such as small-scale manufacturing, wholesale and restaurant, construction and financial services, as shown in Table A1.

Overall, the reform in the 1980s marked a significant shift away from a planned economy towards a more market-oriented approach. However, the reform process was slow and many SOEs and UCEs continued to struggle with low efficiency, overstaffing, and other structural problems. These issues ultimately led to the more revolutionary SOE reform of the 1990s.

[9] "Guanxi" were particularly important during the transitional period.

[10] High school or lower-level graduates did not have access to job assignment.

[11] Actually, even private parties could even be the owner of the UCEs. (Jefferson, 1989; Jefferson et al., 1992)

2.3 Urban Labor Market after the 1990s SOE Reform

By the mid-1990s, it became obvious to the central government that most SOEs and UCEs failed to compete with the growing private firms because of the lack of incentive schemes for workers and managers (Lin et al., 1998; Lin and Tan, 1999; Perkins, 1994). To be specific, about half of the central SOEs were experiencing losses and more than ten percent of total employment was redundant in about half of the SOEs (Hsieh and Song, 2015). However, the issue of SOE reform was politically sensitive because life-time employment and equal pay with equal jobs were regarded as two key characteristics of a socialist society. Data from the National Bureau of Statistics suggests that the employment of SOEs and UCEs even peaked at about 109.5 million in 1995. It was not until the 15th Communist Party Congress in September 1997 that the central government endorsed SOE reform (Frazier, 2006). The *zhuada fangxiao* ("grasping the big, enlivening the small") policy was announced at this Congress. The key component of the reform is to keep only a few large strategic sectors under state ownership and merge, privatize or close most other medium–to–small firms. The job assignment system for new graduates was also completely abolished. By the end of 2002, the number of SOE workers fell to 69.2 million, a more than 40% decline compared with the number in 1995. Another stunning decrease is in the number of firms. The total number of industrial state-owned enterprises declined precipitously by 54.7%, from 110,000 in 1997 to 53,489 by late 2000 (China Labor Statistical Yearbook, 1998, 2003).

A noteworthy fact is that during the SOE reform, the size of UCEs in fact shrunk more than it was among the SOEs proportionately. For example, from 1996 to 2002, SOE employment shrunk by 40.58% and UCE employment shrunk by 63.75%. (China Labor Statistical Yearbook, 1998, 2003). However, due to the greater social stability responsibilities shouldered by SOEs compared to UCEs, workers from SOEs were provided with more monetary and non-monetary compensation when they were forced to leave. Additionally, SOEs implemented an early retirement policy known as "Nei Tui" for employees approaching retirement age. These individuals were effectively laid off, receiving lower wages, but were still officially considered workers of the SOE. This policy helped mitigate the potential for social unrest. Moreover, SOE workers benefited more from the re-employment engineering program (Lee, 2000).

As a result, within 5–6 years, the central planning labor arrangement was abolished. After the SOE reform, all firms worked toward the goal of profit maximization and were free to hire or fire workers from the growing labor market. New entrant workers no longer enjoyed the security of non–contract life–time employment, and their wages were determined by market forces. And although the new SOE still had some monopolistic power in several specific sectors, they did not bear any other social responsibilities as before, such as health care and childcare (Lee, 2000; Solinger, 2002).

3 Data

3.1 Outcomes: Urban Household Survey (UHS)

Our study employs the Urban Household Survey (UHS), which was conducted by the National Bureau of Statistics of China. This survey is a repeated cross-sectional dataset that includes detailed individual and household demographic information, such as gender, age and education attainment, and a set of labor market variables. We have access to 16 provinces covering 201 prefecture-level cities during the study period, 1992-2004. We exclude the prefectures that experience boundary changes over the period and the prefectures that have obvious measurement error in our treatment variables, resulting in a sample of 157 prefectures.[12]

We restrict to individuals between the age of 18 and 54. This age range is relevant for studying labor market outcomes since the legal retirement age for men is 60 and 55 or 50 for women, respectively (Ge and Yang, 2014).[13] We further restrict our sample to non-migrants by dropping individuals without local registration (Hukou) who have limited access to education, medical care, and social welfare in the place they reside, as regulated by the government. Migrants account for only 2% in the sample after 2002, and no migrants present in the survey before that year.

We also exclude prefectures in Guangdong province for the baseline analysis for two reasons. First, Guangdong was at the forefront of the economic reform even before the SOE reform in the 1990s. For example, Shenzhen, a main city in Guangdong, became a special economic zone (SEZ) in 1980, as part of a series of economic reforms aimed at opening up the country to foreign investment and trade.[14] We show that there are systematic differences between prefectures in Guangdong and other places in many economic indicators even before the reform. Thus, it is reasonable to believe that there will be many unobservable differences between these areas, such as the local culture or attitudes toward private-capital and state-capital. We will provide a more detailed discussion in Section 4. Second, Guangdong province is a main destination for migration after the economic reform in China, mainly from rural to urban areas. This is because Guangdong benefited from the economy reform in the 1980s and provided more job opportunities.

Two sampling issues arise with the use of the UHS in our study. The first issue is the over-representation of SOE employees, a problem that was first identified by Ge and Yang (2014). The second issue arises from a major reform of the UHS in 2002, which tripled the sample size. To address these issues, we implement a reweighting strategy. In short, we create the weight of each

[12] We use 67 balanced prefectures as a robustness check in Section 5.5.

[13] Generally, the retirement age of 55 is applicable to women working in government and public institutions, while the retirement age of 50 may be more common for other occupation, such as factory workers, service staff, and domestic workers.

[14] Shenzhen was chosen for its proximity to Hong Kong, which was already a major center of commerce and industry at the time.

individual according to his or her employment type by comparing the public sector's employment share in the UHS and the statistical yearbook data. Also, we adjust the weight with reference to the sample size difference before and after 2002. We present details of our weighting process and the validity of the strategy in Appendix Section A.

Table 1 presents the summary statistics of the weighted sample on both labor outcomes and individual characteristics, divided into two periods: before the SOE Reform (1992-1996) and after (1997-2004).[15]

Panel A displays the labor market outcomes, revealing a decline in employment during the study period.[16] Specifically, employment drops from 87% to 76% among working-age adults (ages 18-54) in the sample.[17] It is along with an increase in unemployment from 3% to 8%.[18] We also observe a significant increase in self-employment (from 2% to 12%) and private-sector employment (from 2% to 7%) in the UHS sample, suggesting that the economy's structural change was a result of the privatization movement.

We observe a significant increase in income before and after the reform.[19] Our analysis indicates that, in the post-SOE period, the real average monthly wage, earnings, and total income had increased by about 20% compared to the pre-reform period. This is not surprising, given that China's economy was growing at an average rate of 9.91% per year during that period. Interestingly, we also document a more than two-fold increase in transfer income, suggesting that individuals were receiving more transfer income due to layoffs induced by the reform.

Panel B depicts the summary statistics of individual characteristics, which demonstrate that individuals were older and more educated during the post-reform period. Given that age, education level, and gender can have an impact on labor market outcomes, we incorporate these variables as controls in our analysis.

[15] This table uses the full sample and we provide the summary statistics using the balanced prefectures only in Table A2.

[16] We note a discrepancy between wage and working status information in our dataset, where some individuals may claim not to be working but report positive wage income, and vice versa. These discrepancies account for approximately 2-3% of the total observations. As our focus is on any form of labor attachment, we choose to assume that wage income accurately reflects labor market engagement. To this end, we redefine the working status variable based on wage income. Specifically, we classify individuals with wage income as employed and in the labor force, and individuals with labor income are considered to be in the labor force regardless of their self-reported working status. Conversely, individuals with no wage income are assumed to be not employed, and those with no labor income are considered to be out of the labor force. This approach ensures that we capture any kind of labor attachment as a labor market outcome while minimizing the impact of the discrepancies in our data.

[17] This includes any type of employment and self-employment.

[18] In the UHS, the unemployment variable is coded as "waiting to be assigned a job" or "searching for a job".

[19] To account for inflation, we adjust the monthly earnings using the Consumer Price Index for the year 2004.

3.2 SOE Reform: Prefecture-level Data

Data Source Our treatment variables come from the employment data (coded as *zhigong*) at prefecture-level from multiple China's statistical yearbooks, including Provincial Statistical Yearbooks, City Statistical Yearbooks, and China Statistical Yearbook for Regional Economy. From these statistical yearbooks, we use the employment data coded by formal employment (*Zhigong*) rather than any type of employment (*Jiuye*). This is because the broader definition of employment (*Jiuye*) also includes contractual workers, who lack job security provided by the public sector, and they are not the target of the reform.[20]

To calculate the public sector employment-to-population ratio, we used the 15-64 non-agriculture population from the 2000 census as the denominator for each year. The numerator is the total of government, SOE, and collective employment.[21]

Construct the Exposure to the Reform We utilize the share of SOE and UCE employment in 1992 (the beginning year of our analysis) as the exposures to the reform. We hypothesize that areas with high pre-reform SOE and UCE employment share are more impacted by the reform than those low pre-shares areas. We also assume that the pre-shares' regional variations are not confounding with other prefectural-level shocks that may impact individuals' labor market outcomes.

We present the definition of the pre-shares in Equation 1 and 2. We calculate the affected SOE snd UCE employment as the numerator and use the 15-64 non-agricultural population as the denominator. The population data is sourced from the 2000 Population census.[22]

$$\text{Pre-SOE Emp Share}_p = \frac{\text{Affected SOE Employment}_{p,1992}}{\text{Working-age Population}_p} \tag{1}$$

$$\text{Pre-UCE Emp Share}_p = \frac{\text{Affected UCE Employment}_{p,1992}}{\text{Working-age Population}_p} \tag{2}$$

We construct the affected SOE and UCE employment numerators as follows. We notice that

[20] In terms of the employment data from the Statistical Yearbook, we notice a new definition of formal employment, working employment (*zaigang zhigong*) emerging after 1998 as a response to the massive layoff during the reform. This is due to some laid-off workers continuing to receive partial compensation from their former employer, even though they are no longer working. As a result, these workers are classified as non-working employment and are included in the formal employment (*zhigong renshu*) but not in the working employment (*zaigang zhigong*). Therefore, we use the working employment (*zaigang zhigong*) measure for the employment variable. For years before 1999 when only a single definition of formal employment (*zhigong renshu*) is available, we assume that the two definitions are equivalent.

[21] For the data missing problems in the numerator, we first digitized data from the provincial and city statistical yearbooks. We then used the China Statistical Yearbook for Regional Economy to fill in the missing data for the working employment (*zaigang zhigong*) from 1999 to 2004. For the missing data prior to 1999, we used linear interpolation.

[22] The Hukou system in China categorizes individuals based on their agricultural or non-agricultural attributes.

not all industries are impacted by the reform. To create a more precise measurement of the proxy for the reform, we exclude certain 2-digit industries that were not affected from the numerator, including government, agriculture, finance, real estate, health, and education.[23] To be specific, we refer to the 1990 population census, which provides industry-specific employment information for each prefecture. Given that the 1990 census does not offer any employment data categorized by ownership, we consult the China Labor Statistical Yearbook to obtain information on the proportion of SOE and UCE workers in each industry.[24] Utilizing these proportions, we calculate the shares of employment by industry and ownership out of the overall working-age non-agricultural population.[25] In this way, we manage to exclude the unaffected industries in SOE and UCE employment from the pre-shares.

We provide the summary statistic of the employment shares by prefecture in Table 2. The mean of raw SOE and UCE employment share are 0.46 and 0.32 respectively prior to the reform. After adjustment, they drop to 0.32 and 0.15.[26]

Figure 3 show the regional variations in pre-SOE share and pre-UCE share. We observe significant variations in all these two measures. For example, the southwestern areas have high proportions of SOE employment and the northeastern areas have high proportions of UCE employment prior to the reform.

4 Empirical Strategy

Simply comparing post-reform outcomes with pre-reform outcomes cannot produce an estimate of the causal impact of the SOE reform since changes in labor market outcomes could be due to multiple reasons other than the reform. For example, individual income grew substantially during our study period and it is possibly the result of other economic reforms in China. Therefore, we rely on both the reform's time shock and regional variation in exposure to the reform, taking advantage of the fact that the reform's effect varies across regions despite it occurring at the national level. We compare outcomes before and after the reform for individuals from the more affected areas to the less affected areas.

[23] Data from China Labor Statistical Yearbook shows that these industries are not the target of the reform. However, they still contribute to a signifcant portion of the total SOE and UCE employment, particularly in the case of SOE employment (Lee, 2000) - more than 90% of employment in these industries belongs to SOEs in 1992.

[24] We provide this information in Table A1.

[25] We adjust for population growth from 1990 to 2000.

[26] A tiny proportion of the adjusted pre-SOE share is negative because of the measurement error across multiple data sources.

4.1 Validating of the Exposure Measures

Prior to discussing the main identification strategy, we first provide evidence that our measurement of exposures to the reform are valid.

Reduction in Public Sector Employment To validate our two reform exposures as discussed in Section 3.2, we take advantage of the key feature of the SOE reform, which resulted in a massive layoff that varies across regions. Ideally, we would like to know the exact number of laid-off workers across ownerships in each year by region, however, such data are not available. Instead, we utilize the reduction in the regional public employment share from 1996 to 2000 to validate our two pre-reform exposures. To be specific, the *Reduction in Public Employment* is calculated as shown in Equation 3.

$$\text{Reduction in Public Employment}_p = \frac{\text{Public Employment}_{p,1996}}{\text{Working-age Population}} - \frac{\text{Public Employment}_{p,2000}}{\text{Working-age Population}} \quad (3)$$

We provide summary statistics of the *Reduction in Public Employment* by prefecture in Table 2. On average, public employment reduces by 20 p.p. with 13 p.p. in SOE employment and 6 p.p. in UCE employment. Figure A6 show the regional variations in the *Reduction in Public Employment*. We notice that the northeast of China experienced a sharp decline in the employment in the public sectors during the reform. And these are the areas with high pre-SOE and pre-UCE employment shares.

Do Pre-shares really predict the *Reduction in Public Employment*? In this part, we validate that both the pre-SOE share and pre-UCE share are positively correlated with the *Reduction in Public Employment*.

The pre-reform employment share by ownership should predict the *Reduction in Public Employment*. It is true that we find that both SOE and UCE share in 1992 positively predict the *Reduction in Public Employment*, as shown in Figure A8. This implies that a higher pre-reform public employment share is positively correlated with the reductions in the public sector. Moreover, we have found that the coefficient of collective enterprise employment share is higher than that of SOE. This is because UCEs were impacted more during the reform. While SOE are mostly big enterprises, UCEs are much smaller. Following the guidance of *zhuada fangxiao* ("grasping the big, enlivening the small"), UCEs are more likely to be shut down or privatized than SOEs. Although we observe the biggest decline in employment numbers in the SOE sector, the UCE sector shrank more proportionately during the reform. Hence, this could contribute to a higher coefficient of the UCE in our analysis.

Do pre-shares by industry predict the *Reduction in Public Employment*? We further ask whether the pre-reform shares by industry can be good proxies to the reform. This hypothesis relies on the assumption that the reform affects certain industries more than others. Indeed, we discover from the China Labor Statistical Yearbook that the manufacturing and wholesale and restaurant industries experienced the most significant declines during the reform period. We want to determine whether the *Reduction in Public Employment* varies based on the pre-reform employment share in different industries. We use the 1990 census to calculate the employment share by industry. We classified the industries into 13 categories using the 2-digit classification system from the 1990 census. However, when we regress the *Reduction in Public Employment* on these pre-shares by industry, none of them is significant, as shown in Figure A8. It means that although the reform indeed targets certain industries, the *Reduction in Public Employment* is not correlated with the composition of these industries prior to the reform.[27] As a result, the pre-reform shares by industry can't be a valid proxy to the reform.

Do pre-determined characteristics correlate with the pre-shares? We leverage the variation in pre-reform SOE share and UCE share as our identification strategy. In this part, we discuss the correlations of other observed variables with the two pre-share variables.

In an ideal scenario, we would expect the pre-reform industry shares to be as good as random. However, this is unlikely to be true in reality. In fact, the SOE reform began in the 1980s, with a focus on property rights, while the labor market remained rigid. Moreover, under the guidance of Deng Xiaoping, China aimed to gradually open up the country to foreign investment and trade. In general, we believe that regions with a more open local economy tend to have a lower share of public employment.

We regress the pre-reform shares on some prefecture economic indicators. We summarize the results in Table A3. We are interested in the explanatory variables *FDI/GDP*, *GDP per capita*, *Finance Income per GDP*, *Finance Expense per GDP*, *GDP Share in Seconday Industry*, and *GDP Share in Tertiary Industry*. We believe they are the indicators for economy opennes. The data used in this analysis was sourced from the City Statistical Yearbook. While it remains the only available source, it should be noted that it suffers from the issue of missing data. Despite this limitation, we believe that the available data still provides valuable insights for our analysis.

Table A3 includes two samples: one that encompasses all prefectures, and another that excludes those within Guangdong province. Guangdong has traditionally been at the forefront of China's economic reforms, with its prefectures being particularly impacted by the economy reform prior to the SOE reform in the 1990s. In the full sample, we observe a negative correlation between

[27] Since we only have 13 industry categories, our prediction has to be relied on this relatively coarse division. If there were more detailed categories, things may change.

FDI/GDP and *GDP per capita* with both *Pre-SOE Emp Share* and *Pre-UCE Emp Share*. This suggests that more prosperous economies tend to have a smaller public employment share within a prefecture. However, this correlation loses significance in the sample that excludes Guangdong.

We exclude prefectures within Guangdong from our baseline analysis. Given that, our proxies for the reform are less confounded by the economic indicators.

4.2 Identification: Difference-in-Differences and Event Study Approach

The Diff-in-Diff Strategy

$$Y_{ipt} = \alpha + \beta_1 \text{Post}_t \times \text{Pre-SOE Emp Share}_p + \beta_2 \text{Post}_t \times \text{Pre-UCE Emp Share}_p + \Phi X_{ipt} + \delta_p + \gamma_t + \varepsilon_{ipt} \tag{4}$$

We leverage the two pre-reform employment shares, *SOE Share* and *UCE Share* in 1992, as the reform exposures in the regression as shown in Equation 4. We employ our analysis following the specification shown in Equation 4. The outcome variable Y_{ipt} includes (1) employment related outcomes: employment dummy (0/1); unemployment dummy (0/1); self-employment dummy (0/1); employment in private sectors dummy (0/1); (2) income related outcomes: real monthly wage; real monthly earnings; real monthly transfer income; and real total monthly income.[28] We use the Inverse Hyperbolic Sine Transformation (IHS) (Bellemare and Wichman, 2020) for all of the income variables. $Post_t$ is 1 if year t is 1997 or after, and 0 vice versa. We include three control variables in the regression, namely Age_{ipt}, $Education_{ipt}$, and $Female_{ipt}$. γ_t are year fixed effects and are included to control for the common shocks that affected all prefectures, such as the setup of labor laws. δ_p are prefecture fixed effects, controlling for the unobservable time-invariant differences across prefectures. The standard error is clustered at the prefecture level. As discussed in Section 3, the UHS is subject to an overweight on the SOE workers, so we come up with a unique weighting strategy to overcome this issue, which is discussed in Section A in details.

The main coefficients of interest in the study are β_1 and β_2. The effect size from β_1 and β_2 would be different due to the differences between SOEs and UCEs.

We need to be cautious in interpreting the counterfactuals though, as the year fixed effect is added in the regression. In general, China's economy grew rapidly after the reform, remaining at the rate of 10% or so for many years. We also find overall income increase from the summary statistics in Table 1. However, concurrently, total employment rate decreased. Given that, the estimated results are all relative effects, causing inequality across prefectures.

[28] To be specific, employment includes both being employed by public and private sector and self-employment; We count "waiting to be assigned a job" and "searching for jobs" as unemployment in the UHS; Self-employment includes small business owners, being employed by business owners, and other jobs like nannies.

The Event Study Strategy

$$Y_{ipt} = \alpha + \sum_{k \geq 1992, k \neq 1996}^{2004} \beta_k \times \text{Pre-SOE Emp Share}_p \times \mathbb{1}\{t == k\} + \sum_{k \geq 1992, k \neq 1996}^{2004} \beta_k \times \text{Pre-UCE Emp Share}_p \times \mathbb{1}\{t == k\} + \Phi X_{ipt} + \delta_p + \gamma_t + \varepsilon_{ipt} \quad (5)$$

We employ an event study, as shown in Equation 5, to investigate the impact of the SOE reform on the labor market using the two pre-shares, which provides two key advantages. First, it enables us to examine the effect over a period of time, thereby enhancing our understanding of how the reform affects the labor market dynamics. Second, by examining the coefficients prior to the reform period, we can also assess the pre-reform trend for the parallel trend assumption.

Threats to the Identification The biggest threat to the identification stems from a series of policies implemented during the period of the SOE reform. This study specifically examines the impact of the SOE reform in the late 1990s, characterized by massive layoffs. Other policies that may introduce confounding factors include China's accession to the World Trade Organization (WTO) in 2001, the expansion of college programs starting in 1999, and the housing property reform in 1994. Another important threat is the migration from the rural to urban areas since the data is cross-sectional. To address these concerns, we conduct a set of robustness checks in Section 5.5 and carefully discuss the validity of our results.

5 Results

5.1 Main Results

Table 3 shows the Difference-in-Difference results on a set of employment outcomes. In panel (A), we focus on employment and unemployment; Panel (B) shows the effect on self-employment and probability of working in the private sector.

Overall, we find the SOE reform lowers employment for the prefectures more exposed to the reform. It corresponds to the overall declining trend in employment as shown in Figure A5. The coefficients are consistently negative regardless of using the pre-SOE or the pre-UCE employment share. To interpret the effects, we need to scale the point estimates with the mean of the pre-shares. The results show how much the reform leads to the change in employment for a prefecture with average pre-share, compared to the prefecture that doesn't have any SOE or UCE employment

prior to the reform.

In terms of employment, the coefficient of pre-SOE employment share is -0.165, meaning that 1 p.p. more in SOE employment prior to the reform leads to 0.165 p.p. relative decrease in employment for a prefecture with mean of the exposure, compared to the prefecture with zero exposure. By scaling with the mean of pre-SOE employment share (0.32), the results show that the SOE reform lowers total employment by 5.3 p.p. (6%). The coefficient of pre-UCE employment share is about -0.328 or so from 1998 to 2002, meaning that 1 p.p. more in UCE employment prior to the reform leads to 0.328 p.p. relative decrease in employment. By scaling with the mean of pre-UCE employment share (0.15), the coefficient translates to 4.9 p.p (6%) relative decrease in employment caused by the reform. In terms of unemployment, the coefficient of pre-SOE employment share is 0.058 and the coefficient of pre-UCE employment share is 0.392. These results translate to a relative increase of 1.9 p.p. (67%) and 5.9 p.p. (196%) in unemployment separately predicted by the two pre-shares. We can understand the gap between the effects on employment and unemployment as those who exit the labor market. While the effect predicted by pre-UCE employment share is similar between employment and unemployment, the effect of pre-SOE employment share is different across the two. It suggests that prefectures with higher SOE share prior to the reform leads to more exits from the labor market.

We also shed light on people who sort into individual business sector, which includes both self-employed individuals and their employees, as is shown in Panel B. We classify both of the types as self-employment. According to Lee (2000), the emerging individual business sector, which consists mostly of service sector positions, is a crucial source of reemployment for laid-off workers. Interestingly, pre-SOE employment share and pre-UCE employment share have different effects with respect to self-employment. Specifically, we find that pre-SOE employment share lowers self-employment by 4.8 p.p. (240%), while the pre-UCE employment share increase self-employment by 6.5 p.p (325%). In fact, the overall trend of self-employment increases in China, as shown in Figure A5. The distinction in results stems from the difference between SOE and UCE. SOE provides higher job security and hires employees with higher education attainment, compared to UCE. The results suggest that SOE laid-off workers are reluctant to get self-employed as they are used to living in the society where basic needs, such as food, health care, and childcare, are provided by their employers. On the other hand, SOE offers more severance payment compared to UCE, as documented by Lee (2000). It means that SOE laid-off workers have less incentives to get self-employed. We do not find any significant effect on the likelihood of working for private sectors.

We show the results on a set of income in Table 4, including wage, earnings, total income, and transfer income.[29] Previous papers have shown that the SOE reform leads to an increase in the

[29]Earnings include wage income and other labor income. Total income includes earnings, business income, invest-

SOE wage premium (Ge and Yang, 2014; Liu and Zuo, 2023). Also, as the privatization opens the door to a market economy, China's economy grew rapidly over those years.[30] On the other hand, the total employment actually went down due to the reform, as shown in A5. Thus, it remains unclear what the relative effect on earnings is for the prefectures. Also, it remains unclear how the SOE reform will affect other forms of income. For instance, we expect the transfer income to grow as the laid-off workers receive severance payment for their former employers. Also, some laid-off workers establish small business as other types of income. If the reform has no effect on total income, it suggests that individuals can seek alternative sources of income, thereby minimizing overall economic effects. Conversely, if the reform lowers total income, it suggests that the reform has a detrimental relative effect on people.

Overall, we find negative coefficients of the reform on both earnings and total income. It is in line with Lee (2000)'s narration - although we see an increase in transfer income, it is insufficient to compensate for earning losses, leading to an overall relative negative impact on workers. We admit that the SOE reform is an effective fuel for the economy growth, as documented by other papers (Sun and Tong, 2003; Song et al., 2011; Hsieh and Song, 2015; Berkowitz et al., 2017). Our point is that prefectures more exposed to the reform grow slower than the prefectures less exposed to the reform, causing the inequality across the prefectures.

We consistently find that the SOE reform causes wage, earnings, and total income to increase more slowly for the prefectures more exposed to the reform. Since we use the inverse hyperbolic transformation for all of the income variables, the effect size is a weighted average of extensive and intensive margin. We interpret the effect in percent.[31] For instance, 1 p.p. increase in pre-SOE employment share leads to 11.62% less increase in earnings; 1 p.p. increase in pre-UCE employment share leads to 39.19% less increase in earnings. Interacting with the pre-share means, these results translate to 37.2% earnings less increase predicted by pre-SOE employment share and 58.8% earnings less increase predicted by pre-UCE employment share. The effect size gets smaller with respect to total income. In summary, pre-SOE share predicts 31.6% less increase and pre-UCE employment share predicts 43.68%.

When comparing the outcomes of employment, the impact on income is considerably more salient. This is primarily due to two reasons. First, some laid-off workers were classified as early retirees (*"Nei Tui"*) when they were nearing retirement age. While these workers are still categorized as employed in the UHS, their income is greatly affected. Second, some laid-off SOE workers may not realize that they are no longer part of the enterprise, causing some underreporting in unemployment in the UHS data (Ge and Yang, 2014). As a result, some of the effects on the

ment income, and transfer income.

[30] The economy grows at the rate of 10% during 2000 to 2010. It aligns with the growing trend in Figure 1.

[31] About 15% of the total income is 0 in our dataset, so the issues raised by Mullahy and Norton (2022) could be less of a concern.

employment may be masked, but the impact on income should be more apparent. We argue that our result on employment should be a lower-bound estimation.

5.2 Event Study Results

Figure 4 displays a series of analyses on employment, unemployment, and self-employment. We plot the point estimate of both the pre-SOE and pre-UCE employment share in the graphs separately. The event study plots show null effects prior to the reform, confirming the parallel trend assumption. The effect becomes to be salient from 1998, when the massive layoffs show up in the data (Figure 2).

We also examine different types of employment, including those employed by governments, SOEs, collective enterprises, private enterprises. As shown in Figure A11, we find no effects on employment by the government either using the pre-SOE or the pre-UCE employment share, indicating that the reform doesn't affect the government employment. It is expected as the reform doesn't affect the government sector (Lee, 2000).

We further examine the effects on SOE employment and collective employment using both pre-SOE employment share and pre-UCE employment share. We find that regions with high pre-SOE share experiences relative decline in SOE employment after the reform. However, the effect is instantaneous, only significant in 1998 and 1999. The effect size is not big as well, at about -0.2, meaning that one percentage increase in SOE employment pre-share lowers SOE employment by 0.2 p.p. after the reform. Scaling with the mean of the pre-SOE share, it indicate that the reform lowers the SOE employment by 6.4 p.p. The pre-UCE employment share doesn't have any effect on the SOE employment.

The pre-UCE employment share sharply lowers collective employment since 1998. The coefficient in 1998 is -0.5, meaning that one percentage increase in collective employment pre-share lowers the collective employment by 0.5 percentage in 1998. The effect gets even bigger thereafter. Scaling with the mean of pre-UCE employment share, 0.17, the reform lowers UCE employment by 8.5 p.p. We should be cautious with this result though, as we indeed detect some pre-trend in the graph.

The pre-SOE employment share sharply increase UCE employment though. The effect size is stable at 0.2 or so, meaning that one percentage increase in pre-SOE employment share leads to 0.2 percentage increase in UCE employment. One possible reason is that individuals living in high pre-SOE employment share areas were provided more opportunities to work in the reformed collective enterprises after the reform. It could be due to the higher education attainment of the laid-off SOE workers.

We also investigate the impact of the SOE reform on individuals' income, as shown in Figure

5. We present our findings on earnings and total income. We find null effects prior to the reform, confirming the parallel trend assumption. The results also demonstrate that the effects are noticeable from 1998. Our analysis has shown that both pre-SOE and pre-UCE employment share has long-lasting impacts on earnings and total income. Specifically, the coefficient of pre-SOE share is stable at -2 or so. This suggests that a 1 p.p. increase in pre-SOE employment share lowers earnings by 6 percent. After the scaling, this translates to 70 percent less in earnings caused by the reform. The coefficient of pre-UCE employment share remains at -5 or so. It translates to 75 percent less in earnings caused by the reform. With respect to total income, we also the reform lowers total income, but the effect size is smaller than the one of earnings. In general, the pre-SOE employment share lowers total income by 70 percent less and the pre-UCE employment share lowers it by 45 percent. We see a smaller effect of the pre-UCE employment share mainly because of the increasing of self-employment as another source of income. We also present results on wage income and transfer income in Figure A10. In general, we see long-lasting less increase in wage income and increase in transfer income.

5.3 Heterogeneity

We provide the heterogeneity analysis to indirectly support our disussion for the mechanisms.

A Quantile Regression Analysis We conducted a quantile regression to gain a deeper understanding of the heterogeneity of the impact, specifically examining how the reform contributed to inequality. The results are presented in Figure 6. We focused on the Diff-in-Diff analysis for the total income variable. Notably, the most pronounced effect was observed among individuals at the bottom 20th percentile of income, as indicated by both the pre-SOE and pre-UCE employment share proxies. This observation aligns with a key characteristic of the reform, which involved significant layoffs. Conversely, for individuals with incomes above the 60th percentile, the effect of the reform was negligible.

This finding sheds light on the mechanisms through which the reform led to inequality. While individuals at the higher percentiles experienced substantial benefits from the economy's transition, those at the lower percentiles received significantly fewer benefits. The overall outcome shows that laid-off individuals faced challenges in returning to employment and bore a more substantial negative impact from the reform compared to the tremendous national economic growth. The results indicate a disparity in the impact from the reform, with the most vulnerable individuals being disproportionately affected.

Effects by Age and Educational Attainment We hypothesize that the SOE reform may have differential impact on different groups. One reason is that individuals were not paid according to

their productivity under the old centralized labor assignment system and they were treated almost the same. After the reform, the wage will reflect their true productivity as well as the labor demand. This will potentially "hurt" some specific groups, such as relatively low skilled or relatively old cohorts. To explore these possibilities, we divide our sample into nine groups according to the age and educational attainment and do a sub-sample analysis. The labor supply results are presented in Table 5, Table A4, and Table A5. We find large heterogeneous effects across different age and skill groups. First, the negative effect in employment is almost driven by least skill young workers (age between 18-25). Workers residing in prefectures with the mean pre-UCEs employment share of 0.17 are 24.53 p.p. less likely to be employed than those 0 share areas. We do not find any significant effect for prime age workers (age between 26 and 40) and the effect is almost three times smaller among elderly workers (age above 41), regardless of the skill level. Second, young and least skilled workers are more likely to experience unemployment than other groups, which echoes the negative effects on employment. Interestingly, we find that young high skill workers are more likely to sort into self-employment, but the effect is detected not only among low skill but also high skill prime age workers.

We also find that young workers are more negatively affected in earnings and total income than other age groups, no matter whether they are low-skilled or high-skilled. For example, panel A in Table A6 shows that least skilled young workers in the prefectures with a pre-UCE employment mean share of 0.17 or pre-SOE employment mean share 0.45 experienced a more than 100% decrease in earnings, relative to those in the prefectures with 0 pre-UCE employment share. And the earnings loss is about 80% for the high-skilled group. The magnitude of the effect is slightly larger in total income, as shown in panel A of Table 6.[32] These results echo the findings of Meng (2012), where younger cohorts experienced higher levels of unemployment. Meng (2012) argue that this trend can be attributed to the rapid expansion of education. In addition to their analysis, we contribute to the existing literature by highlighting that the abolishment of the job assignment system has further exacerbated the challenges faced by younger cohorts in finding employment after graduation.

5.4 Prefecture-level Analysis

In our previous analysis, we show that the SOE reform lowers the employment and income for regions with higher pre-SOE and pre-UCE employment shares. It means that the reform drives the across-prefecture inequality.

[32]We also do sub-sample analysis by age and education groups, separately. The results are shown in Table A7 and Table A8. For 18-25 years old individuals residing in a prefecture with 0.17 pre-reform UCE employment share would suffer 76% decrease in their earnings, relative to individuals in a prefecture with 0 share. This effect is 42% for age between 26 and 40 individuals and the effect is further smaller for the oldest workers. The negative impact on earnings is about 80% for the low-skilled group, which is more than two times larger than the effect on high-skilled group.

We show the overall trend by different percentiles of income in Figure 1. In this subsection, we provide evidence that the reform also leads to inequality within each prefecture. We calculate the 25^{th}, 50^{th}, and 75^{th} percentile of earnings and total income for each prefecture-year. In this way, we create a prefecture-year panel. We conduct the regression analysis as shown in Equation 6.

$$Y_{pt} = \alpha + \beta_1 \text{Post}_t \times \text{Pre-SOE Emp Share}_p + \beta_2 \text{Post}_t \times \text{Pre-UCE Emp Share}_p + \delta_p + \gamma_t + \varepsilon_{ipt} \quad (6)$$

where Y_{pt} stands for different percentiles earnings and total income with inverse hyperbolic sine transformation.

We present the results in Table 7. We show that the results are the strongest in the 25^{th} percentile groups, for both earnings and total income outcome. It means that the SOE reform disproportionately affects the lower percentile groups in each prefecture, compared to the higher percentile groups. This difference suggests the within-prefecture inequality driven by the SOE reform. We will provide a back-of-the-envelope analysis to show how much this reform drives to the overall inequality across different percentile groups in Section 6.

5.5 Robustness Checks

5.5.1 Alternative Samples and Controls

Balanced Sample As desbribed in Section 3, not every city shows up in each year of UHS. This is mainly because UHS has a major expansion in 2002 where sample size increases a lot. While we'd like to use as many prefectures as possible as it gives us more precise estimation, the full sample is suffered from a compositional change issue. In order to deal with this challenge, we provide the results using the balanced city sample in this section. The sample includes 67 prefectures. In general, the point estimate is similar to the ones estimated from the full sample, but the standard deviation is higher, rendering some estimate not significant. We show the results in Figure A12.

Robustness of the Pre-shares In our main analysis, we use the pre-shares that excludes certain 2-digit industries not affected by the SOE reform. While it provides a more precise measure of the exposure to the reform, it suffers from a measurement error issue caused by misalignment between the Statistical Yearbook data and the 1990 census data. In this section, we provide robustness check to show that our results are not driven by the particular definition of the pre-share variables.

We provide the results using the pre-shares not excluding the 2-digit industries in Figure A13. Although we detect some pre-trend here, the overall result is similar to the one in our baseline

analysis.

We also provide results using the 1996 data as the pre-shares in Figure A14. The results here are also very similar to the one in baseline. This is because the public sector employment size remained relatively stable prior to the SOE reform announced in 1997.

Add more controls that are correlated with the pre-shares We show that the two pre-shares are correlated with some economic indicators in 1992 in Tables 7. In our baseline analysis, we exclude the prefectures in Guangdong province as the significance of correlation disappears after the exclusion. We add the economics indicators in 1992 interacted with year dummies in the regressions as a robustness check, as shown in Table A10 and Table A11. We find that adding these controls doen't change our results.

Migration A challenge to the regional approach in this paper is that labor may migrate across regions in response to the SOE reform, if this is true, such migration behavior will potentially change the composition of local labor force and impact employment or earnings.

We first argue that migration was still very limited during our study period. We use 2000 census to calculate the share of migrate workers and it only accounts for 2.3%.[33] The limited migration, especially from urban to urban areas, is almost resulted from the strict household registration *"hukou"* system in China, which legally separates prefectures (Chan and Zhang, 1999; Liu, 2005; Meng, 2012). Access to social services, such as education, healthcare, and housing, are tied to an individual's "hukou" status. Therefore, urban residents have few incentives to migrate in general. We further conducted a regression analysis to examine the impact of SOE reform at the provincial level on both in-migration and out-migration rates. Our results indicate that SOE reform has no effect on migration, as shown in Table A9.

We also admit that it is true that individuals may migrate from rural to urban areas for high paying jobs during that time period. However, many studies show that rural migrant workers were severely discriminated in the urban labor market (Démurger et al., 2009; Meng, 2012). Rural migrant workers usually worked in lower paying occupations. Such segregation resulted in a two-tier labor market (Meng and Zhang, 2001; Meng, 2012). This will potentially relieve some concerns about the change of the labor composition due to the migration.

5.5.2 Other Confounding Policy

During the 1990s, China underwent a series of economic reforms aimed at boosting its economy. Other economic reforms may pose a threat to our identification strategy if they target prefectures

[33] It means that the worker doesn't have a local *hukou*.

that are also heavily impacted by the SOE reform - which is the primary focus of this paper. Therefore, in this section, we provide checks to control for other potentially confounding policies.

Accession to WTO in 2001 Many papers (Erten and Leight, 2021; Dai et al., 2021; Khanna et al., 2020) have shown that China's accession to WTO in 2001 leads to income effect. Specifically, WTO accession played a significant role in China's economic growth, as it led to increased foreign investment, expanded export opportunities, and greater competition in domestic markets. The WTO accession could impose a threat to our identification if it affects more to the prefectures that are also more impacted by the SOE reform. To address this concern, we collect the tradable sector employment share for each prefecture from 1990 census. The more tradable employment prior to the policy shock, more impacted the prefecture gets by the policy. We interact the tradable employment share with each time dummies in our study period as the control. We find that adding this control doesn't affect our point estimation, as is shown in Table A10 and Table A11.

The College Expansion Program from 1999 China has expanded the yearly quota on newly admitted college students by more than 7 times since 1999. This expansion of higher education opportunities could have a significant impact on the labor market in two ways. For example, more students are likely to choose to attend college rather than entering the labor market directly after graduating from high school. This trend could lead to a decrease in the number of young, low-skilled workers entering the job market. At the same time, the supply of high-skilled workers has surged, particularly since 2003, four years after the initial expansion of the college program. Given that, there is a concern that the college expansion program may be targeting primarily prefectures affected by SOE reform. If this is the case, it may lead to uneven distribution of high-skilled workers and leave other areas with a shortage of skilled labor, imposing a threat to our identification.

To deal with this concern, we collect the number of college students in each prefecture from each year. We collect the data from China City Statistical Yearbook. We add the college students number at each prefecture by year level as our control. We show that our point estimates are not affected by this control variable. We present the results in Table A10 and Table A11.

Housing Property Reform in 1994 The housing reform in China in 1994 was a significant change in the country's housing system, which aimed to shift from a state-controlled system to a market-oriented one. Before the reform, the Chinese government owned all urban housing and allocated it to individuals based on their employment and family size. Wang (2012) find an increase in self-employment following the reform in urban China as it allowed state employees who were renting state-owned housing the opportunity to buy their homes at subsidized prices.

We assert that the housing reform in 1994 does not confound our analysis. It is because our

event study results indicate a parallel pre-trend. Had the housing reform influenced our treatment proxy, reflected by pre-shares, its impact would have emerged before the subsequent SOE reform. This parallel trend underscores the credibility of our analysis.

6 A Back-of-the-Envelope Analysis

In this section, we employ the coefficients derived from previous regressions to quantify the impact of SOE reform on income inequality from 1992 to 2004. We conduct a back-of-the-envelope analysis across three dimensions: income percentiles, geographical locations (prefectures), and education attainment. Overall, we find that the SOE reform accounts for 40% of the gap in growth rates of income at the 25th and 75th percentiles, above 50% across prefectures, and above 15% across different education attainment.

6.1 Across Different Percentiles of Income

In Figure 1, we observe a substantial disparity in total income growth rate between the 75^{th} and 25^{th} percentiles from 1992 to 2004. Specifically, while the 75^{th} percentile income increased by 90%, the 25^{th} percentile income only increased by 15%, resulting in a 75 p.p. difference in the rate of growth.

We use the results from Table 7 to quantify the contribution of SOE reform to this income inequality. This back-of-the-envelope analysis requires some strict assumptions. First, the income distribution is similar across different prefectures. Second, the policy doesn't affect the composition of population for prefectures.

We find that only the coefficient of the pre-UCE share is significant in the regressions at the prefecture level; thus, we use only this variable for the back-of-the-envelope analysis in this section. The coefficient for the 75^{th} percentile total income is -0.323. By scaling this coefficient by the national average of UCE share in 1992 (0.15), we obtain the causal effect on 75^{th} percentile total income for a prefecture with national average exposure, -0.05. This result indicates that the SOE reform lowers the 75^{th} percentile total income for a prefecture with national average exposure by 5% from 1992 to 2004. We perform a similar exercise for the 25^{th} percentile total income. We scale the estimated coefficient (-2.328) by the national average of UCE share in 1992 (0.15) to obtain the causal effect on 25^{th} percentile total income for a prefecture with national average exposure, -0.3492. This finding implies that the SOE reform lowers 25^{th} percentile total income by 34.92% on average. Moreover, compared to the effect on the 75^{th} percentile total income, we observe a more substantial effect on the 25^{th} percentile total income by 29.92%.

Overall, our identification strategy predicts a 29.92 p.p. difference in 25^{th} and 75^{th} percentile

total income from 1992 to 2004. The actual difference over this period is 75 p.p., indicating that SOE reform accounts for 40% of the gap in growth rates of income at the 25^{th} and 75^{th} percentiles.

6.2 Across Prefectures

Furthermore, we quantify how much the SOE reform contributes to the income inequality by locations (Chen and Fleisher, 1996; Démurger, 2001; Fleisher et al., 2010), using the pre-SOE and pre-UCE employment shares' coefficients separately.

In terms of pre-SOE employment share, we classify prefectures by the pre-share magnitude in 1992, as shown in the distribution in Figure A9. The 25^{th} percentile share is 0.25, and the 75^{th} percentile share is 0.40. Then, from the UHS data, we find that the total income increases by 29% for prefectures with pre-UCE employment share below 0.25 from 1992 to 2004. On the other hand, the total income increases by 4% for cites with pre-UCE employment share above 0.40 from 1992 to 2004. The difference is 25 p.p. We refer to our results from Table 4. Scaling the coefficient of the pre-UCE share (-0.988) and the difference in pre-UCE share between 25^{th} and 75^{th} percentile (0.15), we derive the estimated total income difference as 14.8 p.p. from our identification strategy. The difference from the real data is 25 p.p., so our strategy shows that the SOE reform accounts for 60% out of the total income difference between the prefectures of 25^{th} and 75^{th} percentile pre-UCE share.

In terms of the pre-SOE employment share, we classify prefectures by their pre-SOE employment share in 1992, as shown in Figure A9. The 25^{th} percentile share is 0.11, and the 75^{th} percentile share is 0.19. Then, from the UHS data, we find that the total income relatively increases by 36% for prefectures with pre-UCE employment share below 0.11 from 1992 to 2004. On the other hand, the total income relatively decreases by 11% for prefectures with pre-UCE employment share above 0.19 from 1992 to 2004. The difference is 47%. We refer to our results from Table 4. Scaling the coefficient of the pre-SOE share (-2.912) and the difference in pre-UCE employment share between 25^{th} and 75^{th} percentile (0.08), we derive the estimated total income difference as 23.3% from our identification strategy. The difference from the real data is 47%, so our strategy shows that the SOE reform accounts for 50% out of the total income difference between the prefectures of 25^{th} and 75^{th} percentile pre-SOE share.

6.3 Across Different Education Attainment

In Figure A4, we also observe a substantial inequality in total income growth between higher and lower education attainment group from 1992 to 2004. Specifically, while people with above high school education increased their income by 150%, people with less than high school degree only increased by 60%, resulting in a 90% difference. According to the heterogeneity by education

results in Table A8, we also find that the coefficients of the group with less than high school education are the lowest among all the groups. Using the pre-SOE employment share, the coefficient of the less than high school group is -1.36, and the coefficient of the above high school is -0.68. It corresponds to 47.6% relative decline in total income for the less than high school group and 23.7% relative decline for the above high school group, resulting in a 23.9 p.p. difference. Overall, the pre-SOE employment share accounts for 26.5% difference in the inequality across different education attainment. We do the similar exercise using the pre-UCE employment share. The coefficient of the less than high school group is -1.80, and the coefficient of the above high school is -0.85. It corresponds to 27% total income decline for the less than high school group and 12.8% decline for the above high school group, resulting in a 14.2 p.p. difference. Overall, the pre-UCE employment share accounts for 15.8% difference in the inequality across different education attainment.

7 Conclusion

This paper investigates how China's large-scale reform of state-owned enterprises (SOEs) in the late 1990s restructures the urban labor market and contributes to overall income inequality. We use the employment share of both SOE and UCE in 1992 as two proxies for the exposure to the reform. We show that these two proxies are significantly and positively correlated with the *Reduction in Public Employment*.

Overall, we find the prefecture more exposed to the SOE reform lagged those that were less exposed. To be specific, the pre-SOE share predicts 5.3 p.p. (6%) decline in employment; the pre-UCE employment share predicts 4.9 p.p. (6%) decline in employment. In terms of earnings, the pre-SOE employment share predicts 40.7% less increase and the pre-UCE employment share predicts 58.8% less increase. Interestingly, pre-SOE employment share and pre-UCE employment share have different effects with respect to self-employment. Specifically, we find that pre-SOE employment share predicts 5.3 p.p. (265%) decline in self-employment, while the pre-UCE employment share predicts 6.5 p.p (325%) increase in self-employment.

At the end, we conduct a back-of-the-envelope analysis to quantify how much the reform contributes to the overall income inequality in urban China. Our calculation shows that the reform explains 40% of the gap in growth rates of income at the 25th and 75th percentiles, above 50% of the inequality across prefectures, and above 15% of the inequality across different education groups.

At the aggregate level, China's economy significantly benefits from reforms. Our study highlights the neglected distributional consequences of sudden severe shocks to the labor market and medium-run equity losses. The findings can also be applied to other contexts to understand the evolution of income inequality associated with the change of labor market policies.

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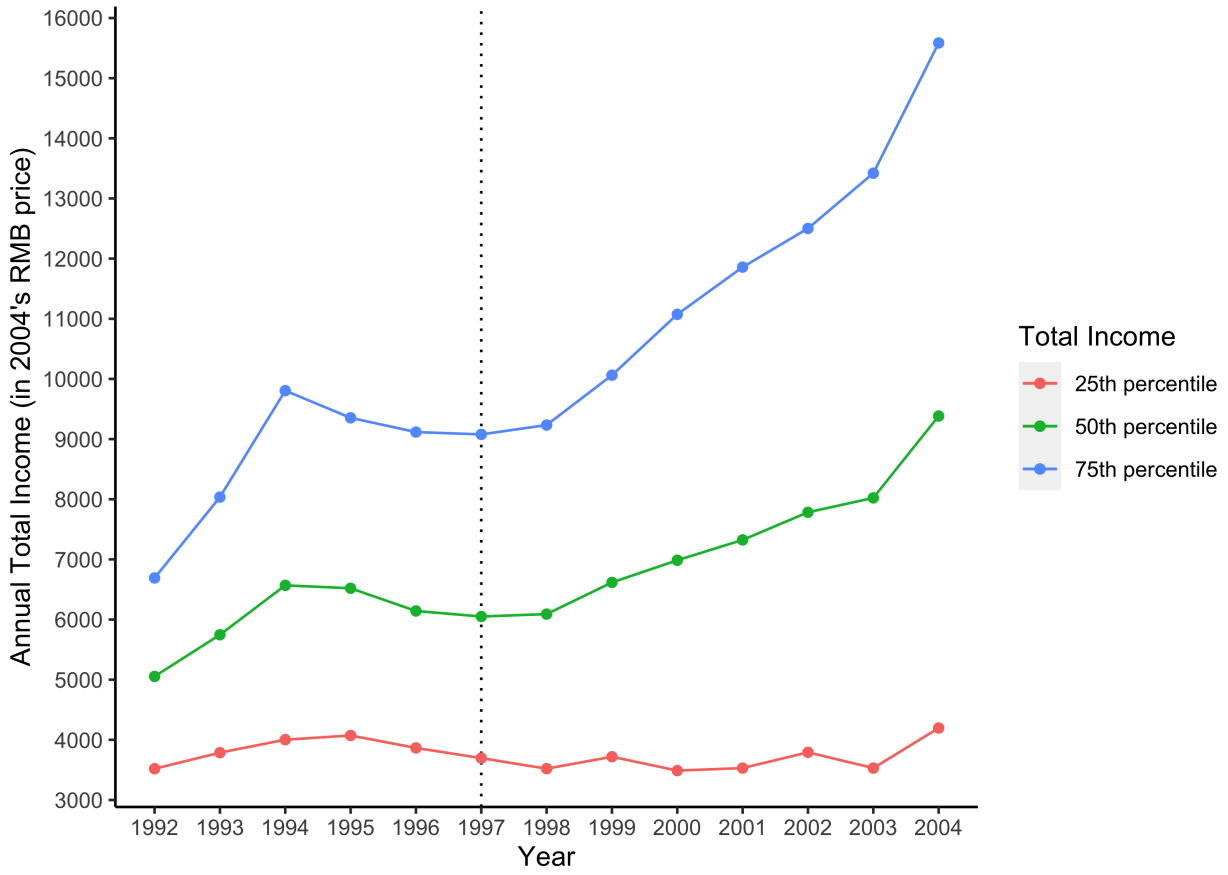
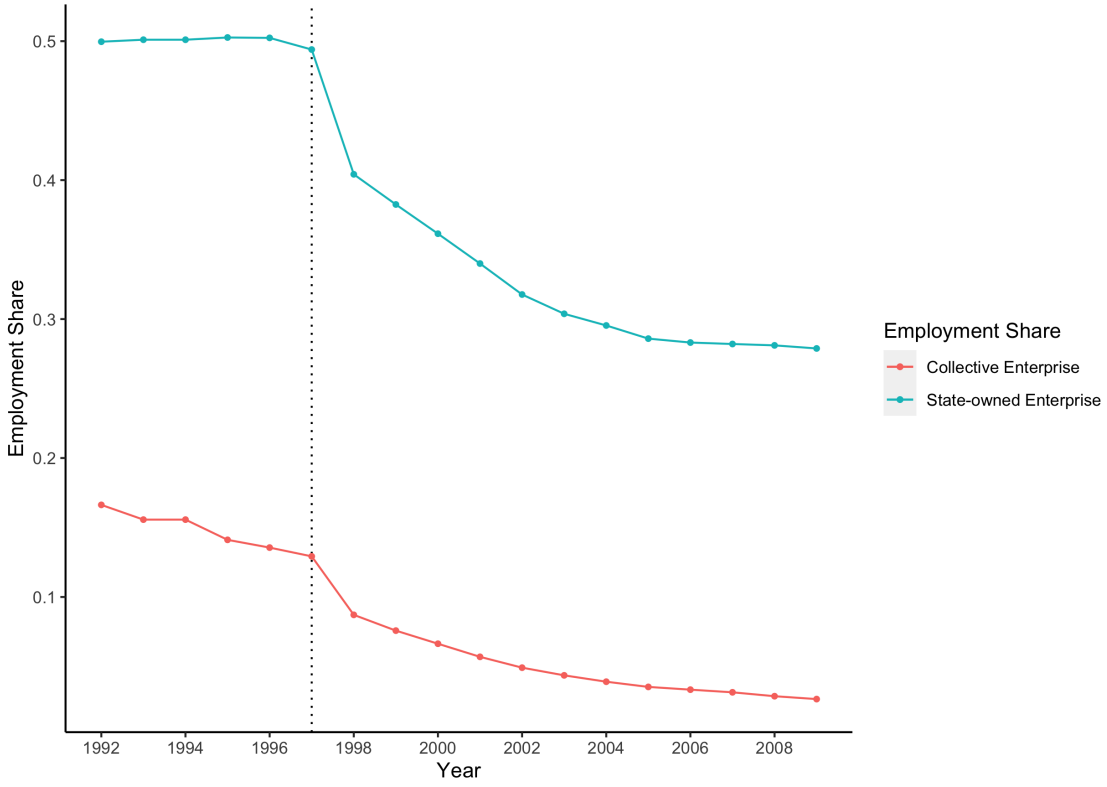
Figures

Figure 1: Income Inequality in Urban China, 1992-2004



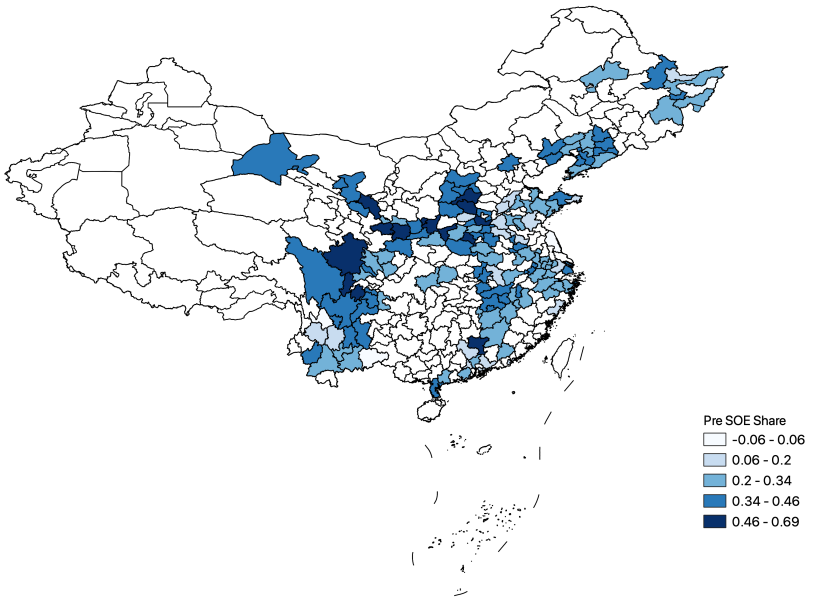
Note: The figure reports the log real total income Sources: Data comes from Urban Household Survey(1992-2004). We restrict the individuals to be age 18-54. We add a vertical line for year 1997 when the SOE reform was officially announced by the central government. We include zero income in the income variable.

Figure 2: Share of Urban Labor Force Working in SOEs and Collectives

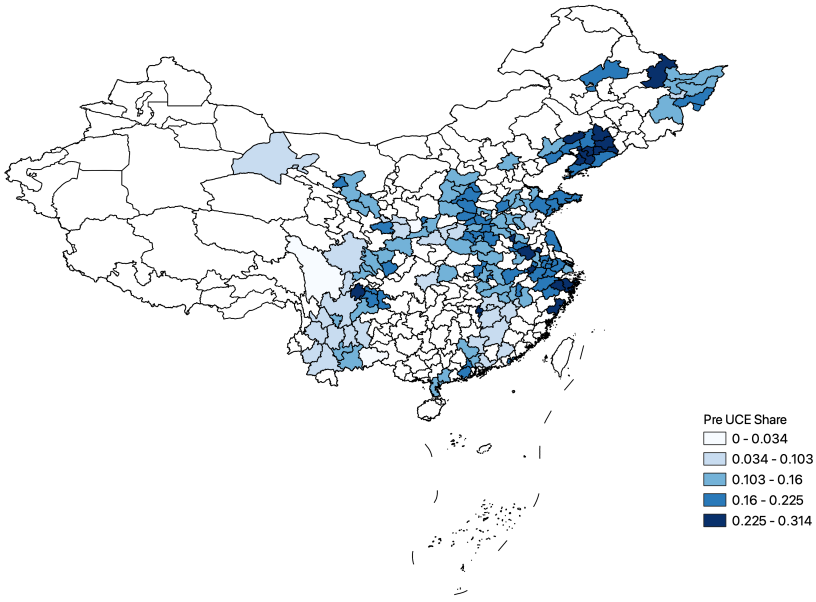


Note: The figure reports the share of SOE workers from 1992 to 2009 in urban China. The numerator is the employment in each ownership (*Zhi Gong Ren Shu* from the Statistical Yearbook of each procince and city), and the denominator is the 15-64 non-agriculture population from 2000 census. We add a vertical line for year 1997 when the SOE reform was officially announced by the central government.

Figure 3: Regional Variation in the Exposures to the Reform



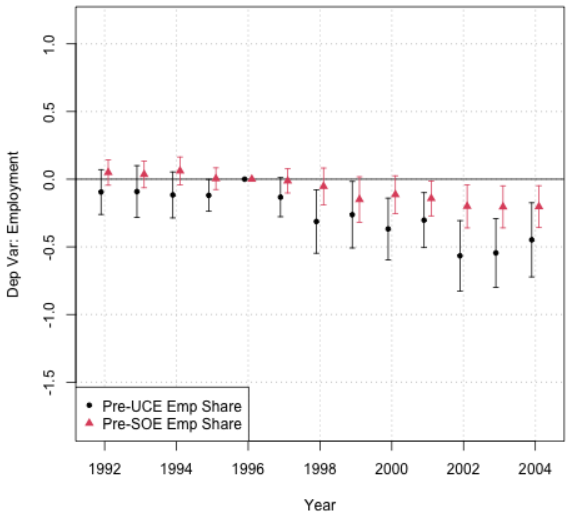
(a) SOE Employment Share in 1992



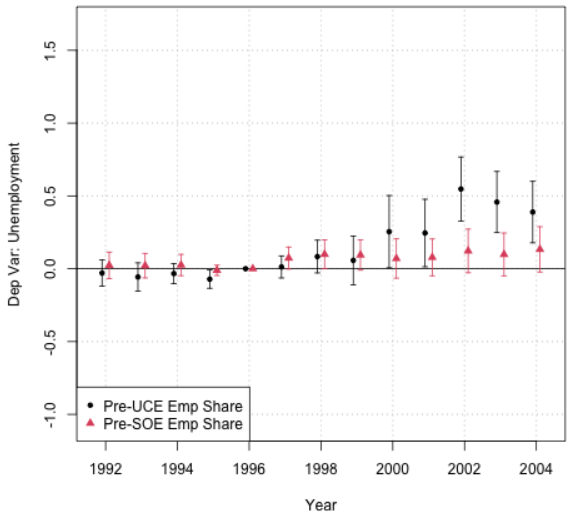
(b) UCE Employment Share in 1992

Notes: This figure reports the change of public employment share (both SOE and UCE) in each prefecture from 1996 to 2000. We use the employment data from the Province and City's Statistical Yearbook to be the numerator. The denominator is 15-64 non-agriculture population from 2000 census. We adjust the pre-shares by the industry data from the 1990 census. A tiny proportion of the pre-SOE employment share is negative because of the measurement error across the multiple data sources.

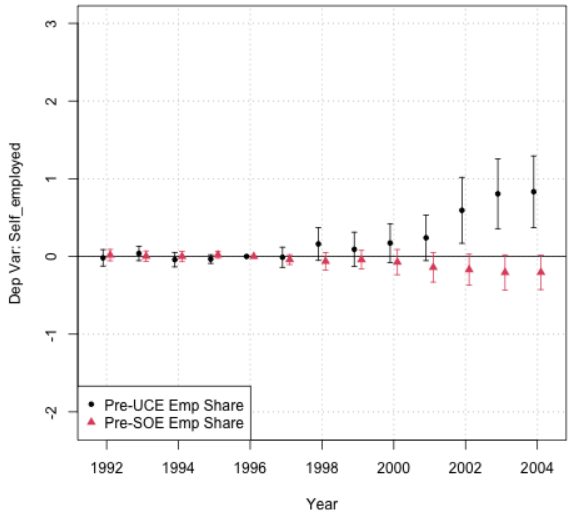
Figure 4: Effect of SOE Reform on Employment, Unemployment, and Self-Employment



(a) Employment



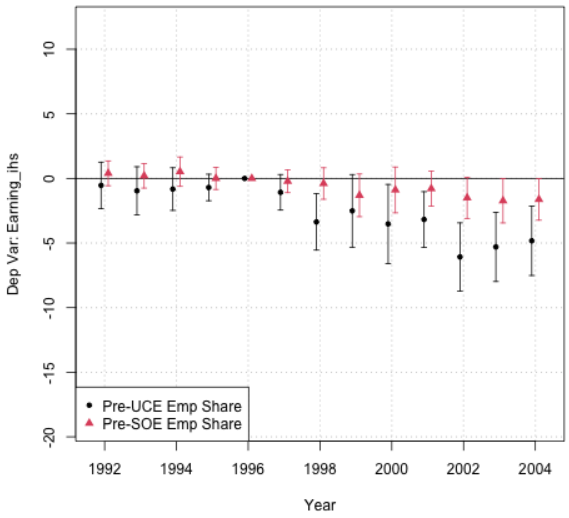
(b) Unemployment



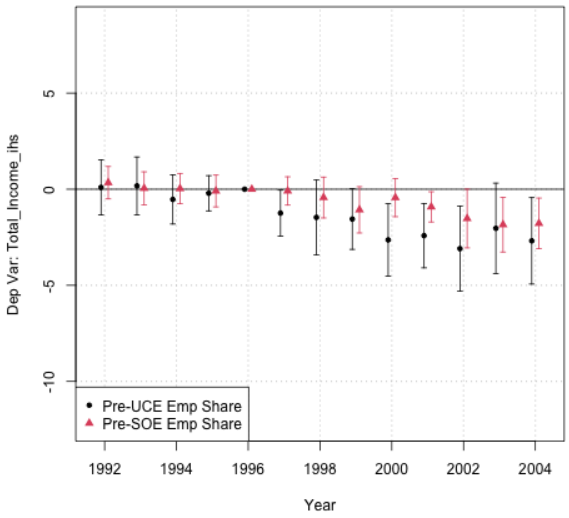
(c) Self-Employment

Notes: We use the DiD Event Study Approach to study the effect of SOE reform on labor force. We use the regional pre-reform SOE and UCE employment share in 1992 as proxies to the reform. We include control variables, such as age, years of education, and gender.

Figure 5: Effect of SOE Reform on ihs(Income)



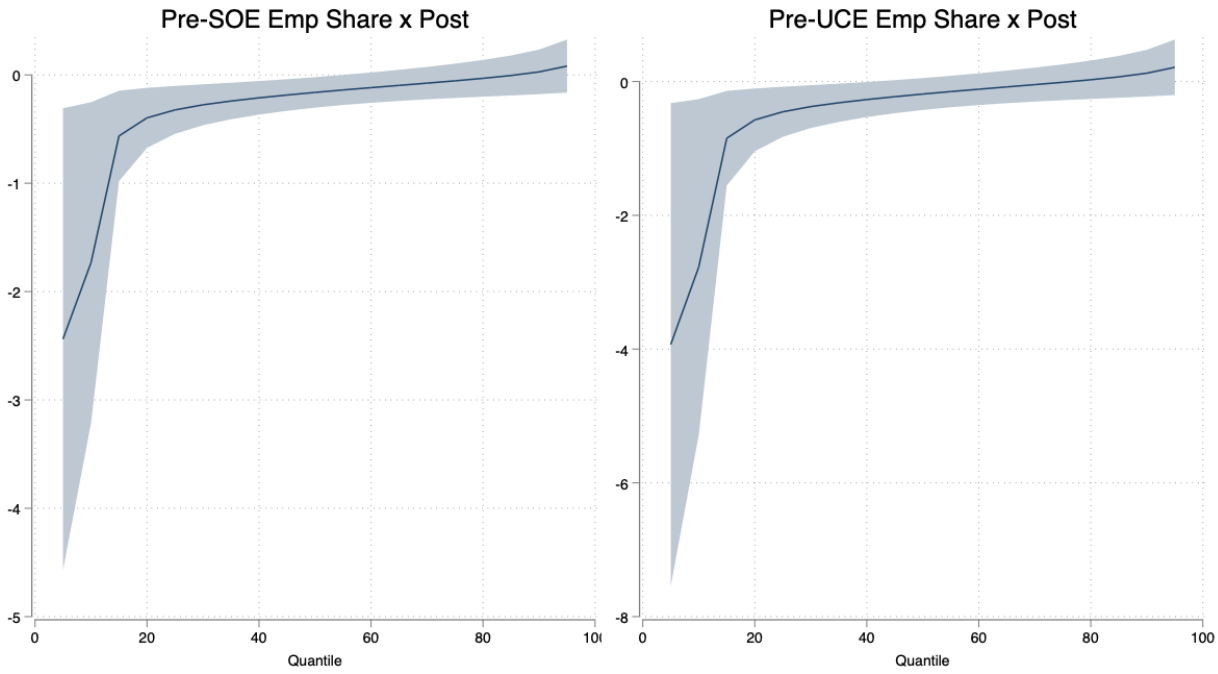
(a) ihs(Earnings)



(b) ihs(Total Income)

Notes: We use the DiD Event Study Approach to study the effect of SOE reform on income. We use the regional pre-reform SOE and UCE employment share in 1992 as proxies to the reform. We include control variables, such as age, years of education, and gender.

Figure 6: Quantile Regression on ihs(Total Income)



Notes: We use the quantile regression to study how the reform affects the total income at different percentile. We employ a DiD design. We use the regional pre-reform SOE and UCE employment share in 1992 as proxies to the reform. We define years equal to or after 1997 as post-reform period.

Tables

Table 1: Summary Statistics of Key Variables: 1992 - 2004

	Before (1992-1996)	After (1997-2004)
Panel A: selected labor market outcomes		
Employment	0.87	0.76
	(0.34)	(0.43)
Unemployment	0.03	0.08
	(0.18)	(0.27)
Self-employment	0.02	0.12
	(0.15)	(0.33)
Work in private sector	0.02	0.07
	(0.13)	(0.25)
Monthly earnings (in 2004 RMB)	487.87	572.88
	(421.18)	(683.66)
Monthly wage (in 2004 RMB)	476.55	554.77
	(416.90)	(679.70)
Monthly total income (in 2004 RMB)	530.86	683.86
	(440.40)	(721.48)
Monthly transfer income (in 2004 RMB)	28.71	65.93
	(111.59)	(236.82)
Panel B: individual characteristics		
Age	36.47	38.17
	(9.77)	(9.99)
Female	0.51	0.51
	(0.50)	(0.50)
Years of schooling	11.11	11.66
	(2.49)	(2.44)
Observations	77399	224605

Notes: Weighted means and standard deviations are presented. Standard deviations in parentheses. Individuals between age 18 and 54. Data comes from Urban Household Survey (1992-2004). Our sample includes 201 prefectures.

Table 2: Summary Statistics of the Employment Shares

Variables	Mean	SD	Min	Max	N
Pre-SOE Emp Share	0.46	0.11	0.10	0.83	157
Pre-UCE Emp Share	0.17	0.06	0.04	0.33	163
Pre-SOE Emp Share after Adjustment	0.32	0.12	-0.05	0.69	157
Pre-UCE Emp Share after Adjustment	0.15	0.06	0.00	0.31	157
Reduction in Public Employment	0.20	0.09	0.00	0.51	163
Reduction in SOE Employment	0.13	0.07	-0.03	0.37	163
Reduction in UCE Employment	0.06	0.04	-0.06	0.20	163

Notes: Data come from China's Provincial and City Statistical Yearbook and 1990 Census. The denominator of the share is the 15-64 non-agriculture population souced from 2000 Sensus. This sample includes the prefectures in Guangdong Province. We are not able to match every prefecture between the Census and the Statistical Yearbook, resulting in missing data for some prefectures. There exists negative value for the Pre-SOEs Emp Share after Adjustment due to measurement error.

Table 3: Effect of SOE Reform on Employment Outcomes

	(1)	(2)
Panel A: Dep. Var.	Employment (0/1)	Unemployment(0/1)
Post × Pre-UCE Emp Share	-0.328***	0.392***
	(0.104)	(0.094)
Post × Pre-SOE Emp Share	-0.165***	0.058
	(0.051)	(0.044)
Mean of Dep. Var.	0.84	0.05
Panel B: Dep. Var.	Self-employment (0/1)	Work in private sector (0/1)
Post × Pre-UCE Emp Share	0.433***	-0.086
	(0.128)	(0.113)
Post × Pre-SOE Emp Share	-0.151*	-0.009
	(0.078)	(0.068)
Mean of Dep. Var.	0.08	0.04

Notes: $N = 205,300$. The mean of pre-UCE emp share and pre-SOE emp share is 0.17 and 0.45, respectively. All regressions include female dummy, age group dummies, education attainment group dummies, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. The omitted age group is age between 18 and 25, while the omitted education attainment group is below high school, including illiteracy, some elementary school, elementary school, and middle school. Our sample includes 201 prefectures. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4: Effect of SOE Reform on Income Outcomes

	(1)	(2)
Panel A: Dep. Var.	Wage	Earnings
Post × Pre-UCE Emp Share	-5.068***	-3.919***
	(1.198)	(1.026)
Post × Pre-SOE Emp Share	-1.020	-1.162**
	(0.653)	(0.563)
Panel B: Dep. Var.	Total income	Transfer income
Post × Pre-UCE Emp Share	-2.912***	2.676
	(0.795)	(2.127)
Post × Pre-SOE Emp Share	-0.988***	0.682
	(0.351)	(1.031)

Notes: $N = 205,200$. The mean of pre-UCE emp share and pre-SOE emp share is 0.17 and 0.45, respectively. All regressions include female dummy, age group dummies, education attainment group dummies, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. The omitted age group is age between 18 and 25, while the omitted education attainment group is below high school, including illiteracy, some elementary school, elementary school, and middle school. Our sample includes 201 prefectures. The inverse hyperbolic sine (IHS) transformation is imposed to all outcome variables. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 5: Effect of SOE Reform on Employment: by age and educational attainment

	Below high school	High school	Above high school
	(1)	(2)	(3)
Panel A: 18-25			
Post × Pre-UCE Emp Share	-1.443***	-0.548	-0.223
	(0.370)	(0.342)	(0.334)
Post × Pre-SOE Emp Share	-0.341*	-0.028	-0.418**
	(0.203)	(0.161)	(0.170)
N	5465	13175	14207
Panel B: 26-40			
Post × Pre-UCE Emp Share	-0.181	0.019	-0.203**
	(0.153)	(0.122)	(0.100)
Post × Pre-SOE Emp Share	-0.114	-0.073	-0.034
	(0.090)	(0.060)	(0.038)
N	22435	25825	34628
Panel C: 41-54			
Post × Pre-UCE Emp Share	-0.253	-0.555***	-0.207*
	(0.211)	(0.196)	(0.124)
Post × Pre-SOE Emp Share	-0.373***	-0.163	-0.020
	(0.102)	(0.124)	(0.076)
N	40634	21299	27632

Notes: All regressions include gender dummy, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. Our sample includes 65 balanced prefectures. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 6: Effect of SOE Reform on Total Income: by age and educational attainment

	Below high school	High school	Above high school
	(1)	(2)	(3)
Panel A: 18-25			
Post × Pre-UCE Emp Share	-10.613***	-5.023*	-5.964*
	(3.389)	(2.565)	(3.420)
Post × Pre-SOE Emp Share	-3.063	0.208	-3.711**
	(1.882)	(1.223)	(1.565)
N	6854	17619	18944
Panel B: 26-40			
Post × Pre-UCE Emp Share	0.845	1.384	-0.886
	(1.432)	(1.185)	(0.867)
Post × Pre-SOE Emp Share	-0.536	-0.338	-0.056
	(1.004)	(0.728)	(0.448)
N	30029	34474	49249
Panel C: 41-54			
Post × Pre-UCE Emp Share	-0.750	-0.670	0.262
	(0.844)	(0.978)	(0.517)
Post × Pre-SOE Emp Share	-1.552***	-0.977**	0.191
	(0.493)	(0.494)	(0.319)
N	54720	30368	37949

Notes: All regressions include prefecture fixed effects, year fixed effects and education attainment dummies. Standard errors are clustered at the prefecture level. Our sample includes 65 balanced prefectures. The inverse hyperbolic sine (IHS) transformation is imposed to all outcome variables. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 7: Effect of SOE Reform on Income Outcomes at City Level

	ihs(Real Earnings)			ihs(Real Total Income)		
	75th pct	50th pct	25th pct	75th pct	50th pct	25th pct
Pre-UCE Emp Share	-0.396	-1.079***	-4.404	-0.323	-0.826**	-2.328**
	(0.247)	(0.377)	(4.910)	(0.233)	(0.322)	(1.021)
Pre-SOE Emp Share	-0.0421	-0.0774	-0.638	-0.0346	-0.0515	0.111
	(0.116)	(0.202)	(2.327)	(0.121)	(0.159)	(0.618)
Observations	780	780	780	780	780	780

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

This table shows the regressions at the city*year level. The outcomes are the income at different percentile in each city*year. We add both city and year fixed effect in our regressions. Our sample includes 65 balanced prefectures. The inverse hyperbolic sine (IHS) transformation is imposed to all outcome variables. * significant at 10%, ** significant at 5%, *** significant at 1%.

Appendix

Appendix A Data: Weight

A.1 Weight by Ownership Type

As Ge and Yang (2014) mentioned in their paper, UHS is known for overweighting of the SOE workers. They mentioned three potential reasons for this. First, self-reporting may introduce error. For example, when a SOE is restructured and becomes a stock-holding firm or a joint venture, its employees may continue to classify their employer as a SOE, failing to recognize the change in ownership for some time. Second, SOE workers usually work a regular eight-hour day, and thus may have more free time in which to respond to surveys than their private-sector counterparts. Third, the China National Bureau of Statistics (CNBS) seeks help from employers to persuade workers to participate in the surveys to reduce the nonresponse rate.

We examine the trend of public employment share (including both government, SOE[A1], and collective employmet) for each prefecture from the UHS data and present the results. While we observe a sharp decline in public employment share for most prefectures during the reform period of 1996-2000, we also find abnormalities in some prefectures, such as those in Henan and Hubei, two provinces that have been most affected by the reform according to previous literature (Lee, 2000). We provide the comparision of the public employment share of Henan across the Statistical Yearbook data and the UHS data in Figure A1. Interestingly, the UHS data shows a steady or even increasing trend of public sector employment in these prefectures, providing evidence of a sampling issue in the UHS data.

We also refer to other data sources to confirm the problem.

First, we examine the trend of public employment share using data from the statistical yearbook of each prefecture. The statistical yearbook is an authoritative source of economic indicators coded by the statistical bureau of each prefecture. Figure 1 shows the trend of public employment share in most prefectures, indicating a sharp decrease during the reform period of 1996 to 2000. Furthermore, we note that the most significant declines occurred in 1998, the year following the national announcement in 1997. By comparing the public employment share data from the UHS and the statistical yearbook, we find a significant discrepancy, further implying a sampling issue in the UHS data.

Next, we refer to the China Labor Statistical Yearbook coded by CNBS. It provides data at the provincial level. In Figure A7, we display two data sources: the share of SOE sector layoffs for

[A1] We are not able to separte government and SOE employment from our data source, Statistical Yearbook of each province and city.

each province from 1998 to 2000 and the change in public employment share for each province from 1996 to 2000. Both graphs are consistent with the treatment intensity proxy as described above.

Based on the evidence presented above, we conclude that there is a need to address the representativeness issue in the UHS data. To achieve this, we propose adjusting the weight of each observation. While Ge and Yang (2014) utilize a resampling approach to address this issue, we propose reweighting the employment by ownership type to make more efficient use of the UHS data.

We compare the shares of different types of employment (namely SOE employment, collective employment, and other employment) between the statistical yearbook and the UHS for each prefecture-year. for each prefecture-year. We define the the variable $Weight\_emp_{ict}$ in Equation A1.

$$Weight\_emp_{ict} = \begin{cases} \frac{SOEShare_{yearbook}}{SOEShare_{UHS}} & \text{For Gov \& SOE workers i} \\ \frac{CollectiveShare_{yearbook}}{CollectiveShare_{UHS}} & \text{For Collective workers i} \\ \frac{1-PublicShare_{yearbook}}{1-PublicShare_{UHS}} & \text{For non-public workers i} \end{cases} \tag{A1}$$

A.2 Weight by Year

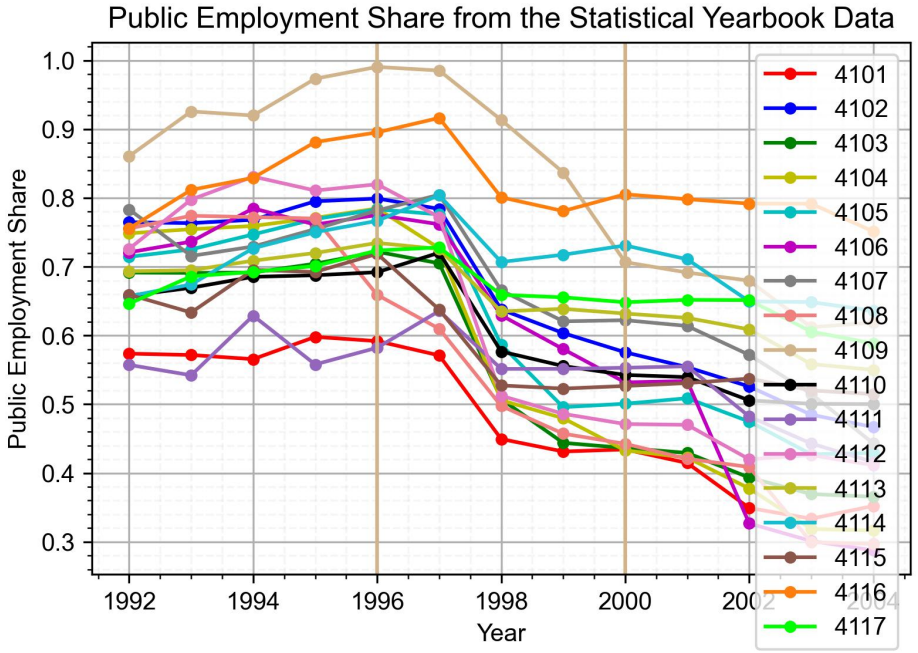
Another notable issue with the UHS dataset is the tripled sample size following the 2002 reform, which creates a need to downweight observations after 2002 to account for the potential bias in the data. To address this issue, we create a new variable $Weight\_year_{ict}$ that measures the change in population before and after the reform in each prefecture. By comparing the mean population before and after 2002, we calculate a weight ratio that is applied to adjust for the year-level discrepancy, as presented in Equation A2. As noted by Dai et al. (2021), the UHS sample size for each prefecture is proportionate to their population, so we don't need to weight the sample according to the population.

$$Weight\_year_{ict} = \begin{cases} 1 & t < 2002 \\ \frac{AverageSampleSizeBefore2002_{ict}}{AverageSampleSizeAfter2002_{ict}} & t \geq 2002 \end{cases} \tag{A2}$$

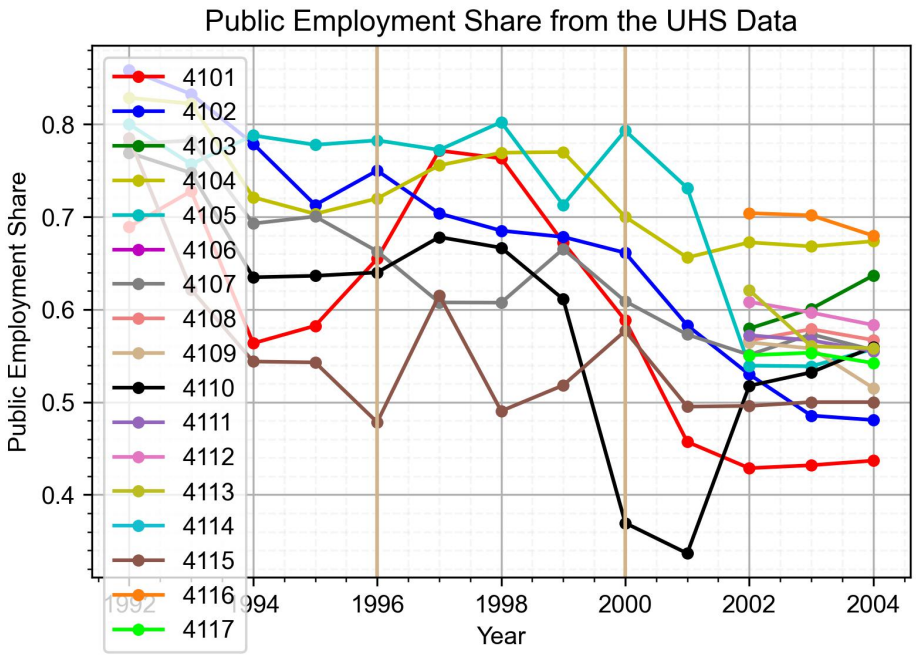
We multiply the two weights and use as our weighting index $Weight_{ict}$, as shown in Equation A3.

$$Weight_{ict} = Weight\_emp_{ict} \times Weight\_year_{ict} \tag{A3}$$

Figure A1: Compare the Public Employment Share Trend in Henan across UHS and Statistical Yearbook



(a) Data from Statistical Yearbook



(b) Data from UHS

Notes: The legend represents each city code from Henan province. Some prefectures in Henan province only show up after 2002 in the UHS. Public employment includes government, SOE, and collective enterprise. We divde the public employment by working-age (15-64) non-agriculture population.

A.3 Verify the Weighting Approach using the *Reduction in Public Employment*

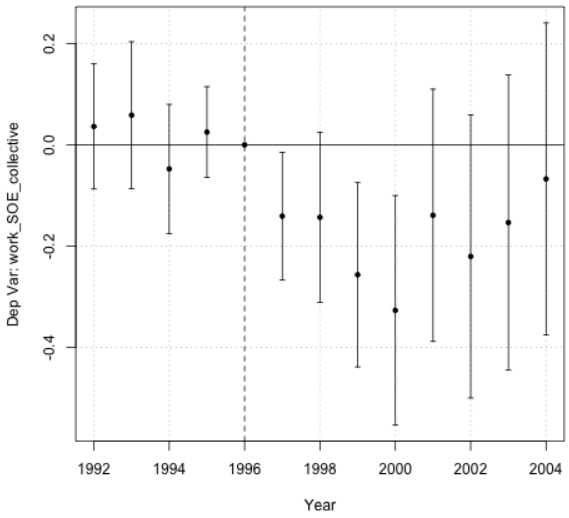
Is our weighting approach is valid? To answer this question, we conduct an event study to correlate the *Reduction in Public Employment* with the individual's probability of working in the public sector. If our measurement of *Reduction in Public Employment* is reliable, which relies on the data that comes from the statistical yearbook, the point estimate should be around -1 in year 2000. The reason is simple. Mechanically, if the change in public employment share went from 100% in 1996 to 0 in 2000, we should observe that the probability for any workers to work for any public sector is 0. In other words, as the outcome variable *Work in Public Sector* is a stock variable, a coefficient of -1 at year 2000 implies that public employment has completely diminished compared to the base year 1996.

The specific event study regression design is as follows:

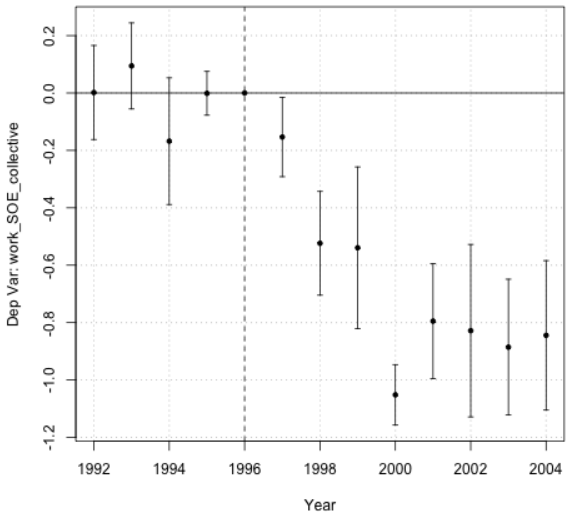
$$\begin{aligned}\text{Work in Public Sector}_{ipt} = &\alpha + \sum_{k \geq 1992, k \neq 1996}^{2004} \beta_k \times \text{Reduction in Public Employment}_p \times \mathbb{1}\{t == k\} \\ &+ \Phi X_{ipt} + \delta_p + \gamma_t + \varepsilon_{ipt} \end{aligned} \tag{A4}$$

We present a comparison between the event study with and without our weighting approach, as illustrated in Figure A2. Our findings indicate that without the use of weighting, the coefficient at year 2000 is -0.2. This suggests that the UHS data fails to accurately capture the public sector employment reported by the statistical yearbook data. The reason for this disparity is that certain prefectures oversample SOE employees, thereby failing to reflect the contracting public sector, as detailed in Section A. In contrast, when we apply our weighting strategy, the coefficient at year 2000 is -1. This confirms the mechanical accuracy of our weighting approach and provides evidence that it successfully addresses UHS's sampling issue. Therefore, we use our weighting strategy for all analyses in this paper.

Figure A2: Validity of the Weighting Approach: Effect on Employment in the Public Sector



(a) With Weighting and Control Variables

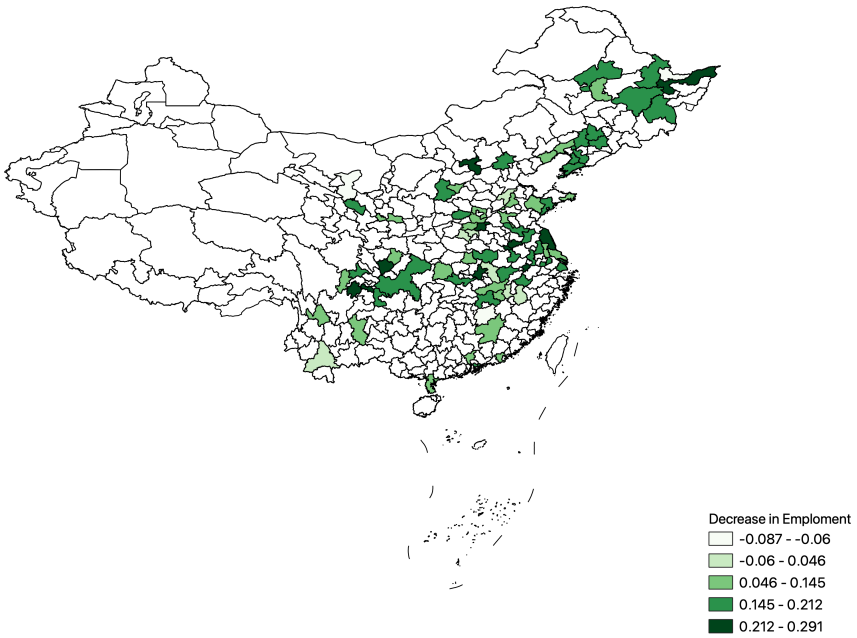


(b) With Weighting but Without Control Variables

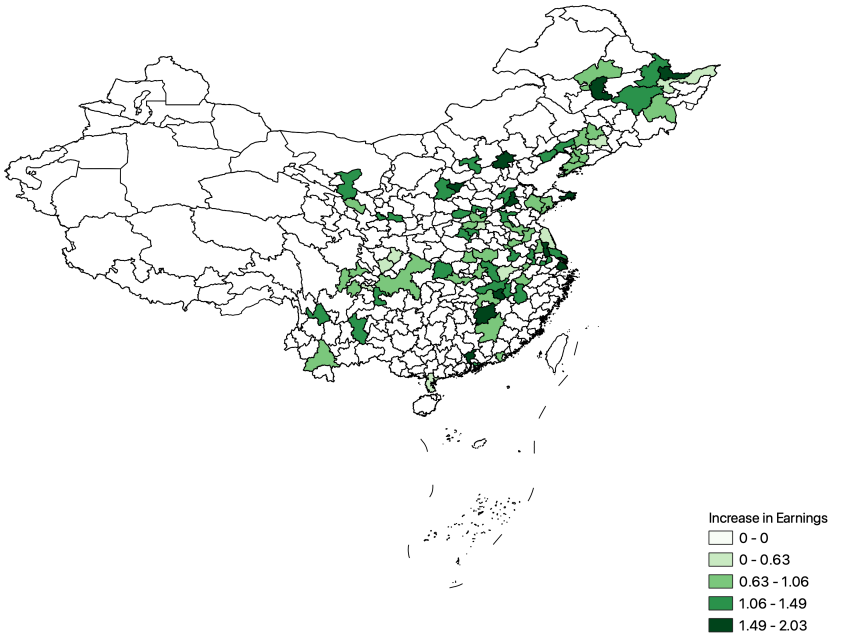
Notes: We regress the variable Work in Public Sector to check the validity of our weighting approach. We use the regional variation in change of the public employment share from 1996 to 2000 as the *Reduction in Public Employment*. In (a), we use the DiD Event Study Approach without any weighting and control variables. In (b), we use the DiD Event Study Approach with weighting but without control variables. We show that the weighting strategy is successful in correcting the oversampling of SOE workers.

Appendix B Other Figures and Tables

Figure A3: Regional Inequality in the Change of Employment and Earnings



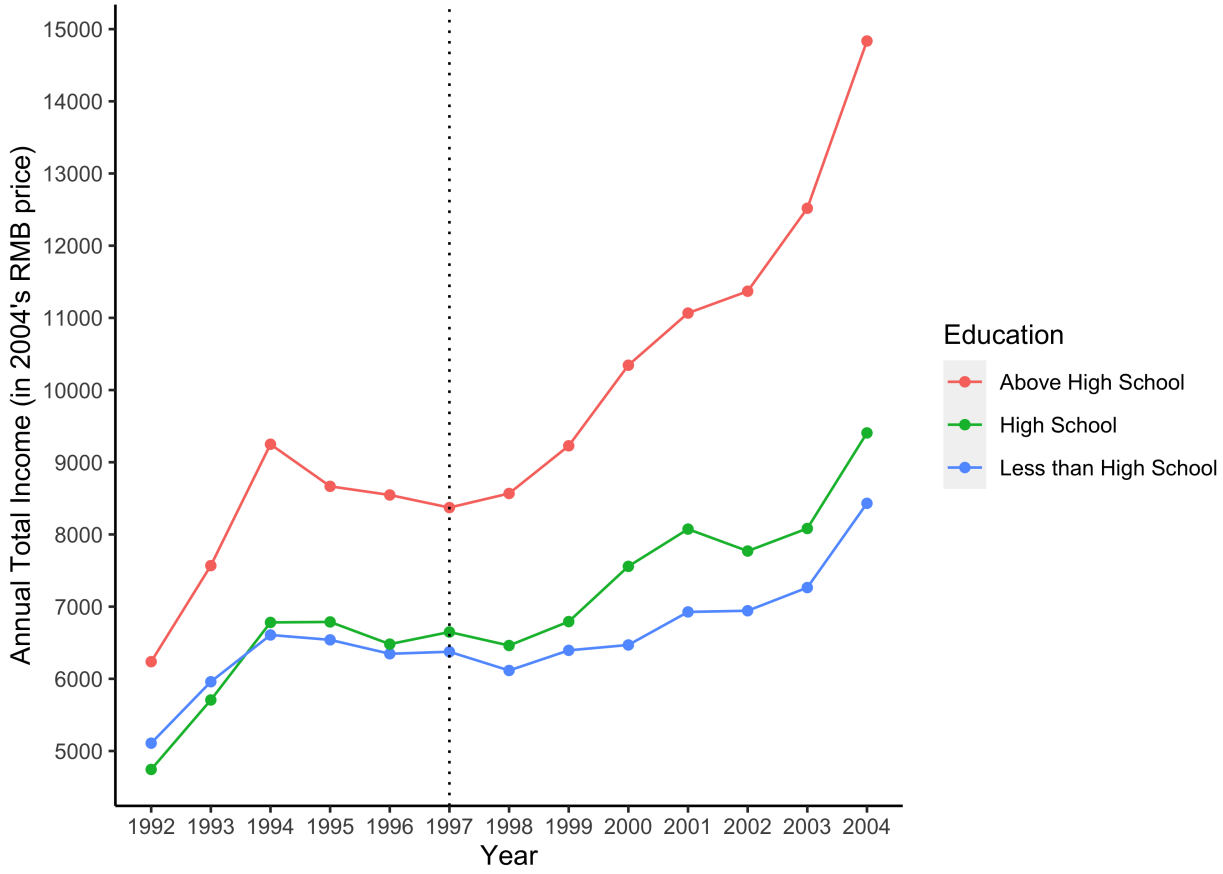
(a) Decrease in Employment



(b) Increase in Earnings

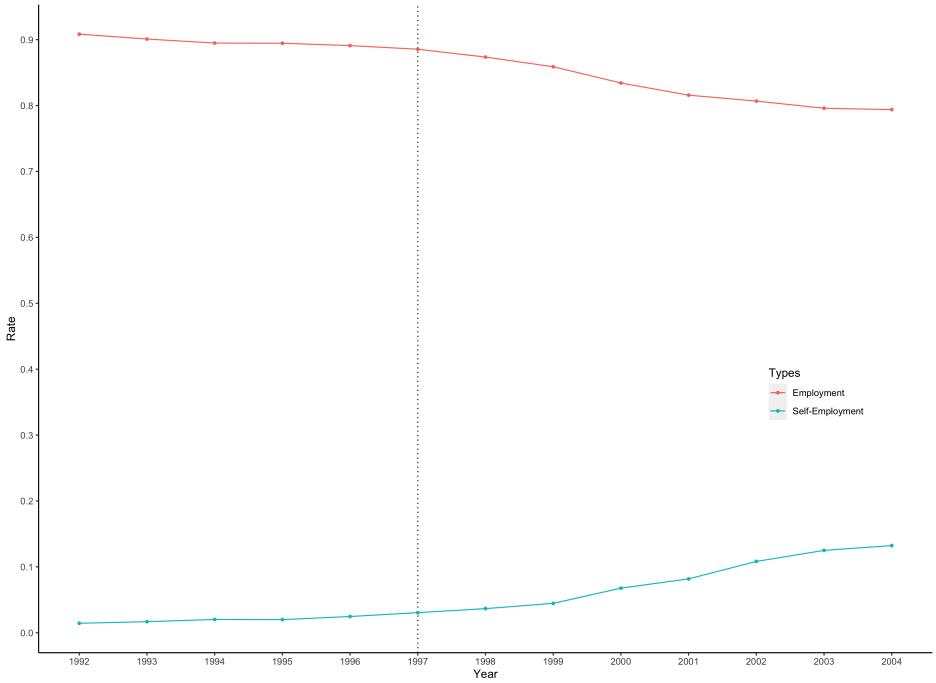
Notes: Top figure shows the percentage point decrease in employment from 1992 to 2004. Bottom figure shows the percent increase in earnings from 1992 to 2004. The dark the color, the bigger the change is. Data is from the Urban Household Survey

Figure A4: Income Inequality by Education Attainment



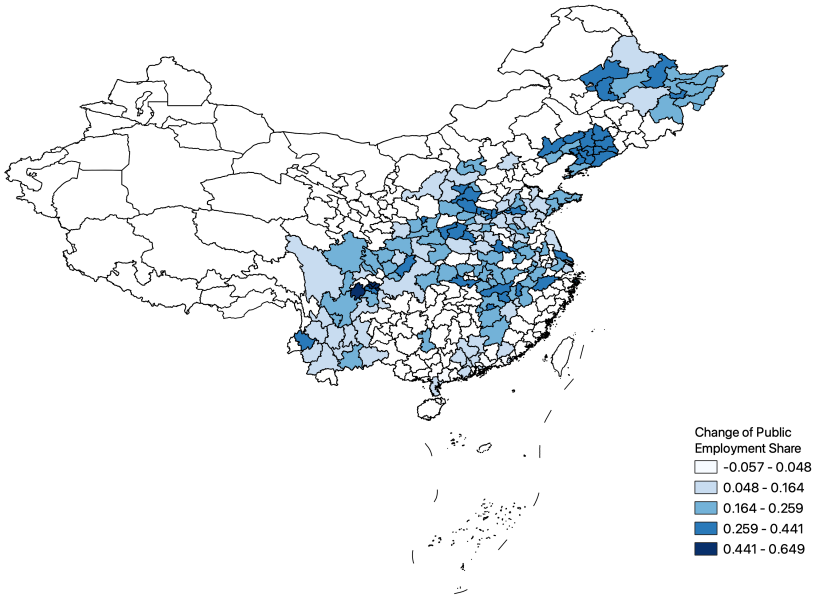
Notes: Data comes from Urban Household Survey(1992-2004). We restrict the individuals to be age 18-54. We add a vertical line for year 1997 when the SOE reform was officially announced by the central government. We include zero income in the income variable.

Figure A5: Labor Trend Overtime



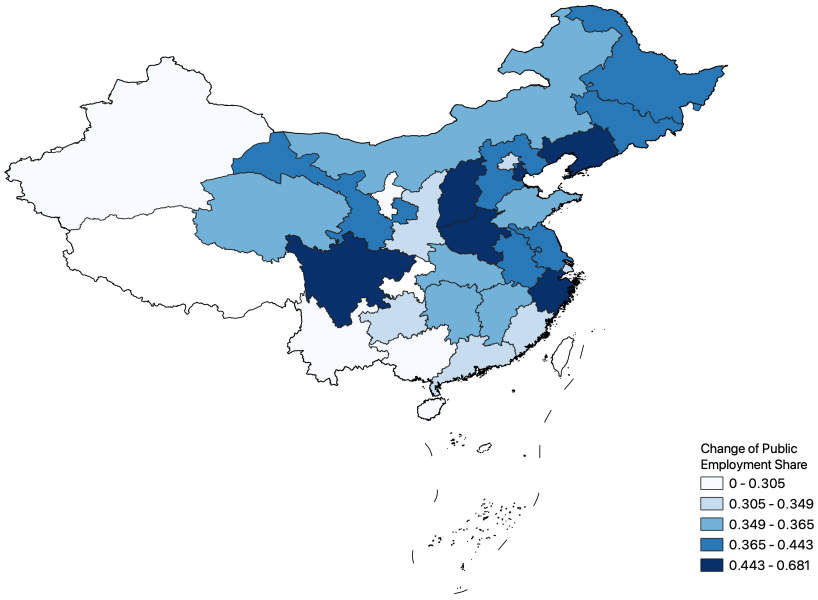
Notes: Data comes from Urban Household Survey(1992-2004). Employment includes both being employed by public and private sector and self-employment. Self-employment includes small business owners, being employed by business owners, and other jobs like nannies

Figure A6: Reduction of Public Employment Share

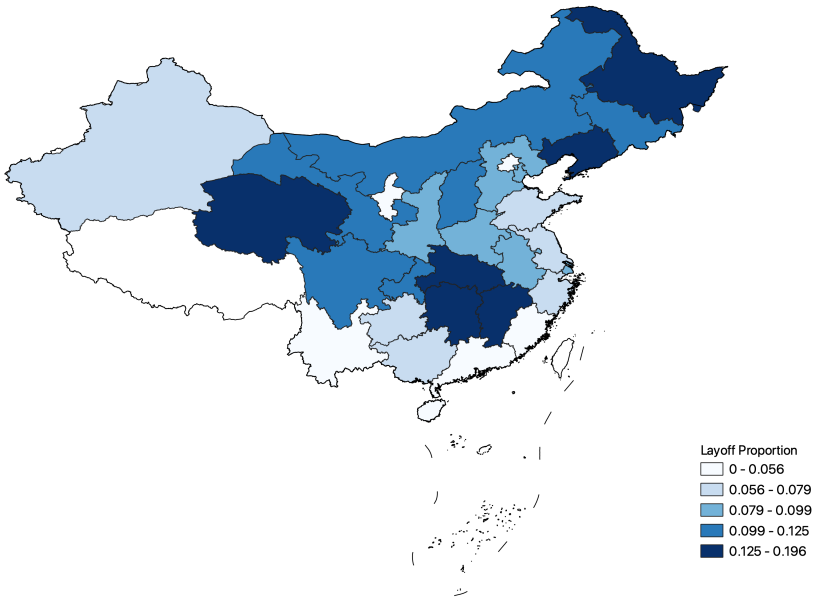


Notes: This figure reports the reduction of public employment share (including both SOE and UCE) in each prefecture from 1996 to 2000. The darker the color, the more reduction at the prefecture level. Data comes from Statistical Yearbook of each province and prefecture.

Figure A7: Provincial Variation in the Reduction of the Public Sector



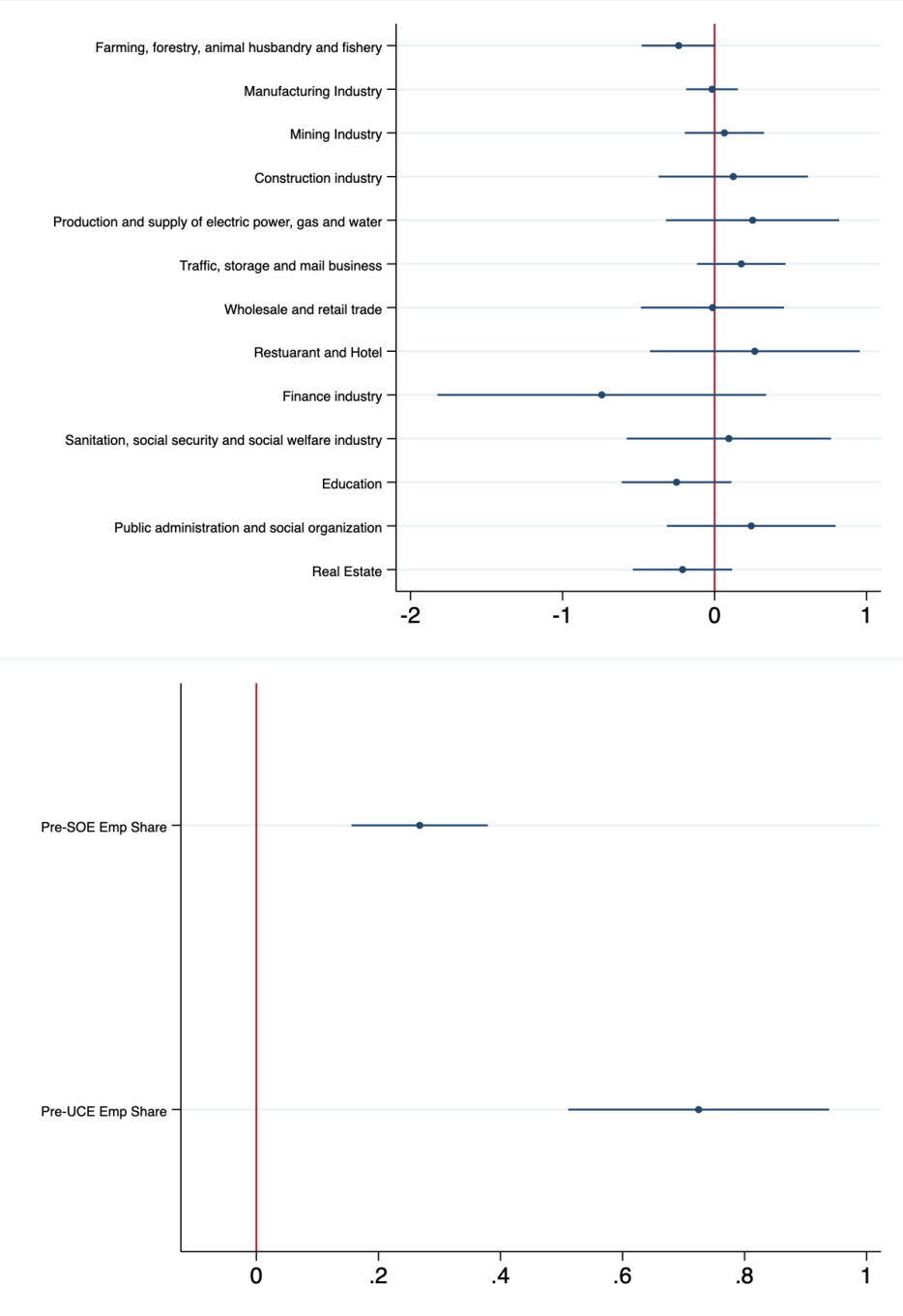
(a) Reduction in the Public Sector



(b) Layoff Proportion

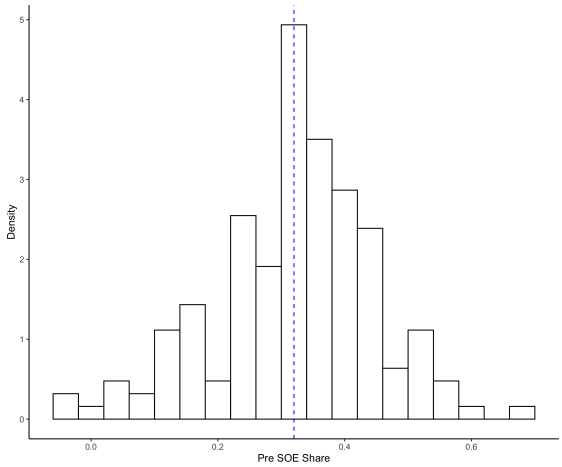
Notes: These figures show the reduction in the public sector and layoff proportion in each province from 1996 to 2000. Data comes from China Labor Statistical Yearbook.

Figure A8: Coefficients of the Pre-reform Characteristics

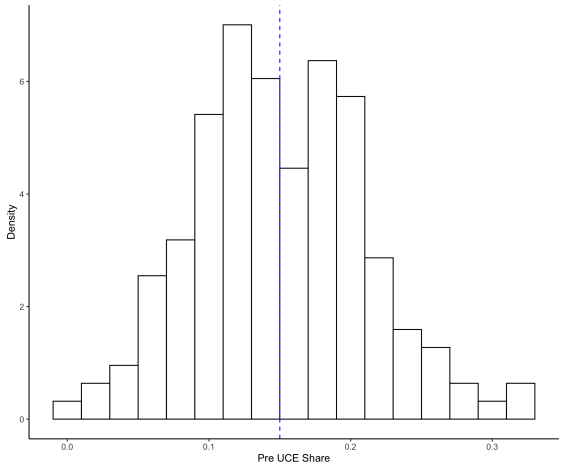


Notes: The top figure reports the results of regressing the *Reduction of Public Employment Share* upon each Industry employment share in 1990. The bottom figure shows the results of regressing the *Reduction of Public Employment Share* upon each sector employment share in 1992. Employment by industry data comes from Census of 1990. Employment by ownership data comes from Statistical Yearbook of each province and prefectures in 1992.

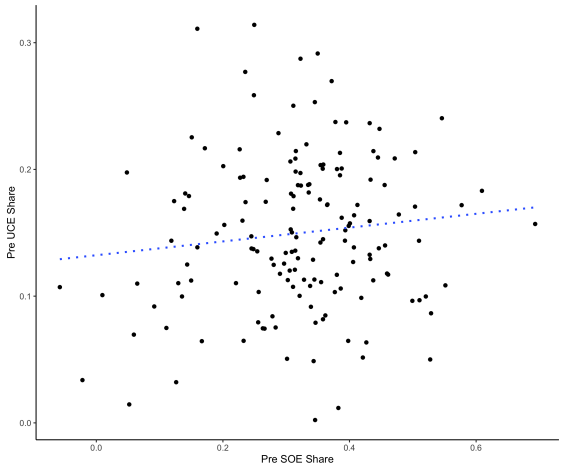
Figure A9: The Histograms of the Two Pre-shares and their Correlation



(a) Pre-reform SOE Employment Share Distribution



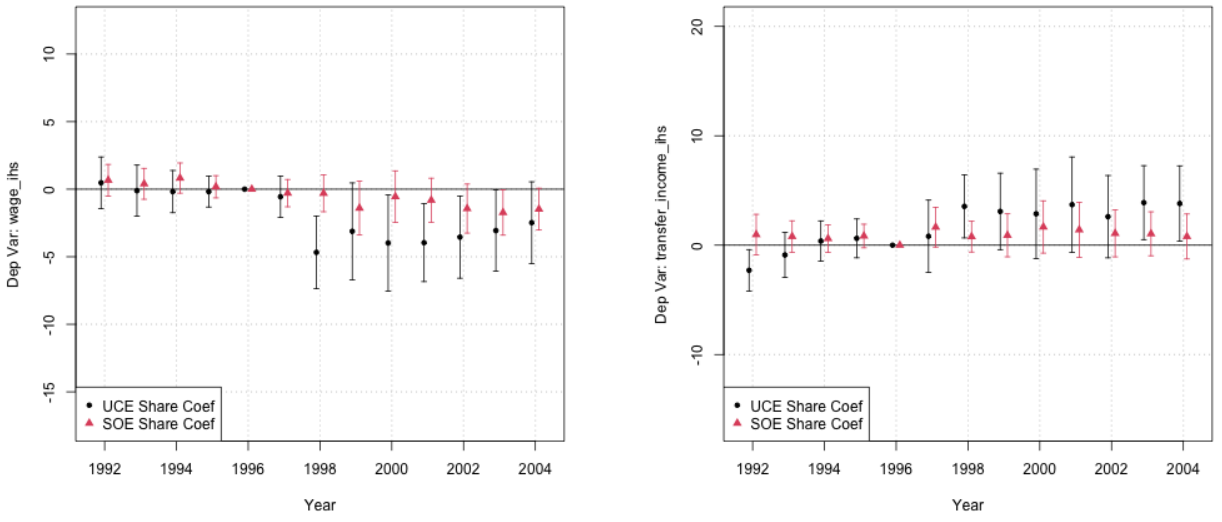
(b) Pre-reform UCE Employment Share Distribution



(c) Correlation between the Two Pre-shares

Notes: We use the employment data from the Province and City Statistical Yearbook to be the numerator. The denominator is 15-64 non-agriculture population from 2000 census. We adjust the pre-shares by the industry data from the 1990 census. A tiny proportion of the pre-SOE employment share is negative because of the measurement error across the multiple data sources.

Figure A10: Effect of SOE Reform on Wage and Transfer Income

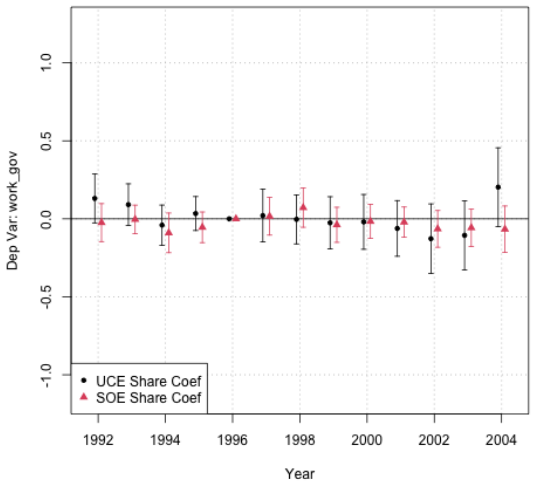


(a) ihs(Wage Income)

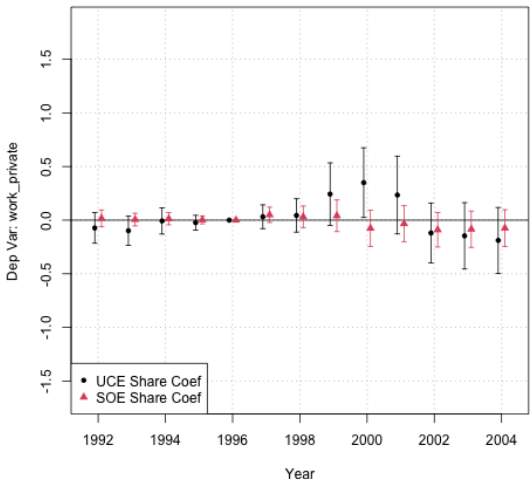
(b) ihs(Transfer Income)

Notes: We use the DiD Event Study Approach to study the effect of SOE reform on income. We use the regional variation in pre-reform SOE emp share and pre-UCE emp share In 1992 as proxies to the reform. We include control variables, such as age, years of education, and gender.

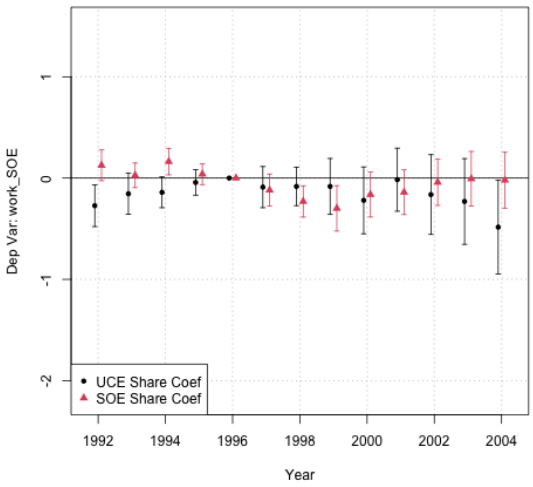
Figure A11: Effect of SOE Reform on Employment of Different Ownerships



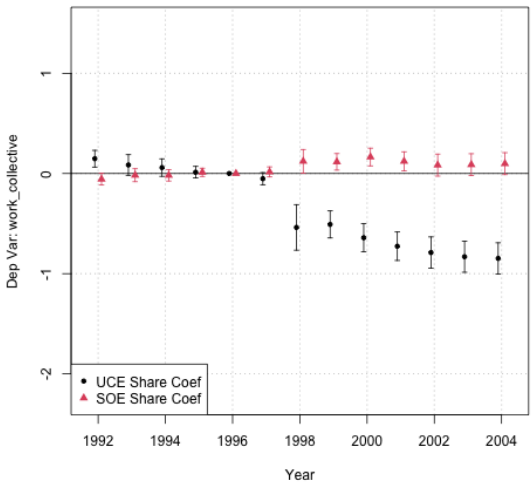
(a) Government Employment



(b) Private Employment



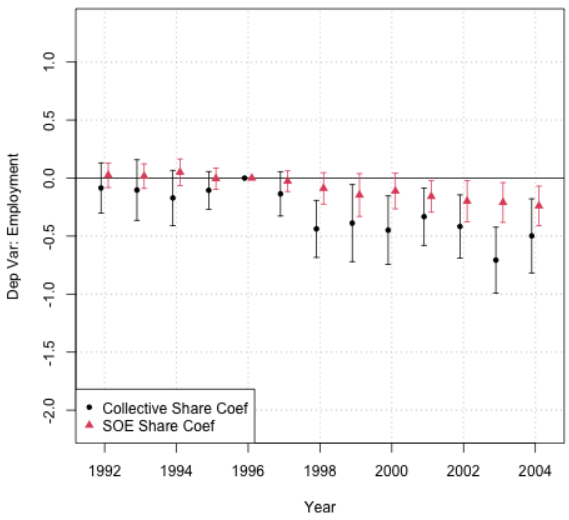
(c) SOE Employment



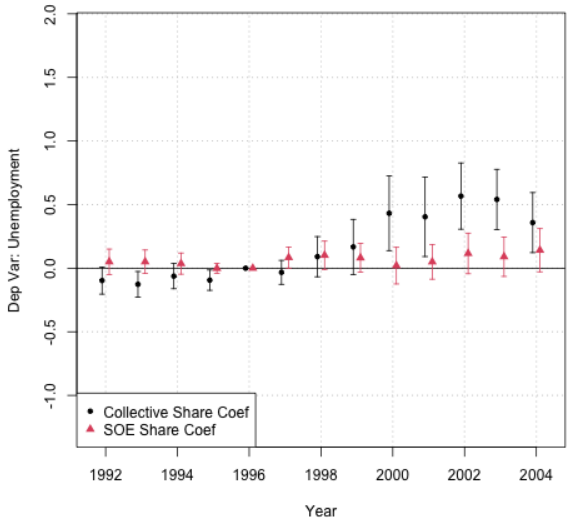
(d) UCE Employment

Notes: We use the DiD Event Study Approach to study the effect of SOE reform on labor force. We use the regional variation in pre-reform SOE emp share and pre-UCE emp share In 1992 as proxies to the reform. We include control variables, such as age, years of education, and gender.

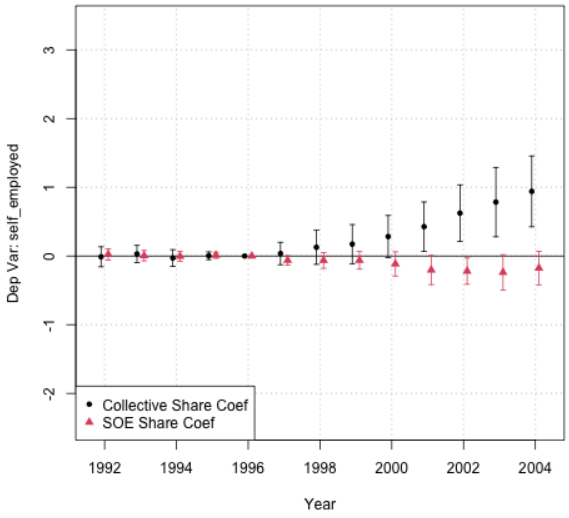
Figure A12: Event Study Results from the Balanced Sample



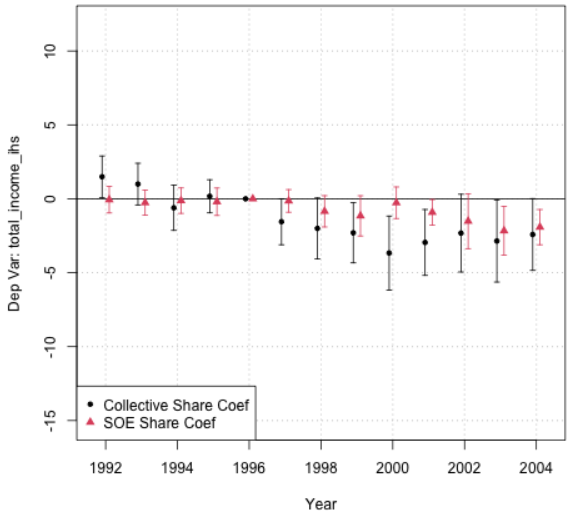
(a) Employment



(b) Unemployment



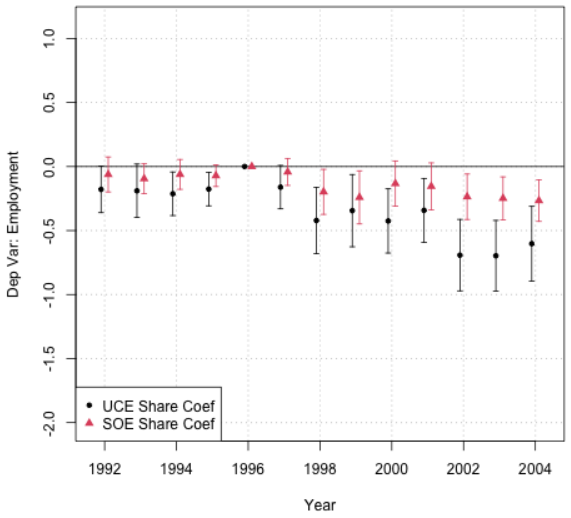
(c) Self-employment



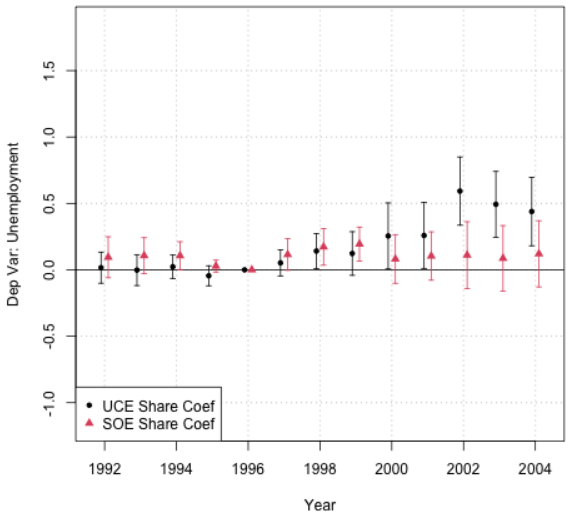
(d) ihs(Total Income)

Notes: We use the DiD Event Study Approach to study the effect of SOE reform on employment and income. These results are from the balanced city sample. We employ the inverse hyperbolic sine transformation for each of the outcome. We use the regional variation in pre-reform SOE emp share and pre-UCE emp share In 1992 as proxies to the reform. We include control variables, such as age, years of education, and gender.

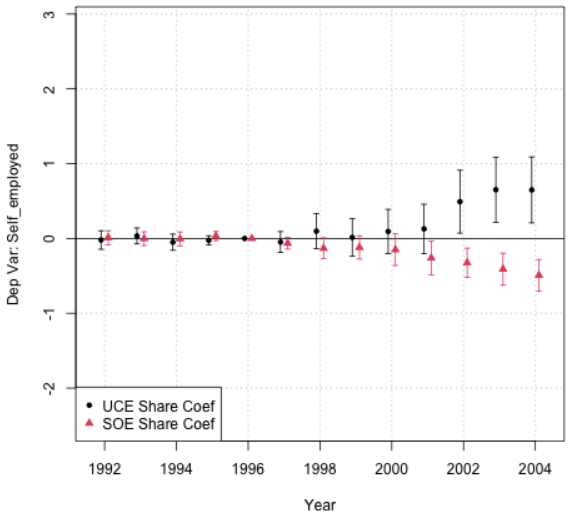
Figure A13: Event Study Results using the Pre-shares not excluding any industries



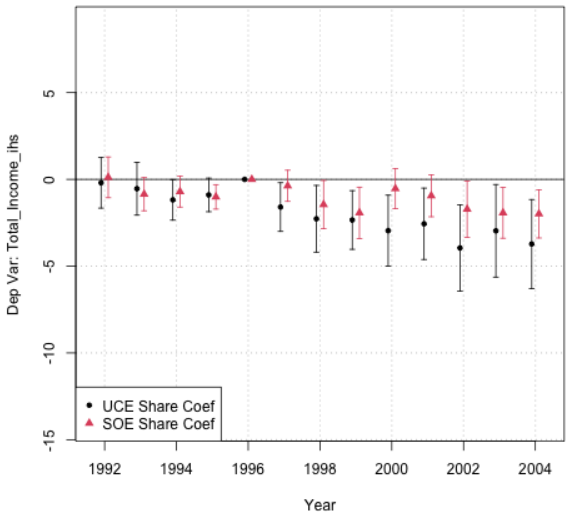
(a) Employment



(b) Unemployment



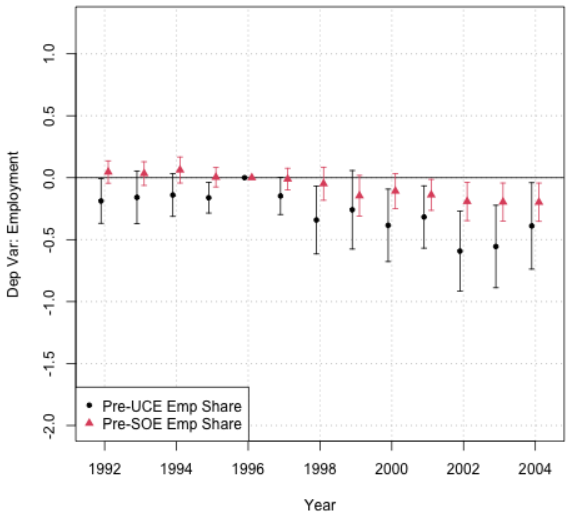
(c) Self-employment



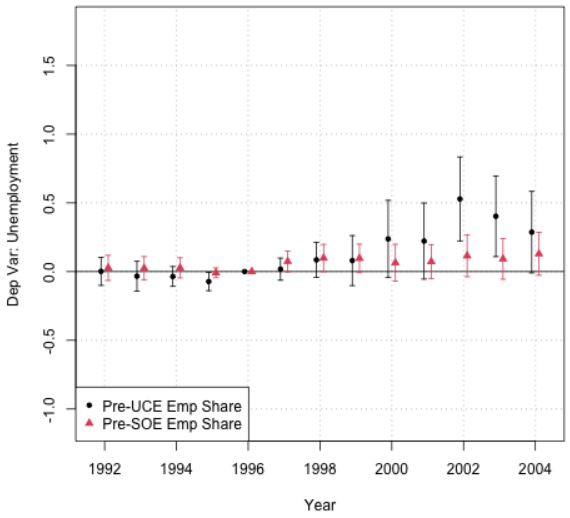
(d) ihs(Total Income)

Notes: We use the DiD Event Study Approach to study the effect of SOE reform on income. These results are from the balanced city sample. We employ the inverse hyperbolic sine transformation for each of the outcome. We use the regional variation in pre-reform SOE emp share and pre-UCE emp share In 1992 as proxies to the reform. In this version, we don't exclude any industries from the pre-share variables. We include control variables, such as age, years of education, and gender.

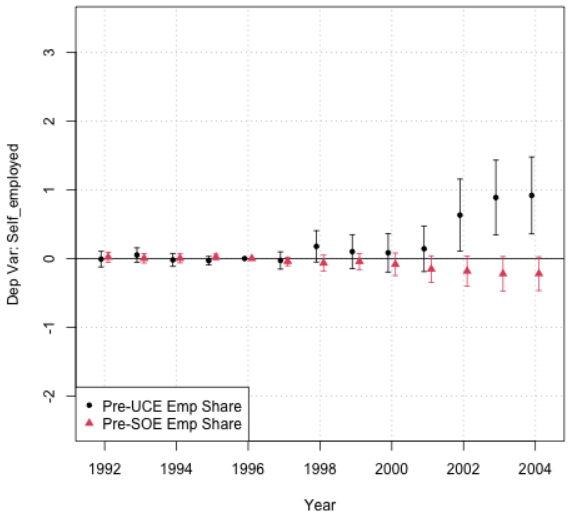
Figure A14: Event Study Results using the Pre-shares in 1996



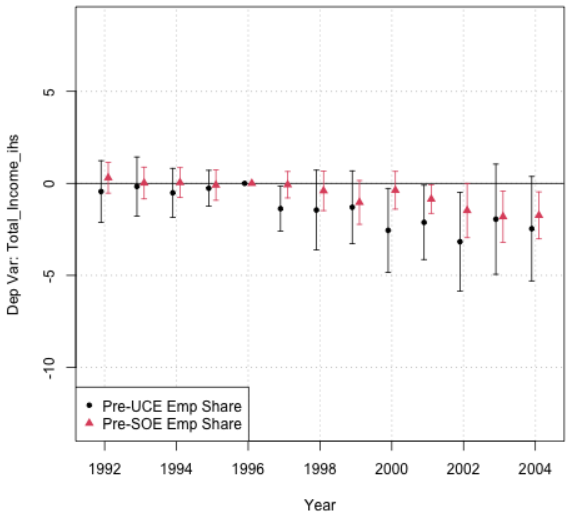
(a) Employment



(b) Unemployment



(c) Self-employment



(d) ihs(Total Income)

Notes: We use the DiD Event Study Approach to study the effect of SOE reform on income. These results are from the full city sample. We employ the inverse hyperbolic sine transformation for each of the outcome. We use the regional variation in pre-reform SOE emp share and pre-UCE emp share In 1996 as proxies to the reform. We include control variables, such as age, years of education, and gender.

Table A1: SOE and Colletive Enterprise Employment Share in Each Industry

	SOE	UCE
Farming, forestry, animal husbandry and fishery	0.959	0.035
Mining	0.914	0.081
Manufacturing	0.608	0.254
Production and supply of electric power, gas and water	0.919	0.039
Construction	0.574	0.398
Geologic examination	0.983	0.016
Traffic, storage and mail business	0.824	0.162
Wholesale and retail trade	0.584	0.369
Finance	0.722	0.252
Real estate	0.771	0.089
Social welfare	0.717	0.187
Health, sports, social welfare	0.865	0.134
Education	0.983	0.016
Scientific research	0.939	0.042
Public administration and social organization	0.994	0.007
Other	0.723	0.263

Data source: China Labor Statistics Yearbook of 1992. This table shows the SOE and CE employment share in each industry. SOE stands for State-owned Enterprise and UCE stands for Urban Collective Enterprise.

Table A2: Summary Statistics of Key Variables: 1992 - 2004

	Before (1992-1996)	After (1997-2004)
Panel A: selected labor market outcomes		
Employment	0.86	0.76
	(0.34)	(0.43)
Unemployment	0.03	0.08
	(0.18)	(0.27)
Self-employment	0.02	0.10
	(0.15)	(0.31)
Work in private sector	0.02	0.06
	(0.13)	(0.24)
Monthly earnings (in 2004 RMB)	475.84	533.78
	(405.54)	(653.86)
Monthly wage (in 2004 RMB)	465.45	514.34
	(401.75)	(649.55)
Monthly total income (in 2004 RMB)	516.69	638.48
	(418.27)	(691.92)
Monthly transfer income (in 2004 RMB)	28.98	67.47
	(110.79)	(231.63)
Panel B: individual characteristics		
Age	36.41	38.16
	(9.77)	(10.10)
Female	0.51	0.51
	(0.50)	(0.50)
Years of schooling	11.13	11.66
	(2.48)	(2.41)
Observations	70073	156159

Note: Weighted means and standard deviations are presented. Standard deviations in parentheses. Individuals between age 18 and 54. Data comes from Urban Household Survey (1992-2004). Our sample includes 76 balanced prefectures.

Table A3: Balance Check

	All Cities		Cities w/o Guangdong	
	Pre-SOE Emp Share	Pre-UCE Emp Share	Pre-SOE Emp Share	Pre-UCE Emp Share
FDI per GDP	-4.480**	-0.415	1.704	1.526
	(2.001)	(0.887)	(3.043)	(1.281)
GDP per capita	-0.00000331***	-0.00000115***	-0.00000453**	-0.000000595
	(0.000000917)	(0.000000336)	(0.00000217)	(0.000000799)
FinanceIncome per GDP	0.339	0.00121	-0.0426	-0.198
	(0.595)	(0.384)	(0.671)	(0.453)
FinanceExpense per GDP	0.813	-0.109	0.940	0.148
	(0.551)	(0.354)	(0.583)	(0.380)
Tertiary GDP Share	0.0254	-0.0174	-0.0243	-0.0691
	(0.163)	(0.0631)	(0.167)	(0.0660)
Secondary GDP Share	0.318**	0.143**	0.352**	0.121*
	(0.136)	(0.0639)	(0.154)	(0.0723)
Observations	134	134	121	121

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: Data come from China's Provincial and City Statistical Yearbook and China City Statistical Yearbook. The outcome data is in 1992. Some prefectures can't be matched across different Statistical Yearbook, so the sample size is smaller than the we in the baseline regressions. Standard errors in parentheses.

Table A4: Effect of SOE Reform on Unemployment: by age and educational attainment

	Below high school	High school	Above high school
	(1)	(2)	(3)
Panel A: 18-25			
Post × Pre-UCE Emp Share	1.336***	0.714***	0.415
	(0.435)	(0.223)	(0.286)
Post × Pre-SOE Emp Share	0.336*	0.063	0.088
	(0.190)	(0.126)	(0.114)
N	5465	13175	14207
Panel B: 26-40			
Post × Pre-UCE Emp Share	0.249	0.059	0.200**
	(0.149)	(0.121)	(0.094)
Post × Pre-SOE Emp Share	0.182	0.110	0.028
	(0.131)	(0.078)	(0.044)
N	22435	25825	34628
Panel C: 41-54			
Post × Pre-UCE Emp Share	0.327**	0.287*	0.102**
	(0.126)	(0.167)	(0.048)
Post × Pre-SOE Emp Share	0.009	0.021	-0.009
	(0.037)	(0.062)	(0.027)
N	40634	21299	27632

Notes: All regressions include gender dummy, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. Our sample includes 65 balanced prefectures. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A5: Effect of SOE Reform on Self-employment: by age and educational attainment

	Below high school	High school	Above high school
	(1)	(2)	(3)
Panel A: 18-25			
Post × Pre-UCE Emp Share	-0.138	0.115	0.406***
	(0.288)	(0.114)	(0.099)
Post × Pre-SOE Emp Share	-0.141	0.014	-0.077
	(0.170)	(0.061)	(0.060)
N	5465	13175	14207
Panel B: 26-40			
Post × Pre-UCE Emp Share	0.762***	0.400	0.373**
	(0.210)	(0.257)	(0.156)
Post × Pre-SOE Emp Share	-0.327**	-0.159	-0.029
	(0.161)	(0.123)	(0.059)
N	22435	25825	34628
Panel C: 41-54			
Post × Pre-UCE Emp Share	0.320	0.408**	0.291*
	(0.205)	(0.194)	(0.161)
Post × Pre-SOE Emp Share	-0.217**	-0.092	-0.096*
	(0.106)	(0.106)	(0.048)
N	40634	21299	27632

Notes: All regressions include gender dummy, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. Our sample includes 65 balanced prefectures. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A6: Effect of SOE Reform on Earnings: by age and educational attainment

	Below high school	High school	Above high school
	(1)	(2)	(3)
Panel A: 18-25			
Post × Pre-UCE Emp Share	-9.556***	-3.182	-4.710*
	(3.232)	(2.026)	(2.486)
Post × Pre-SOE Emp Share	-3.936**	0.374	-3.235**
	(1.655)	(1.041)	(1.341)
N	6854	17619	18944
Panel B: 26-40			
Post × Pre-UCE Emp Share	-1.718	-0.045	-0.938
	(1.683)	(1.501)	(1.140)
Post × Pre-SOE Emp Share	0.254	-0.115	0.252
	(1.206)	(0.845)	(0.677)
N	30029	34474	49249
Panel C: 41-54			
Post × Pre-UCE Emp Share	-1.045	-4.111**	-0.877
	(1.585)	(1.821)	(1.078)
Post × Pre-SOE Emp Share	-2.551**	-0.924	-0.359
	(1.012)	(1.034)	(0.730)
N	54720	30368	37949

Notes: All regressions include gender dummy, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. Our sample includes 65 balanced prefectures. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A7: Effects of SOE Reform on Income Outcomes: by age

	18-25	26-40	41-54
	(1)	(2)	(3)
Panel A: Dep.Var.: Wage			
Post × Pre-UCE Emp Share	-5.365***	-2.196	-1.826
	(1.795)	(1.372)	(1.354)
Post × Pre-SOE Emp Share	-2.455***	-0.028	-1.517*
	(0.913)	(0.899)	(0.815)
N	43417	113752	123037
Panel B: Dep.Var.: Earnings			
Post × Pre-UCE Emp Share	-4.791***	-1.812	-1.885
	(1.723)	(1.096)	(1.170)
Post × Pre-SOE Emp Share	-1.911**	0.140	-1.688**
	(0.834)	(0.773)	(0.768)
N	43417	113752	123037
Panel C: Dep.Var.: Total Income			
Post × Pre-UCE Emp Share	-6.273**	-0.347	-0.619
	(2.523)	(0.875)	(0.685)
Post × Pre-SOE Emp Share	-1.924*	-0.234	-0.989***
	(1.079)	(0.594)	(0.363)
N	43417	113752	123037

Notes: All regressions include prefecture fixed effects, year fixed effects and education attainment dummies. Standard errors are clustered at the prefecture level. Our sample includes 201 prefectures. The inverse hyperbolic sine (IHS) transformation is imposed to all outcome variables. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A8: Effects of SOE Reform on Income Outcomes: by education attainment

	Less than High school	High school	Above high school
	(1)	(2)	(3)
Panel A: Dep.Var.: Wage			
Post × Pre-UCE Emp Share	-2.500	-3.260**	-1.256
	(1.718)	(1.294)	(0.999)
Post × Pre-SOE Emp Share	-2.060**	-0.099	-0.953
	(0.880)	(0.630)	(0.649)
N	91603	82461	106142
Panel B: Dep.Var.: Earnings			
Post × Pre-UCE Emp Share	-2.452*	-2.518**	-1.102
	(1.306)	(1.037)	(0.947)
Post × Pre-SOE Emp Share	-1.971***	-0.076	-0.772
	(0.699)	(0.486)	(0.610)
N	91603	82461	106142
Panel C: Dep.Var.: Total Income			
Post × Pre-UCE Emp Share	-1.795**	-1.620*	-0.853
	(0.853)	(0.857)	(0.940)
Post × Pre-SOE Emp Share	-1.360***	-0.105	-0.676
	(0.467)	(0.429)	(0.486)
N	91603	82461	106142

Notes: All regressions include prefecture fixed effects, year fixed effects and age group dummies. Standard errors are clustered at the prefecture level. Our sample includes 201 prefectures. The inverse hyperbolic sine (IHS) transformation is imposed to all outcome variables. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A9: Migration Rate and SOE Reform Intensity

	In-Migration Rate	Out-Migration Rate
Lay-off Rate in 1998	-0.051	0.015
	(0.083)	(0.095)
Reduction in Public Employment 1996-2000	-0.019	-0.066
	(0.041)	(0.047)
Observations	29	29

Standard errors in parentheses

* $p < .10$, ** $p < 0.05$, *** $p < 0.01$

Notes: Migration data is from 2000 Census and the layoff and *Reduction in Public Employment 1996-2000* is from the China Labor Statistical Yearbook. The analysis is at the province level. In-Migration rate refers to the proportion of residents without local Hukou; out-migration refers to the proportion of people who leave their origin families as recorded in the census.

Table A10: Effect of SOE Reform on Employment Outcomes: Add controls

	Employment(0/1)		Unemployment(0/1)		Self-employment(0/1)	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Pre-UCE Emp Sharet	-0.275***	-0.241***	0.178**	0.230***	0.387***	0.297**
	(0.086)	(0.085)	(0.083)	(0.086)	(0.095)	(0.119)
Post × Pre-SOE Emp Share	-0.150***	-0.186***	0.032	0.100**	-0.039	-0.145*
	(0.054)	(0.055)	(0.028)	(0.046)	(0.047)	(0.080)
Tradable sector emp share 1990	Yes	No	Yes	No	Yes	No
Number of college students	Yes	No	Yes	No	Yes	No
GDP per capita in 1992	No	Yes	No	Yes	No	Yes
FDI per GDP in 1992	No	Yes	No	Yes	No	Yes
Observations	259095	261196	259095	261196	259095	261196

All regressions include gender, age, education attainment, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. The omitted age group is age between 18 and 25, while the omitted education attainment group is below high school, including illiteracy, some elementary school, elementary school, and middle school. Our sample includes 65 balanced prefectures. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table A11: Effect of SOE Reform on Income Outcomes: Add controls

	Wage		Earnings		Total income	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Pre-UCE Emp Sharet	-3.319***	-0.241***	-3.036***	-0.241***	-1.876***	-0.241***
	(1.029)	(0.085)	(0.776)	(0.085)	(0.568)	(0.085)
Post × Pre-SOE Emp Share	-1.541***	-0.186***	-1.315***	-0.186***	-0.759***	-0.186***
	(0.553)	(0.055)	(0.474)	(0.055)	(0.286)	(0.055)
Tradable sector emp share 1990	Yes	No	Yes	No	Yes	No
Number of college students	Yes	No	Yes	No	Yes	No
GDP per capita in 1992	No	Yes	No	Yes	No	Yes
FDI per GDP in 1992	No	Yes	No	Yes	No	Yes
Observations	259095	261196	259095	261196	259095	261196

All regressions include gender, age, education attainment, prefecture fixed effects, year fixed effects. Standard errors are clustered at the prefecture level. The omitted age group is age between 18 and 25, while the omitted education attainment group is below high school, including illiteracy, some elementary school, elementary school, and middle school. Our sample includes 65 balanced prefectures. * significant at 10%, ** significant at 5%, *** significant at 1%.