Industrialization from Scratch: The Persistent Effects of China's "Third Front Movement"

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Abstract

This paper studies the long-run impacts of industrial investment on the structural transformation of agrarian local economies. We exploit a massive industrialization campaign in China known as the "Third Front Movement," which invested heavily in the industrial sector in China's remote and largely agrarian areas (the Third Front Region) in the 1960s and 1970s. Exploiting the quasi-randomness in the geographic distribution of the Movement's investment, we find that local economies that received more investment continue to have larger and faster-growing modern sectors over two decades after the Movement ended. Urbanization is mainly accounted for by rural-to-urban transformation within the same local economy, rather than inter-regional migration. Therefore, the effects of the Movement are captured by the local residents. We find that the persistent effects are sustained by positive spillovers to a fast-growing non-state sector and explore several channels through which those spillovers take place. Finally, we discuss the welfare implications of the Movement at the national level.

1 Introduction

The close connection between industrialization and growth observed in the history of developed countries has motivated both academics and policymakers to seek ways to stimulate structural transformation in developing countries. Such policies take different forms and operate at different levels, but they all share a common core rationale: industrial activities generate positive spillover effects to other parts of the economy.[1] The spillovers, in the form

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[1] At the national level, for example, international aid programs help underdeveloped countries build infrastructures, and host countries design policies to attract FDI; at the subnational regional level, there are special economic zones and subsidies in the form of tax credits offered by regional governments to attract foreign enterprises.

of input sharing, labor market pooling, and local knowledge transmission (Marshall, 1920), and amplified through various connections between industries, can pull an underdeveloped economy onto a new equilibrium path of modernization. Therefore, temporary subsidies to the industrial sector can be welfare-improving in the long run.

Despite the ubiquity of such policies, researchers still have a limited understanding of their effects on structural transformation and development, let alone the channels at work. The primary empirical difficulty lies in the confounding factors: policies are not handed out randomly—the location choice of an industrial investment usually takes into account of the growth prospects of the local economy. In this paper, we overcome this difficulty and estimate the causal effects of place-based industrial investment on regional structural transformation in an agrarian economy by exploiting a unique natural experiment in China: the "Third Front Movement" (hereafter the Movement).

Launched in 1964, the Movement was a preparation for potential military confrontations with the United States and the Soviet Union. The Movement built industrial projects in China's remote and mountainous hinterland, known as the "Third Front Region." The goal of the Movement was to create self-sustaining industrial clusters in the deep hinterland, so that in the scenario of losing its existing industrial centers in the east, China could still produce industrial products and keep on fighting. Within the Third Front Region, these industrial projects were strategically located in places less vulnerable to military attacks, particularly airstrikes and long-range nuclear missiles. They were scattered and hidden in the high mountains and rugged terrains. Potential economic returns were less of a concern than strategic military location.

The scale of the Movement was massive: at its peak, over half of the national industrial investment was allocated to the Third Front Region, an area that accounted for only one-fifth of China's population. As a result, by the time China started its urban-sector market reform in the mid-1980s and, in effect, ended the decades-long Movement, some previously agrarian local economies had a significant industrial presence with some of the most sophisticated industrial plants in the country, while other local economies in the region, with similar initial characteristics before the Movement, remained predominantly rural.

The Movement provides the quasi-randomness in the location choices of these industrial projects and allows us to compare, within the Third Front Region, the long-run development of the urban sector in local economies that received industrial investment to those that did not. We focus on the investment in manufacturing in a sample of counties that were predominantly rural prior to the Movement.[2] We track the urbanization and industrialization of these

[2] The Movement also invested in the extraction industry and infrastructures such as roads, railways, and power stations. We control for these investments.

counties in the decades after the end of the Movement. We interpret the results discussed in this paper as the long-run effects of industrial investment at the early stage of development on subsequent modern economic transformation.

We measure the magnitude of the Third Front investment by the number of manufacturing workers as a share of a county's total population, using a directory of major industrial firms in 1985, the cutoff year between the Movement and the comprehensive market reform. In our baseline specification we estimate the effects of Third Front investment on long-run urbanization and industrialization using the Ordinary Least Squares estimator while controlling for a rich set of initial conditions prior to the Movement. These initial conditions include geographic and demographic characteristics, natural resources, levels of development in the urban sector, and distances to existing infrastructure and industrial centers. According to various accounts, these variables represent the local characteristics that decision-makers took into consideration when deciding where to put the industrial projects.

We find that counties that received industrial investment continue to be more developed two decades after the end of the Movement. Each extra percentage point in the number of manufacturing workers as a share of total population in 1985 equates to about two extra percentage points in the urbanization rate in 2000. Shares of employment in the manufacturing and service sectors are also proportionately higher. Although there has been rapid growth since market reform in counties that did not receive large investment during the Movement, these counties started at a lower level and, as of 2000, there was no sign of the gap closing soon. In fact, between 1990 and 2000, counties with more Third Front investment saw larger shares of their rural population become urbanized.

Labor mobility plays an important role in evaluating the welfare implications of place-based policies (Glaeser and Gottlieb, 2008; Kline and Moretti, 2014). We find that the expansion of the urban sector is driven by the urbanization of the rural population within the same county, not from the reallocation of urban workers across counties. Therefore, these results represent an inherent structural transformation of the local economy, rather than a reshuffling of economic activity across space. Since the marginal productivity of labor is higher in urban sectors (Cheremukhin et al., 2014), higher urban shares in the treated counties translate into higher local incomes.

Our identification strategy relies on the crucial assumption that, conditional on the initial characteristics included in the regression, there are no other omitted variables that correlate with both the distribution of investment and the potential of local economic development. We perform a battery of tests to check this assumption. In the first test, we exploit the natural experiment in a case study in which the government debated where to locate a major

Third Front project, choosing between a few similar places. Because the final winner of the project and the runner-up survived many rounds of close scrutiny, they are likely to share characteristics, both observable and unobservable, that matter for location choices. We show that, prior to the Movement, the observable geographic and economic characteristics of the winner and the runner-up were very similar. Economic development indicators diverged after the Movement and remained far apart decades after the Movement ended. We construct a statistical counterfactual of the winner based on the observable characteristics using the Synthetic Control approach (Abadie et al., 2010). Since the statistical counterfactual only contains information based on observables, a test of the differences between the runner-up and the synthetic control is a test of the importance of the unobservable factors. We find that the differences are all very small and statistically insignificant.

The second test involves checking the stability of coefficients as we gradually include more predictors in the OLS regression. If there is an omitted variables problem, the addition of predictors of the outcome variable is likely to pick up some of the omitted factors, and the estimate of the coefficient is likely to change (Altonji et al., 2005). Instead, our estimate remains stable. This result is not due to the irrelevance of these predictors. In fact, the $R-$squared increases as more covariates are added. Moreover, when we perform the same exercise in a sample of counties outside the Third Front Region, we find the estimated coefficient is very sensitive to adding control variables.[3]

We then explore the channels through which these persistent effects work. We show that counties that received larger Third Front investment also had a larger non-state manufacturing sector in 2004, a sector that was close to non-existent before the market reform. The larger non-state manufacturing sector accounts for about a quarter of the total effect. These non-state manufacturing firms are also more efficient, suggesting that some agglomeration forces are at play. When the non-state firms are further separated into entry cohorts, we find that the dynamic entry and vibrant growth of these firms play an increasingly important role over time. These findings suggest that the persistent effects are sustained through the positive spillovers of the Third Front firm to new firms in the local economy. Finally, when breaking down the effects by industry, we find that the spillover effects are concentrated within the same 2-digit industry of the initial investment, while input-output linkages and other cross-industry spillovers do not have a economically significant effect.

A simple story consistent with all of these findings is one in which skill and entrepreneurship are scarce, and the spillover effects take the form of learning. The opportunity to learn

[3] In the Appendix, we also conduct extensive specification tests, as well as an alternative specification with a different identification strategy, by exploiting the geographic cutoff of the Movement, all of which come to the same qualitative conclusion.

from firsthand experience at a nearby Third Front firm and the abundance of skilled workers in the local economy makes it easier for potential entrepreneurs to set up their own businesses. More businesses in the urban sector in turn recruit additional rural workers and reinforce the structural transformation. If this channel is important, we should expect the effects to be largely mediated through human capital, and knowledge-intensive industries should generate higher spillover effects than other industries. Both predictions are supported in the data.

Although the Movement has positive effects on the local economy, the gains come at a cost at the national level. Due to its remote location and less favorable natural and economic conditions, Third Front Region is less suitable to developing industries in the first place. In 2004, manufacturing firms in the Region were, on average, 12 to 15 percent less productive than those in more productive parts of the country. By directing industrial investment to less productive places, the Movement leads to misallocation of resources and loss in aggregate output. However, we find that the spatial productivity gap in the agricultural sector is even larger than that in the industrial sector. The higher welfare improvement in the Third Front Region through transforming an additional worker from the agricultural sector to the industrial sector partly offset the efficiency loss in production.

This paper is organized as follows: Section 2 explains the position of this paper in the literature. Section 3 describes the background of the Third Front Movement and the natural experiment it exploits. Section 4 introduces data, sample, and measurement. Section 5 presents the baseline specification and results. Section 6 explores some mechanisms. Section 7 discusses the welfare implications of the Movement. Section 8 concludes.

2 Related Literature

This paper contributes to the empirical studies that estimate the effects of place-based policies, which, under a broad definition, include those that target specific countries, or regions within a country, such as foreign aid to developing countries, the Empower Zones in the U.S. (Busso et al., 2013), Structural Funds in the EU (Becker et al., 2010), and Special Economic Zones in China (Wang, 2012; Alder et al., 2013). Relative to the papers on place-based policies (see Neumark and Simpson, 2014 for a recent review), our primary contribution is to look beyond the effects of policy on short-run outcomes such as firm entry and employment rate, and focus on long-run outcomes such as structural transformation and growth, especially in the setting of developing countries. Relative to the papers that study the effects of international aid programs or development strategies on growth, such as papers reviewed in Rajan and Subramanian (2008), our primary contribution is to use within-country variation from a natural experiment for credible identification.

The paper most similar to ours is Kline and Moretti (2014), which studies the long-run effects of the Tennessee Valley Authority (TVA) in developing the U.S. South. This paper differs in several dimensions. First, the aims and the policy contents of the two projects are different. The TVA resembles a "Big Push" strategy where investments were made to various sectors in a coordinated manner. Its aim was that different projects would work together to boost the regional economy. In contrast, the Third Front Movement focused almost exclusively on industrial investment. Its aim was to establish self-suffcient industrial clusters that would rely little connections with other parts of the economy. Different policy contents lead to different research questions. As Kline and Moretti (2014) focus on the persistent effects of TVA on agricultural and manufacturing employment in the region, we ask specifically whether temporary industrial investment promotes structural transformation of the local economy. Second, the special design of the Movement and historical context allows us to exploit quasi-random variation within the Third Front Region. In particular, the firm restriction of migration across regions allows us to treat counties as largely isolated local economies. Third, using detailed information on each project, we can look deeper into the role of connections across industries, shedding more light on the mechanism.

This study also contributes to the literature that tests the existence of multiple equilibria in spatial distribution of economic activity. This literature examines whether there are persistent effects after temporary shocks, such as war damages (Davis and Weinstein, 2002; Miguel and Roland, 2011), depleted transportation projects (Bleakley and Lin, 2012; Jedwab et al., 2014; Jedwab and Moradi, 2015), and temporary electricity subsidies (Severnini, 2012). Most of these papers focus on population as the main intermediating factor for the persistent effects—shocks lead to an increase in population, which in turn generates sustainable advantage through agglomeration effects—without examining the mechanism. Our contribution to this strand of literature is twofold: First, we show that even in the absence of population effects, by changing the composition of local economic activity, temporary shocks could have persistent effects; second, we take advantage of the richness of the natural experiment to shed more light on the mechanisms and find that the spillovers of the initial investment on the entry and growth of other local firms account for the persistence of the effects. Human capital is important in intermediating the effects, while physical capital and transportation infrastructures are not. These results add to a literature that has yet to arrive at a consensus.[4]

[4]For example, Bleakley and Lin (2012) suggest that the physical capital is unlikely to be the driver of persistence, while Jedwab and Moradi (2015) suggest that large sunk cost of physical capital serves as a coordination device.

Finally, this paper contributes to the literature on the economic development of China.[5] To the best of our knowledge, we are the first to systematically evaluate the effects of the Third Front Movement, an important economic policy during the period of command economy (between 1949 and 1979), and a primary example of a large-scale location-based industrialization campaign.[6] Our findings suggest that industrial investment generates positive spillovers to the entry and growth of other local economic activity, accelerating the structural transformation of local economies.

3 Historical Background

3.1 The Third Front Movement

In 1964, China was a very poor country with a per capita GDP only one-fortieth of that of the United States. Agriculture accounted for 40 percent of GDP, and over 80 percent of the population lived in rural areas. The country's limited industrial production was concentrated in a handful of cities in the eastern part of the county, particularly the Northeast and the East Coast.

National security conditions facing China worsened dramatically in 1964. The relationship between China and the Soviet Union had been deteriorating since the late 1950s, and resulted in a complete split marked by the publication of Mao's open letters criticizing Khrushchev's leadership. On another front, the Gulf of Tonkin incident in August 1964 signaled an escalation of the Vietnam War. Immediately afterward, the United States started deploying regular troops in Vietnam and began massive bombing of North Vietnam. China's leaders worried that the country's industrial capacity concentrated in the Northeast and the East Coast was vulnerable in possible wars with the United States or the Soviet Union.

The Third Front Movement was launched later that year as a response to these imminent threats. The name "Third Front" was first used as a national defense concept, and referred to the vast area far away from possible war fronts. The purpose of the Movement was to establish self-sustaining industrial clusters in the Third Front Region, such that China could still have the industrial capacity to support a war even if it was to lose its industrial clusters in the east. The top map in Figure 1 shows the area of the Third Front Region, and the two maps on the bottom show the average slope (as a measure of the ruggedness of the terrain) and elevation. The Third Front Region is far away from the coast. It includes the mountain-

[5] See a recent review by Yao (2014).

[6] (Naughton, 1988) systematically documents the Movement. But his approach is mostly descriptive and does not provide an evaluation of the program in the long-run.

ous and rugged areas to the west of the Beijing-Guangzhou line encircled by mountains but avoids Xinjiang, the Tibetan Plateau, and other ethnic minority autonomous districts. The Movement was planned and organized in a command system led by a central committee in Beijing. It was not an omnibus development package aiming at pushing the local economy out of poverty. Instead, investment focused on several industries that produce basic industrial materials and sophisticated manufacturing industries that produce machinery, electrical equipment, and electronic devices. A small number of firms producing goods necessary for everyday life were also established as supplements. The committee assigned different industries to different places. For example, Panzhihua in Sichuan Province was designated a large steel and non-ferrous metal production center. Counties around Chongqing were assigned to host conventional weaponry firms. Mianyang was made a base for nuclear industries. But the committee avoided clustering many large plants in one location. Established in haste and with limited funding, many new plants were spin-offs from existing plants in other parts of the country.[7]

The scale of the Movement was massive. It is estimated that, at the peak of movement between 1965 and 1971, about a half of the total national investment in dollar terms was made in the Third Front Region (Naughton, 1988). Manic installation of massive industrial projects gradually lost its steam with the Sino-US rapprochement in the 1970s, but investment continued in many cases until factories were finally operational. Over a decade of intensive investment has changed the country's economic landscape. In 1960, the provinces the Third Front Region, with one fifth of the nation's population, accounted for only 10 percent of its industrial output. This share rose to about 37 percent by 1977.[8]

Figure 2 documents this strategic shift of investment. The vertical axis shows investment per capita in provinces containing the Third Front Region between 1955 and 2000, with the national average standardized at 1 in each year. Per capita investment in the Third Front Region was low relative to the national average before the early 1960s. It increased dramatically after 1964 and peaked in 1970, with a level of per capita investment about 1.5 times that of the national average. The Third Front Movement was the only period in which large investment was made to that part of China. Investment gradually declined after the mid-1970s, and, to date, has never again achieved the same relative level.

[7] For example, in the case of the Second Auto Works in Shiyan, which we will discuss in detail later, the initial machinery and workers were moved from the First Auto Works in Changchun, in the Northeast.

[8] Source: National Bureau of Statistics of China.

3.2 Location Choices of Third Front Firms

National defense considerations were of paramount importance when deciding where each proposed project would be located. The most dreadful threats were airstrikes and nuclear attacks. To minimize the potential damage of these threats, the location choices of large industrial projects followed a guiding principle that stated that the plants should be "dispersed, hidden, close to the mountains, and when necessary, in caves" (*"fensan, yinbi, kaoshan, biyaoshi jindong"*). Nationwide, as the provincial investment data reflect, investment was directed to the Third Front Region, China's most mountain-surrounded and rugged areas. Even within the Third Front Region, relatively more developed areas were avoided.

This principle is well represented in the data. Table 1 summarizes the structural shift of industrial investment during the Movement. The table shows the characteristics of the key industrial plants by year of opening.[9] Columns 1 through 3 compare industrial plants that started operating before the Third Front period (between 1949 and 1964) with those that started operating during the Third Front period (between 1964 and 1978). The characteristics of the counties in which these plants were located differ greatly. Only 16% of the industrial plants established before the Third Front period were in the Third Front Region, compared with 41% of those established during the Third Front period. Plants that started operating during the Third Front period are less likely to be located in a provincial capital city; they are more likely to be located in less densely populated counties with higher elevation and more rugged terrains; they are also not as connected to existing or planned railroads. These differences are all statistically significant. The characteristics of the plants that started operating in the two periods differ as well. Plants built in the Third Front period are less likely to be in light industries and more likely to be in sophisticated manufacturing sectors. Columns 4 through 6 show that even within the Third Front region, the same patterns hold: plants established during the Third Front period are located in places with geographic and initial conditions that the conventional wisdom would deem less favorable for the development of the industrial sector.

Market reforms of China's urban sector started in the mid-1980s. Firms were made responsible for their own profitability and, if they continued losing money, were allowed to go bankrupt. Many state-owned enterprises (SOE) failed while a booming non-state sector became increasingly important in propelling China's miraculous growth. Third Front plants did particularly badly due to their flawed designs and non-optimal location choices. Nev-

[9]These plants are from a directory included in China's Second Industrial Census, conducted in 1985. These plants collectively accounted for about half of the total industrial output in 1985. Other industrial plants at that time included smaller SOEs. Township and Village Enterprises (TVEs) were nascent then and private and foreign firms were close to nonexistent, especially in the inland.

ertheless, some places in the Region received large industrial investment at an early stage of transforming into a modern economy. Such investment would not have been possible had the Movement not occurred. Third Front plants left these local economies with stocks of physical capital, advanced technology, and an educated workforce. Whether and through what mechanisms the Movement has lasting effects on the structural transformation of the local economies is the question this paper aims to answer.

4 Sample, Measurement, and Data Sources

4.1 Sample and Measurement

To study the effects of industrial investment at the early stages of modern economic transformation, we focus on local economies in the Third Front Region that started off predominantly rural and agricultural. We treat county-level jurisdictions as local economies. A county is an appropriate unit of analysis for studying structural transformation in China for several reasons. First, it consists of one urban center and surrounding rural areas. Second, it has a county-level government that wields substantial power over economic policy within its jurisdiction. Third, migration was very costly until recently, so cross-border spillovers are less of a concern. These features make a county a relatively independent local economic unit.[10] We use the share of urban population in 1964 as a proxy for the size of the urban economic sector before the Third Front Movement and restrict the sample to counties with urban population share less than 10%.[11] We also drop from the sample counties in provincial capital areas because their economies are closely tied to the nearby metropolis.

We use the size of manufacturing employment from key industrial plants listed in the Second Industrial Census in 1985 as a proxy for industrial investment during the Movement.[12] Two concerns exist regarding this measurement. First, this measurement overlooks small

[10] A county-level jurisdiction in China can be a city district, a county-level city, or a rural county. An alternative for the unit of analysis is a prefecture, which usually contains over a half dozen county-level jurisdictions. In Appendix C we report results at the prefecture level, which are quantitatively similar.

[11] There are two reasons for this restriction: First, counties with higher urban shares might have better fundamental characteristics for economic growth; second, the focus of this paper is the effects of industrial investments at early stages of industrialization. The effects might differ for regions that were already at a more advanced stage. Over 80% of the counties in the Third Front region are kept in the sample. Later we show that the results are not sensitive to a wide range of cutoff values.

[12] Industries include manufacturing, mining, construction, and utility (such as the production of electricity, water, etc.). Following the convention of the literature on structural transformation, we focus on employment in the manufacturing sector. Presence of mining employment reflects vicinity to natural resources, and it is thus included as a control variable. We use employment, rather than capital, partly because capital depreciate overtime, and partly because in the command economy, the price of capital is likely to be distorted, and this distortion will be reflected in the stock value of capital.

plants. Second, the Movement faded away after the mid-1970s, and our measure based on the 1985 data might be a noisy approximation of the true investment by the Movement, or may be correlated with local unobservable characteristics that affect the firms' subsequent growth. We argue, however, these two drawbacks are unlikely to be important. Regarding the first concern, the key industrial plants listed in the census account for the majority of industrial production output in China in 1986. The Third Front Plants were overwhelmingly large in scale and regarded as crucial for the nation's economy, so they are likely to make it onto the list. Regarding the second concern, although the Movement ended in the early 1980s, the comprehensive market reform in the urban sector, after which firms were required to be responsible for their profitability, did not start until 1985. Before that, independent decisions of hiring and layoffs were very difficult; therefore the size of industrial employment in the 1985 industrial census is likely to be a good approximation of the size of the Third Front investment.[13]

4.2 Data Sources

We assemble a new panel dataset of Chinese counties over half a century from various sources. The dataset includes information on geography, demography, transportation infrastructure, and many economic conditions. To alleviate concerns about the reliability of Chinese official data, we only use data from satellite images, random samples of individual-level population censuses, county-level population census tabulations, firm-level data from industrial censuses, and nationwide surveys.[14]

We extract county geographic characteristics, including county boundaries, elevation, slope, and access to waterways, from GIS files available at the China Historical GIS database. Access to roads and railroads in various years between 1962 and 2005 come from a new database compiled by Baum-Snow et al. (2012). We measure characteristics of the local industrial sector using firm-level data from the Second Manufacturing Census in 1985, the First Economic Census in 2004, and a unique dataset from the National Industrial Survey of 1936. We use county-level tabulations of five population censuses between 1953 and 2000 on counts of employment by sector, and demographic characteristics such as population density, share of urban population, and educational attainment, for both outcome and control

[13]Cheremukhin et al. (2014) provides a thorough account of economic and political reforms in China. They document that, in the mid-1980s, "the government introduced a dual-pricing system and a contract management responsibility system in state-owned industrial enterprises," and before that " the incentives within large urban non-agricultural firms basically remained the same as in the command economy of the pre-1978 period."

[14]Appendix B provides details on how some variables are constructed.

variables. Different population censuses cover different pieces of information and some variables are not consistently defined overtime. In such situations, we corroborate data from various sources and construct consistently defined measures whenever possible. Samples of individua-level census data in 1982, 1990, 2000, and 2005 are used to construct cross-county migration and county-level income by sector.

4.3 Summary Statistics

Table 2 shows the summary statistics of the 509 sample counties. Panel A shows the number of manufacturing workers from the key industrial plants for every 100 residents in 1985. On average, there were 0.33 manufacturing workers employed by the key industrial plants in 1985. The distribution of manufacturing jobs has a fat tail. Only about 25% of the counties in the sample had positive manufacturing employment from key industrial plants in 1985, while the county at the 90^{th} percentile had per capita employment of 0.68.

Panel B shows the initial conditions of sample counties before the Third Front Movement. The median prefecture in the sample had a population density of 73 people per square kilometer (4.3 in log value). The urban rate of the sample counties was rather evenly distributed after trimming at the top at 10%. The 10^{th} percentile is 3.1%, the 90^{th} percentile is 8.7%, and the median is 5.3%. These counties are in remote and rugged areas. The median distance to existing or planned railroads was about 31 kilometers (3.43 in log value), and the median distance to the nearest provincial capital was 200 kilometers (5.3 in log value). The median elevation is over 1 kilometer, and the average slope is 4.4 degrees (the national average is less than 1 degree). With few exceptions, these places had no industrial presence in 1936.

These counties were significantly more developed by the early 2000s. As Panel C shows, population grew by an average of 60 percent over the 36 years, and the average urban rate rose to 16 percent. In 2004, there were about 2.1 manufacturing workers employed in the non-state sector per 100 residents in 1985, and over 90% of them worked in firms that did not exist in 1985. 13 percent of employment was in the tertiary sector. Middle school education was common (31 per 100 adults), especially among the younger generations, and college education was on the rise (1.3 per 100 adults).

5 Industrial Investment and the Structural Transformation of Rural Economies

5.1 Econometric Models

Separately for each year after the market reform (1985) for which we have data, we estimate the following equation using Ordinary Least Squares:

$$y_{it} = \mathbf{X}_{i,64} \cdot \beta + \gamma ManuEmp_{i,85} + \varepsilon_{it}, \tag{1}$$

where y_{it} is some outcome in county i in year t. For the baseline results, we focus on direct measures of structural transformation. The main outcome variables are (1) the share of local population residing in the urban area, (2) the share of employment in the manufacturing sector, and (3) the share of employment in the service sector. To explore mechanisms, we later also use county-level outcomes on human capital, entrepreneurial activity, firm productivity, and county-industry employment as outcome variables. $ManuEmp_{i,85}$, the number of manufacturing workers from the Key Industrial Plants for every 100 county residents, is our primary explanatory variable of interest. Its coefficient, γ, captures the long-run effects of the Third Front industrial investment. ε_{it} is the error term.

$\mathbf{X}_{i,64}$ is a vector of initial county conditions prior to the Movement. It includes geographic conditions; natural resources; initial economic indicators such as urban population rate, industrial development, and existing infrastructure; and a constant term. Although it is specified in a linear way in Equation 1, we also explore different specifications such as reweighting and propensity-score matching to allow these conditions to enter the estimation equation in more flexible ways.[15]

For the estimate $\hat{\gamma}$ in Equation 1 to be interpreted as causal, we must make the usual assumption of conditional independence: $E[ManuEmp_{i,85} \cdot \varepsilon_{it} | \mathbf{X}_{i,64}] = 0$. This assumption might not be valid. The distribution of economic activity is correlated with various existing conditions and economic potentials in the local economy, including access to markets, local labor resources, and government quality. It is difficult to believe that all the relevant conditions can be controlled for since the information available to the econometrician is always

[15] For some outcomes we also estimate the differenced equation:

$$\Delta y_{it} = \mathbf{X}_{i,64} \cdot \tilde{\beta} + \tilde{\gamma} ManuEmp_{i,85} + \Delta\tilde{\varepsilon}_{it},$$

in which case $\mathbf{X}_{i,64}$ controls for the heterogeneous trends in the outcome variable. $\tilde{\gamma}$ captures the impacts of Third Front industrial investment on growth. First-differencing the outcome variable may get rid off unobservable regional differences in levels but not the unobservable differences in trends. The identification still requires a different conditional independence assumption. $E[ManuEmp_{i,85} \cdot \Delta\tilde{\varepsilon}_{it} | \mathbf{X}_{i,64}] = 0$.

limited. In the context of the Third Front Movement, however, there are three reasons to believe this assumption holds. First, the history of the Movement, as we document in Section 3, suggests that the distribution of industrial investment during the Movement was mainly driven by national defense concerns, not existing conditions or future economic potentials. We control directly for geographic and economic characteristics that were key determinants according to the principles of choosing locations for industrial projects. Second, to the extent that some counties might be better suited for economic development, this advantage should have already been reflected in their early development. We drop counties that were relatively developed prior to the Movement, so that the remaining counties were all predominantly rural and agrarian. Third, since the Movement was launched amid an abrupt turn in China's international relations, the Movement was planned and carried out in haste. As a result, decision-makers at that time faced the problem of choosing from a large number of similarly poor places for a limited number of projects. Moreover, beyond national defense considerations, decision-makers—in a popular optimistic mood for overcoming any obstacles—often did not take suitability of the location for a specific project into serious consideration.[16]

Nevertheless, there might still be concerns that there is an omitted variables problem: there may be information available to the decision-maker but not to the econometrician. To the extent that this information matters for location choices and future economic development, the OLS estimate of Equation 1 will be biased. Right after we present our baseline results in Section 5.2, we conduct two tests to address this concern. Section 5.3 exploits a placebo test based on a case study in which, due to a natural experiment, omitted variable bias is less of a concern. In Section 5.4 we conduct extensive coefficient stability tests in the spirit of Altonji et al. (2005) to check for the existence of potential omitted variables bias. We conduct a host of additional robustness checks to ensure that we have the correct specification for the initial conditions. We also provide an alternative specification based on a geographic cutoff. We obtain similar results throughout. These results are reported in Appendix C.

5.2 Urbanization and Non-Agricultural Employment

Table 3 shows the effects of the number of manufacturing workers by the end of the Movement on indicators of structural transformation in the two census years of 1990 and 2000. The dependent variables include urban population rate (Column 1), share of employment in the

[16]Right after the Great Leap Forward and the subsequent Great Famine of 1959-1961, the original Third Five-Year Plan (1966-1971) put an emphasis on recovering agricultural production and investment in light industries that supply necessities for everyday life. The change in the international environment was seized by Mao to steer the focus of economic investment to national defense and heavy industrial sectors.

manufacturing sector (Column 2), and share of employment in the service sector (Column 3). Panels A and B report the effects on the levels of these indicators, while Panel C reports the effect on changes of these indicators. A larger manufacturing sector at the start of the market reform translates into overall better economic development indicators. Counties that received larger investment are more urbanized, with higher shares of manufacturing and service employments. The magnitude of these effects is also meaningful: focusing on the effects on levels in year 2000, one additional manufacturing worker in 1985 for every 100 residents increases the urban population rate in 2000 by 2.18 percentage points. Most counties in the sample has a very low manufacturing presence in 1985: the median, mean, and the 90$^{\text{th}}$ percentile of the independent variable is 0, 0.33, and 0.68, respectively. Therefore, the effect at the average level of treatment ($0.33 \times 2.18 = 0.72$) is small compared with an average urban rate of 16.24 percent. Perhaps not surprisingly, given that the Movement was targeted at the industrial sector, the effect relative to the mean of the dependent variable is much larger for the manufacturing employment than for service sector employment. Panel C examines the pace at which the structural transformation took place between 1990 and 2000.[17] For an additional manufacturing worker in 1985, the county gains 1.7 more urban residents between 1990 and 2000.[18] The county also gains 0.5 more manufacturing workers and 0.2 more service workers, although the estimates for these two columns are noisier.

5.3 A Case-Based Placebo Test

One way to identify the causal effect is to take advantage of the decision-making process for the location choices for the Third Front projects. Suppose the decision-maker runs a tournament among potential locations with varying degrees of suitability for a project and only one location eventually wins. The final decision is likely to be made between locations with very similar characteristics. By simply comparing the winner and the runners-up in a case, it is as if we are free-riding on the decision-maker's knowledge about what they take into account when deciding where to put the project, without knowing the exact information.[19]

The quasi-randomness between the winners and the runners-up also help us test the conditional independence assumption. We construct a statistical comparison for the treated unit

[17] These changes are calculated as the absolute change relative to the initial population size. For example, the change in urban population between 1990 and 2000 as a share of the initial 1990 population is $(urban_{i,2000} - urban_{i,1990})/pop_{i,1990}$, where $urban_{i,t}$ is the number of urban residents in year t and $pop_{i,1990}$ is the population in 1990. The results can potentially be very different using a log difference measure, since the indicators in the untreated counties start from a very low level.

[18] Section 6.1 investigates where these new urban residents come from.

[19] This is the intuition of the identification strategy used by Greenstone et al. (2010).

based on observable characteristics, $\mathbf{X}_{i,64}$, and compare its outcomes to those of the runners-up. If the differences between the runners-up and the statistical comparison are small, then we may conclude that, in deciding where to place the industrial project, the decision-maker does not use much additional information that matters for the outcomes of interest. In other words, the omitted variables problem is unlikely to be driving the results.

Formally, denote the treated unit as i, the runner-up as j, and the statistical comparison for the treated unit as j'. The data generating processes for outcomes y's are:

$$y_i = \mathbf{X}_{i,64} \cdot \beta + \gamma + v_i + \xi_i \tag{2}$$

$$y_j = \mathbf{X}_{j,64} \cdot \beta + v_j + \xi_j \tag{3}$$

$$y_{j'} = \mathbf{X}_{j',64} \cdot \beta + \xi_{j'}. \tag{4}$$

For simplicity, we assume that the treatment is binary, and γ is the treatment effect. v is the omitted variable: it is the characteristics that matters for location choice and the potential outcome. It is unobservable to the econometrician but is available to the decision-maker. $v_{j'}$ is standardized to be zero for simplicity. ξ is the *i.i.d* shock and $E[\xi] = 0$. Since i and j are in the final round, their characteristics observable to the decision-makers should add up to something very similar, i.e., $\mathbf{X}_{i,64} \cdot \beta + v_i = \mathbf{X}_{j,64} \cdot \beta + v_j$ holds in approximation. That is

$$v_i = (\mathbf{X}_{j,64} - \mathbf{X}_{i,64}) \cdot \beta + v_j.$$

The statistical comparison j' is constructed such that it shares very similar observable characteristics with i, i.e., $\mathbf{X}_{i,64} = \mathbf{X}_{j',64}$. The expectation of the difference between the comparison unit and the statistical comparison is

$$\begin{aligned} E[y_j - y_{j'}] &= (\mathbf{X}_{j,64} - \mathbf{X}_{j',64}) \cdot \beta + v_j \\ &= (\mathbf{X}_{j,64} - \mathbf{X}_{i,64}) \cdot \beta + v_j \\ &= v_i. \end{aligned}$$

Therefore, a test for hypothesis $H_0: \ y_j - y_{j'} = 0$ is a test for hypothesis $H_{0'}: v_i = 0$.

The Case of Second Auto Works

We identify these tournament-like decision processes by comparing the planned locations for large Third Front industrial projects and the locations that were eventually chosen.[20]

[20] A list of planned large projects and their proposed locations is found in "The Outlines for the Third Five-

There is only one such case: the Second Auto Works. It was a major project during the Third Front Movement, spreading out in several locations in Shiyan, a mountainous prefecture about 450 kilometers to the northwest of the provincial capital, Wuhan. It was the only large investment Shiyan received during the Third Front Movement (and also throughout the entire command economy period). By bringing millions worth of investment and hundreds of skilled workers, the project basically created the urban sector of Shiyan from scratch. In 1985, the plant employed more than 65,000 workers and was the second largest automobile manufacturer in China.

According to the plan published in 1965, the site of the Second Auto Works was originally to be not in Shiyan, but in Xiangxi, a similarly remote and mountainous prefecture in western Hunan Province, just about 500 kilometers to the south of Shiyan. As is shown in Table 4 Panel A, Column 1 and Column 2, the two locations were very similar in terms of observable characteristics before the Third Front Movement, although we cannot statistically test the differences between the two directly.[21] They are equally far away from the coast. They have similar terrains: average slope is 4.7 degrees in Shiyan and 3.2 degrees in Xiangxi; log elevation is 6.6 versus 6.3. They were almost the same distance to the nearest provincial capital and to the railway. The population density was almost the same (4.48 versus 4.50 in log values). Most importantly, Shiyan and Xiangxi both had very low levels of industrialization and urbanization before the Movement: both places had no industrial plants in 1936, and in 1964, only 5 percent of the population in Shiyan was urban, compared with 7.9 percent in Xiangxi.

The Third Front Movement dramatically changed this parity. The Second Auto Works employed thousands of manufacturing workers, while during the same period Xiangxi received little investment and its economy remained largely agricultural. By 1985 Shiyan was significantly more industrialized and urbanized than Xiangxi. According to Panel B of Table 4, there were 2.6 workers in the key manufacturing plants per 100 residents in Shiyan, compared with only 0.06 in Xiangxi. 11.6 percent of the workforce was employed in the non-agricultural sector in Shiyan, compared with 8 percent in Xiangxi. The differences persist after the market reform. Shiyan had a much higher urbanization rate in 2000, a much larger manufacturing sector, and a slightly larger service sector. Shiyan also saw its urban rate and share of manufacturing employment grow faster between 1990 and 2000, although the growth in the service

Year Plan" (*guanyu disange wunian jihua anpai qingkuang de tigang*), presented at the Communist Party Plenary in 1965.

[21] The decision between Shiyan and Xiangxi is close. Xiangxi originally had the advantage of being close to a railway. The site was finally chosen in Shiyan when a railroad was planned that would go through Shiyan. The relatively high ethnic minority in Xiangxi might have played a role in the decision, despite the fact that the ethnic minority people in Xiangxi have been peaceful with the government historically.

sector was slightly slower.

Synthetic Control

Since we have only one case, we use a synthetic control approach to construct the statistical comparison for Shiyan and conduct statistical inference (Abadie et al., 2010). Synthetic Shiyan, denoted as j', is constructed as the weighted average of a potential comparison prefecture (k's) such that the distance of the vector of initial conditions ($\mathbf{X}$) between the treated unit and its synthetic control is minimized. The weights are restricted to be bounded between 0 and 1 and sum up to 1. Formally, we find the weights that solve the following problem:

$$\begin{aligned} \omega_k &= \underset{\omega_k}{argmin} ||\mathbf{X}_i - \sum_{k \in K} \omega_k \mathbf{X}_k||, \\ s.t., &\ \ \omega_k \in [0,1],\ \forall k \\ &\ \ \sum_k \omega_k = 1. \end{aligned} \tag{5}$$

The donor pool of potential comparing units, K, includes all 40 prefectures in the Third Front Region that did not receive large industrial investment during the Movement.[22] We denote synthetic Shiyan's outcome as $y_{j'} = \sum_k \omega_k y_k$. The treatment effects can be denoted as $d = y_i - y_{j'}$. The difference between synthetic Shiyan and Xiangxi (comparison j) can be denoted as $d_0 = y_j - y_{j'}$. Both d and d_0 can be statistically tested. The $p-$values can be obtained using a permutation test. A test for $d_0 = 0$ is a test for the significance of potential omitted variables bias.[23]

Results

Column 3 of Table 4 shows the characteristics of synthetic Shiyan before the Third Front Movement (panel A), by the end of the Third Front Movement but before the market reform (panel B), and after the reform (panel C). By nature of the way the synthetic control is

[22] We also drop Xiangxi from the donor pool. If Xiangxi is included, it only contributes a small fraction to synthetic Shiyan, and the results are not changed. The reason that Xiangxi only contributes a small fraction to synthetic Shiyan, we speculate, is that there are potentially other prefectures that serve as better comparisons to Shiyan than Xiangxi. Indeed, since all the potential comparison prefectures were underdeveloped in 1964, many had very similar attributes. Consistent with this argument, the results are also robust to a wide range of selections of the donor pool.

[23] The details of the permutation tests are as follows: Among the group of potential comparison units, a placebo treatment is assigned to each potential comparison unit. The synthetic control is constructed from the remaining comparison units in the same way that we construct synthetic Shiyan. Denote the synthetic control for each unit b from the donor pool as y_i^b, we calculate differences parallel to d and d_0 as $d^b = y_i - y_i^b$ ($d_0^b = y_s - y_i^b$). We rank all the d^b's (d_0^b's) along with the original estimate, d (d_0), and use the percentile of d (d_0) in the distribution as the $p-$value of the relevant test.

constructed, Shiyan and synthetic Shiyan had very similar characteristics before the Third Front Movement. Differences were economically meaningful in the two later periods. Column 4 reports the $p-$values of these differences. For characteristics in 1964, the $p-$values are often close to 1, and never below 0.1. Unlike Shiyan, synthetic Shiyan had little industrial presence in the 1980s and non-agricultural employment was 4 percentage points lower. The differences are statistically significant. The differences remained statistically significant and economically meaningful in the post-reform period. In 2000, the synthetic control has an urban rate 10 percentage points lower, share of manufacturing employment 9 percentage points lower, and share of service sector employment 4 percentage points lower. These indicators have been growing more slowly, although the statistical powers are weaker.

In contrast, the economic conditions for synthetic Shiyan are very close to those of Xiangxi throughout the periods. These differences are economically small, and as suggested by the $p-$values reported in Column 5 of Table 4, in most cases statistically insignificant.[24] Figure 3 visualizes the evolution of the urban rates in the three places over time. The top figure shows that all three places had similar urban rates in 1964, after which urbanization took off in Shiyan, while Xiangxi and synthetic Shiyan retained similarly low urban rates throughout the period. The bottom figure shows the $p-$values for the differences between synthetic Shiyan and both Shiyan and Xiangxi. We also test these differences on a host of other outcome variables. Our results give the same message.[25] Throughout, the synthetic control, constructed to minimize the distance in observable characteristics, has very similar outcomes as the natural comparison, which may contain some additional information only available to the decision-maker. These results show that the unobservable information, if any, is unlikely to cause severe bias in the OLS estimation of Equation 1.

5.4 Coefficient Stability with Additional Covariates

We provide another piece of evidence that omitted variables bias in the OLS estimation of Equation 1 is not a concern. We test the stability of the coefficient associated with the potentially endogenous variable when additional predictors of the outcome variable (denoted as $\mathbf{Z}_i$) are included. If there is an omitted variables problem, including some variables of

[24]The only exception is that Xiangxi in 1964 was a little farther away from the nearest provincial capital city than synthetic Shiyan, and a little more urbanized. The differences in conditions in 1964 do not invalidate our claim. These covariates may well be unimportant for location choices or economic performance. In fact, none of the outcomes in the post-reform period between synthetic Shiyan and Xiangxi are economically substantive or statistically significant.

[25]In the interest of space, these results are not reported here. We will return to these outcomes in the pooled regressions below.

$\mathbf{Z}_i$, correlated with both $ManuEmp_{i,85}$ and ε_i, is likely to alter the coefficient associated with $ManuEmp_{i,85}$. The stability of the coefficient along with an increasing R squared (indicating that $\mathbf{Z}_i$ are truly good predictors for the outcome variable) is a sign that the omitted variables problem may not be a serious issue (Altonji et al., 2005).

Panel A of Table 5 presents the test with urban population ratio in 2000 as the outcome variable. The first column includes no initial conditions of the county before the Third Front Movement. Later columns gradually add county conditions before the Third Front Movement.[26] The coefficient associated with $ManuEmp_{i,85}$ stays stable. Statistical tests cannot reject the null hypotheses that any pair of the coefficients throughout the table are statistically equal. The associated standard errors are also stable and slightly declining. On the other hand, the R squares of the model have been increasing steadily from 0.27 in Column 1 to 0.46 in Column 6.

These results suggest the absence of an omitted variables problem and are consistent with the conditional independence assumption crucial to our identification. However, it is also possible that these additional covariates, though covering a wide range of information and have predictive power for the outcome variable, fail to capture the potential correlation between the key explanatory variable and the error term. If that is the case, we should expect the same coefficient stability results to hold for other places, including places in which we believe industrial investment did select on initial conditions. We apply the same set of tests on counties to the east of the Third Front Region.[27] Panel B of Table 5 shows that for this group of counties, the coefficient declines substantively as more covariates are included. Statistical tests of equality between coefficients in specifications several columns apart consistently reject the null hypotheses that they are equal.

5.5 Additional Robustness Checks

The test for coefficient stability and the case study of Shiyan both show that, conditional on the available information of counties' initial conditions, the assignment of industrial in-

[26] All columns include a dummy variable indicating whether the county is the central city of the prefecture. Many prefectures and their central cities were assigned after the Third Front Movement, partly as a result of the investment, which made some counties more industrialized. Column 1 adds geographic and natural resources conditions: mining sector employment per 100 residents in 1982 as a proxy of natural resource reservation, log average elevation, average slope, log distance to the nearest provincial capital. Column 3 adds initial economic conditions: urban population rate in 1964, industrial sector employment in 1936 per 1,000 1964 residents, log population density in 1964, and population growth between 1953 and 1964. Column 4 adds access to infrastructure: the log distance to the existing or planned railroad. Column 5 includes all quadratic terms of these covariates. Column 6 adds provincial dummies.

[27] Thus counties in ethnic minority autonomous provinces such as Tibet, Xinjiang, Qinghai, Ningxia, and Inner Mongolia are excluded.

vestment in our sample of rural Third Front counties is almost as good as random. In the baseline, we rely on a simple specification in which these conditions enter linearly. We also provide a battery of robustness checks to ensure that we have the correct functional form for these initial conditions. These alternative methods include various propensity-score matching, reweighting of covariates (Kline, 2011), and a set of results at the prefecture level. All results are robust to these changes.

We also adopt an alternative identification strategy based on a geographic cutoff in industrial investment at the borders of the Third Front Region. We compare counties in the eastern-most part of the Third Front Region with those in the Second Front Region, an area between the Third Front Region and coastal provinces that did not receive significant industrial investment throughout the command economy period. The results are qualitatively similar.

These robustness checks are reported in Appendix C.

6 Mechanisms

6.1 Migration

The higher urbanization rate found in counties with higher industrial investment may come from two different sources: reallocation of urban residents across regions, or rural-to-urban transformation of the local residents.[28] The two channels have distinct policy implications. If industrial investment promotes urbanization of the rural population within the same county, there are potentially welfare gains to local residents as urban sector jobs are more productive and pay higher wages. In contrast, if the larger urban population in the county comes at the cost of other counties, industrial investment may not end up being beneficial to local residents while the subsidized industrialization may result in additional efficiency losses at the national level, a point to which we will return in the next section.[29]

We estimate how much of the higher urban rate is due to cross-county migration using 2000 census micro data. Column 1 of Table 6 replicates the baseline result on the urban population growth between 1990 and 2000. The 2000 census asks respondents who changed addresses between 1995 and 2000 where their original addresses were. We use that piece of information to back out how much the increase in urban residents can be accounted for by cross-county migration. The outcome variable of Column 2 is the number of currently urban

[28] Urbanization of rural people from a different county is negligible due to migration restrictions.

[29] The crucial role of migration in evaluating a location-based policy in is also highlighted in the study of Empowerment Zones by Busso et al. (2013).

residents, as a percentage of 1990 population, who migrated from other counties between 1995 and 2000. The coefficient shows that an additional manufacturing worker in 1985 increases the number of urban residents who moved from another county between 1995 and 2000 by 0.2. To make the numbers in Column 1 and Column 2 comparable, we impose some assumptions about the trend in migration rates and a simple demographic model. We assume that the effects on migration from other counties in the 1990-1995 period are the same as in the 1995-2000 period.[30] The children of these migrants born after the move are also urban residents. Therefore, we need to take into account natural population growth. Population nationwide grew by 11.3% between 1990 and 2000, and 4.81% between 1995 and 2000. Therefore, the upper bound for the increased in urban residents that can be accounted for by cross-county migration is 0.432, less than a quarter of the estimated effect [31] [32]

6.2 Continued Subsidies?

One concern about the mechanism of the findings in this paper is that the increased urbanization and industrialization could be a result of the continued subsidies or policy distortions favorable to the existing SOEs established during the Third Front Movement. If that is the case, the persistent effects we find here are mechanical and not generalizable to the more important question of whether temporary subsidies to the industrial sector could have effects on long-run development of a region.[33]

Our baseline specifications already build in a check against this continued-subsidy hypothesis. As documented in Li et al. (2012), while mining, utility, transportation, and financial service industries are largely under the grip of the state, other industries are much more open to private and foreign entry.[34] In constructing key independent variables, we focus on manufacturing industries, so our coefficients are less likely to pick up continued subsidies

[30] In fact, migration has gradually been less restrictive over the years after the market reform. The second half of the 1990s had a higher cross-county migration rate than the first half.

[31] That is, 0.2×1.113 from those who migrated between 1990 and 1995, and 0.2×1.0481 from those who migrated between 1995 and 2000.

[32] Note that this migrations might be from rural regions in other counties; for the purpose of analyzing structural transformation, they should be included.

[33] If, on the other hand, the market is liberalized and SOEs compete on a level ground with private and foreign enterprises, then even if the increased urban employees were recruited by the SOEs, our results are still generalizable to settings in which researchers are interested in the long-run effects of temporary policies that aim at attracting investment: in liberalized markets, the state ownership of a plant does not imply that the result is mechanical. See Hsieh and Song (2015) for evidence on SOEs improving their productivity and outperforming private enterprises.

[34] The non-state sector was essentially non-existent in the command economy era and was just nascent in the early 1980s, yet by early 2000s it accounted for over half of the manufacturing employment and output nationwide.

towards SOEs.

To strengthen our argument, we use firm-level data from the manufacturing portion of the 2004 Economic Census, which allows us to separate urban employment into state and non-state sectors. We focus on non-state sector manufacturing employment as our key outcome variable. If the non-state employment increases in regions receiving more investment, it would be indicative of the existence of spillover effects. Indeed this is what we find. Column 1 of Table 7 shows that one additional manufacturing worker in 1985 increases the number of manufacturing workers by 1.2 in the same county in 2004. Column 2 shows that about 30% of this increase is accounted for by a higher non-state manufacturing employment. The coefficients are statistically significant at the 1% level in both cases.

In Column 3, we include the growth of the state-owned manufacturing sector employment between 1985 and 2004 as a covariate. If counties experienced faster growth in the non-state sector achieved this growth by reaping the subsidies to the SOEs, then once we control for the growth rate in the state-sector, the effects should be gone. Including these covariates substantively increases the explanatory power of the model—the $R-$squared increases from 0.2 to 0.65—but does not change the coefficient of interest at all. Therefore, it is true that the non-state manufacturing sector in counties with an expanding state-owned sector—whether due to invisible market forces or the government's visible helping hands—grow rapidly, but these counties are not necessarily those that received large industrial investment during the Third Front Movement. This finding means that our coefficient is unlikely to pickup continued subsidies to the state sector.

Given that the state-sector in China has gone through major waves of privatization since the 1990s, there might be concern over whether the "non-state" firms are truly private or are simply privatized SOEs. We first note that that privatized SOEs should not necessarily be interpreted as a mechanical result of the Movement. Thousands of SOEs went bankrupt and millions of workers were laid off since the market reform without being bailed out by entrepreneurs and private investment. The fact that a privatized SOE is operating suggests that it is productive enough to survive without government subsidies. A change of ownership does not completely invalidate our interpretation. As assurance, however, here we provide several pieces of evidence that our results are unlikely to be driven by privatization of SOEs.

Specifically, we exploit information on the year in which a firm first started operating to rule out the mechanical effects of privatization. Assuming that a privatized SOE does not change its year of establishment, non-state firms that were established after the market reform are unlikely to be a result of privatization. Column 4 of Table 7 uses manufacturing employment from non-state sector firms that were established after 1985 as the outcome variable.

Comparing the means of the dependent variable in Column 4 and Column 2 suggests that over 90% of the employment in the non-state sector is from firms that were established after 1985. Column 5 further restricts the firms to those established after 2000, when a major wave of privatization was finalized. The coefficients associated with manufacturing employment in 1985 remain positive and statistically significant in both cases. Moreover, in Column 4, the estimate is about 37.5% of the mean outcome variable, whereas in Column 5, this ratio rises to 50%, suggesting that the entry of new firms becomes increasingly important over time. Finally, since privatized SOEs are usually large, Column 6 further restricts the sample firms to those with fewer than 25 workers in 2004, a significant and economically meaningful effect remains.

Finally, we test whether the non-state manufacturing sector in counties with a higher initial industrial presence is not only larger, but also more efficient. We use three different measures of efficiency of non-state firms in the manufacturing sector. Column 7 uses county-average total factor productivity (TFP) as the outcome variable. Column 8 uses the county-average labor productivity as the outcome variable.[35] Column 9 uses the log county-average earnings as the outcome variable.[36] The coefficients associated with manufacturing employemnt are consistently positive and statistically significant. The coefficients are similar across columns and have economically meaningful magnitudes: With one additional manufacturing worker per 100 residents in 1985, average TFP increases by 1.4 percent, average labor productivity increases by 2.1 percent, and average earning increases by 1.2 percent in the non-state manufacturing sector twenty years later.

6.3 Channels of Spillovers

We have documented that those counties that received the Third Front investment experienced faster urbanization with a larger and more productive non-state manufacturing sector. In this section, we explore the mechanisms underlying the spillover effects. We first check cross-industry linkages by decomposing the employment effects into industry levels. We then explore whether the effects of the Third Front investment mediate through some other factors.

[35] Both TFP and labor productivity are log residuals; they are relative measures with zero means, and the coefficients can be conveniently interpreted as percent differences. In calculating TFP and log labor productivity, all manufacturing firms in sample counties are used. Therefore, that the mean dependent variable being positive suggests that non-state-sector firms are, in general, more efficient than state-sector firms. See Appendix B3 for details on the construction of these variables.

[36] Individual-level earning is from 2005 mini-census. Earning is defined as total individual income in the previous month.

The Role of Linkages

Table 8 conducts industry-level regressions to investigate several channels of industrial linkages. The regressions can be summarized as:

$$ManuEmp_{ijt} = \mathbf{X}_{i,64} \cdot \beta + IndLinkage_{ij,85} \cdot \gamma + \kappa_j + \varepsilon_{ijt}, \quad (6)$$

$\mathbf{X}_{i,64}$ is the same set of covariates as in the baseline. In some specifications we replace it with a county fixed effects, therefore only exploiting the variation within the same industry across sectors. j is one of the 19 two-digit manufacturing sector, κ_j is the sector fixed effect. $IndLinkage_{ij,85}$ is a vector of some measures of industrial linkages, constructed using manufacturing employment by sector in 1985.

We first use the employment in the same sector as the main explanatory variable. Column 1 controls for county initial conditions while Column 2 controls for county fixed effects. Both give very similar results. The coefficient associated with same-industry manufacturing employment in 1985 is as large as the main effect at the county level (Column 2 Table 7). It suggests that all the spillover effects take place within the same industry.

Column 3 includes input and output linkages. Input linkages refer to spillover effects in which industry j (measured in 2004) uses the products of industry i (measured in 1985) as inputs. Similarly, output linkages refer to the spillover effect in which the products of industry j (measured in 2004) are used as inputs for industry i (measured in 1985).[37] It seems that output linkages have small but positive spillovers, while input linkages are negative and less stable. Nevertheless, a back-of-the-envelope calculation shows that the additional effect explained by input and output linkages is in the order of 1% of the total effect. Column 4 includes labor linkages. To calculate labor linkages, we first tabulate the share of 3-digit occupation o in each industry i, s_{oi}. The occupation composition for industry i is thus $S_i = \{s_{oi}\}$. We then calculate pairwise correlations of occupation composition between industry i and industry j, $\rho_{ij} = corr(S_i, S_j)$. The labor linkage for industry i is thus equal to $\sum_{j \neq i} \rho_{ij} \cdot E_{j,85}$, where $E_{j,85}$ is the 1985 employment in industry j divided by population. Similarly, we find that the labor linkage does not explain much of the variation. Column 5 includes the employment in other manufacturing industries alongside employment in the same industry as the explanatory variables. If manufacturing industries are linked in some way, a larger overall manufacturing sector in other industries is likely to have an positive effect on the

[37]See Appendix B4 for how input-output linkage measures are created. We only use off-diagonal (cross-industry) elements of the input-output matrix in calculating input linkage and output linkage measures, while always keeping the same-industry employment in the regression.

size of this industry. The coefficient associated with the manufacturing employment in other sectors is negative, suggesting a "crowding out" effect, although the magnitude is very small economically.

Overall, Table 8 shows that the spillover effects exist mainly within the same 2-digit sector. Neither input-output linkages (Hirschman, 1958) nor the aggregate expansion in the local economy (Murphy et al., 1989) are important in accounting for the increased non-state employment.[38] Our result is consistent with a simple story of technological spillover: Potential entrepreneurs acquire important skills such as knowledge about firm operations from an existing firm in the local economy. With that know-how, they take advantage of the local workforce with specific skills and start their own businesses when market reform allows private entry. With greater skills and a better-suited workforce, the plants are also more productive than those elsewhere. We provide evidence below that is consistent with this hypothesis.[39]

Industry Heterogeneity and Intermediate Factors

If the main channel is through knowledge spillover, we should expect this effect to be larger for industries in which knowledge is more important (i.e., more advanced industries), and effects of industrial investment should be absorbed by its effect on local human capital.

Table 9 tests these hypotheses. Column 1 takes a direct look at industry heterogeneity by breaking the manufacturing employment in 1985 into three broad sectors: (1) sophisticated manufacturing, which includes firms that produce machinery, transportation equipment, electric and electronic equipment; (2) material manufacturing, such as ferrous and non-ferrous metal products, petroleum refinery, electricity, fertilizers, etc; and (3) light manufacturing, which includes food and textile industries. The outcome variable in all three columns is the number of manufacturing workers for every 100 residents into the non-state sector in 2004. Sophisticated manufacturing seems to generate the largest spillovers on the non-state sector.

The remaining columns test whether there are important intermediate factors through which the investment generates persistent effects. In Columns 2 through 8, we add potential intermediate factors measured in the mid-1980s. We pay attention to the changes in the $R-$squared, which indicate whether these conditions *per se* are good predictors for the outcome variable, and changes in the coefficient associated with the manufacturing employment. Column 2 includes no other intermediate conditions and replicates Column 2 of Table

[38] Admittedly, some of these cross-industry spillovers may have been masked by the lack of more detailed industry classifications.

[39] Although our data does not allow us to investigate this channel directly, previous studies have found evidence of learning among neighboring firms. For example, Fernandes and Tang (2014) documented local learning among neighboring firms from a sample of Chinese exporters.

7. Column 3 includes a set of prefecture dummies, which intends to capture prefecture-level policies and trends. Column 4 includes log distance to the railroad in 1980, a measure of infrastructure and connectivity to the national market. Column 5 includes measures of the local human capital. Column 6 includes stock of physical capital. Column 7 includes population density. None of these factors matter much except for the human capital measures, which cut the coefficient by over a half.[40] Column 8 includes all these additional covariates from Column 2 to Column 7; the coefficient is basically the same as in Column 5, in which human capital is included. As conjectured previously, the large effect of human capital might be because human capital provides a proxy for the stock of potential entrepreneurs and skilled workers; it might also measure the knowledge intensity of the local manufacturing plants. Both interpretations are consistent with the knowledge spillover channel highlighted above.[41]

7 Welfare Implications

The Movement has persistent effects on promoting structural change in the local economy, but this alone does not guarantee that the Movement is welfare-improving in aggregate. In fact, the Movement might have resulted in substantial efficiency loss at the national level. After all, it reallocated production activity from the coastal regions, where natural and geographic characteristics are more favorable to industrial production, to the remote and less productive Third Front Region. This misallocation is evident from Table 10. In the first three columns, we compare the efficiency of non-state-owned manufacturing firms in counties invested by the Movement, with counties that are to the east of the Third Front Region.[42] We measure efficiency by average TFP, average labor productivity, and log average wage. In all measures we find the efficiency of firms to the east of the regions is about 12 to 15 percent higher than that of those in counties that received large industrial investment during the Third Front Region, implying a substantial loss from misallocation due to the Movement.[43]

This spatial misallocation can be justified, in terms of national aggregate welfare, if there are poverty traps in the local economy level, or if there is heterogeneous returns across space

[40]See Glaeser et al. (1995) for similar findings in the role of human capital in city growth.

[41]Of course, there are other explanations, such as a labor pool with higher human capital attract more entrepreneurs. We cannot rule out these alternatives, but we note that according to this specific alternative, we should expect the effect to be relative even across industries, rather than concentrated in the same industry as the initial investment.

[42]It excludes non-Third Front counties in Xinjiang, Tibet, and the western part of Inner Mongolia.

[43]This difference is substantial. Recall that in Table 7, we estimate that raising the manufacturing employment to population ratio by one percentage point brings about 1 to 2 percent efficiency gain. Extrapolating this effect, it takes a manufac- turing employment to population ratio somewhere between 6 and 15 to cover this gap. Few counties in the Third Front region had such a higher manufacturing presence in 1985.

to urbanization. If there is poverty trap in local economies, initial investment may push the local economies into a virtuous cycle of industrialization and growth, the temporary efficiency loss could be well justified by a much higher income level in the new equilibrium. On the other hand, if the marginal benefit of sector transformation is much higher in the Third Front Region, the Region's inefficiency in the modern sector may also be justified.

Our findings in this paper do not support that there is poverty trap at the local economy level. Specifically, we find that counties at different stages of development all experienced rapid growth during the sample period, and that although the treated counties grew faster and persisted to have higher levels of urbanization and industrializaton, there is no sign that the differences are diverging.[44]

However, there is some evidence that the return to urbanization is higher in the Third Front Region. As is shown in Column 4 of Table 10, the gap in agricultural productivity inside and outside of the Third Front Region is even larger than in the manufacturing sector. A typical worker in the non-state-owned manufacturing sector in a Third Front county makes about 15 percent less than a similar worker in eastern China, but a typical worker in the agricultural sector in a Third Front county makes about 32 percent less. Therefore, although the manufacturing sector in the Third Front Region is less efficient, the industrialization process there could have resulted in a larger increase in aggregate welfare.[45] Of course, this simple logic overlooks the massive waste of the Movement during construction and subsequent operation, and assumes away the possibility that the same investment in the non-Third-Front region would have a larger spillover effects on the non-state sector and the structural transformation. Without a natural experiment in the non-Third-Front region, we are unable to obtain causal estimations there as we did for the Third Front Region. Nevertheless, the above discussion illustrates the case in which industrial investment in less productive places may have high welfare-improving effect by transforming particularly poor agricultural workers into the modern sector. This welfare gain can at least offset some of the efficiency losses due to misallocating industrial investment in less productive places.

[44] We discuss the implications of two broad classes of poverty trap commonly studied in the literature and relate our findings to these implications in Appendix D.

[45] The log average monthly income for an agricultural worker in the Third Front Region is 5.47, the log average monthly income for a manufacturing worker there is 6.42. Transforming an agricultural worker to a manufacturing worker increases her earning by 0.95 log points. In contrast, the same transformation in eastern China increases one's earning by 0.78 log points (from 5.78 to 6.56). In a typical utility function with decreasing marginal utility, setting up a firm in the Third Front Region actually increases nationwide welfare.

8 Conclusions

This paper evaluates the long-run effects of China's Third Front Movement on structural transformation of local agrarian economies. We find persistent and economically significant effects of the Movement on several measures of structural transformation and economic development. The long-run effects are sustained by the spillover effects on the new and dynamic non-state sector. Due to the high migration cost in China, the positive effects are captured by local residents. The Movement likely results in substantial efficiency loss by setting up industrial plants in places that are inherently less productive. But the inefficiency is at least partly offset by the higher marginal returns from transforming the poor local economy.

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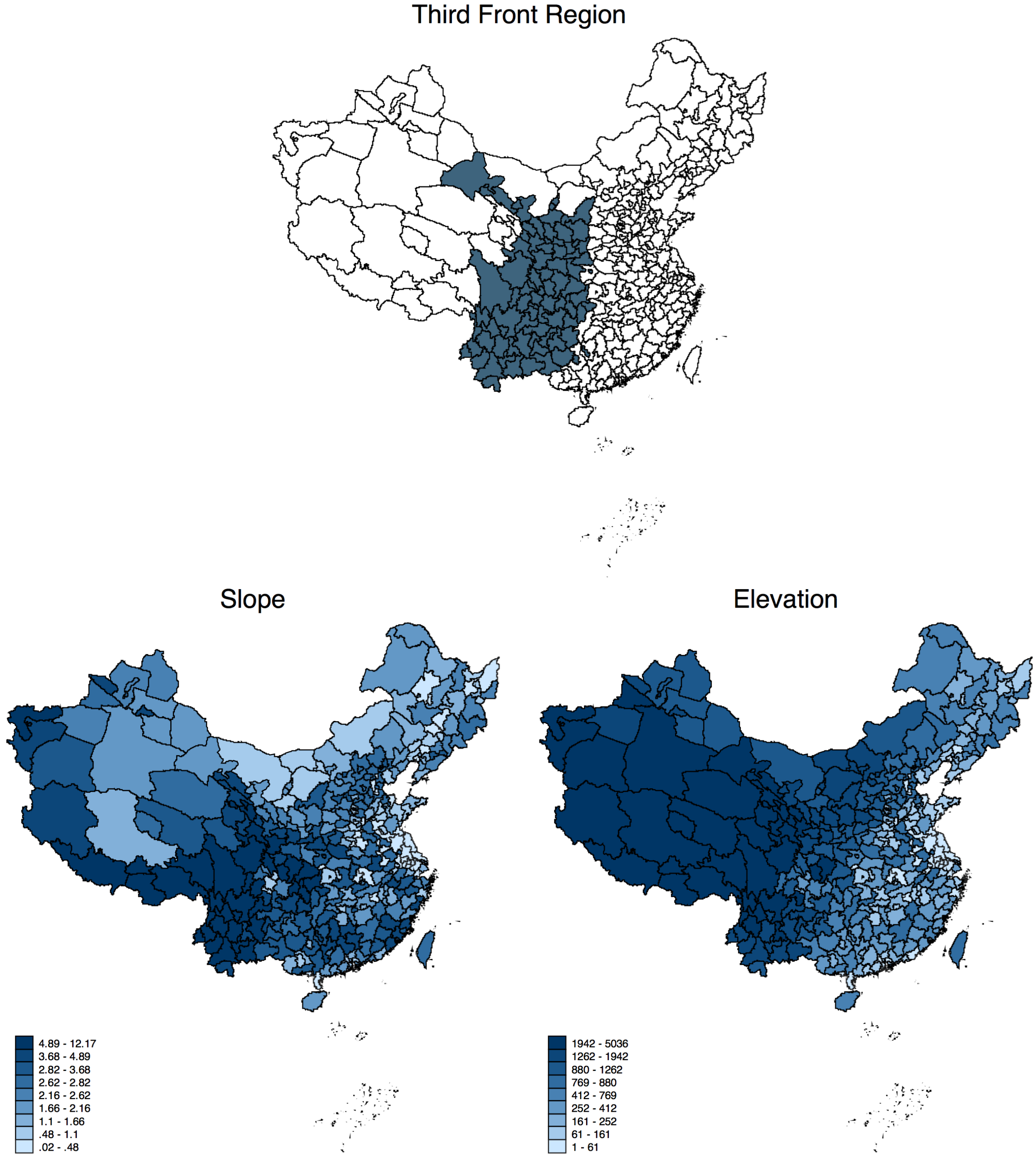
Tables and Figures

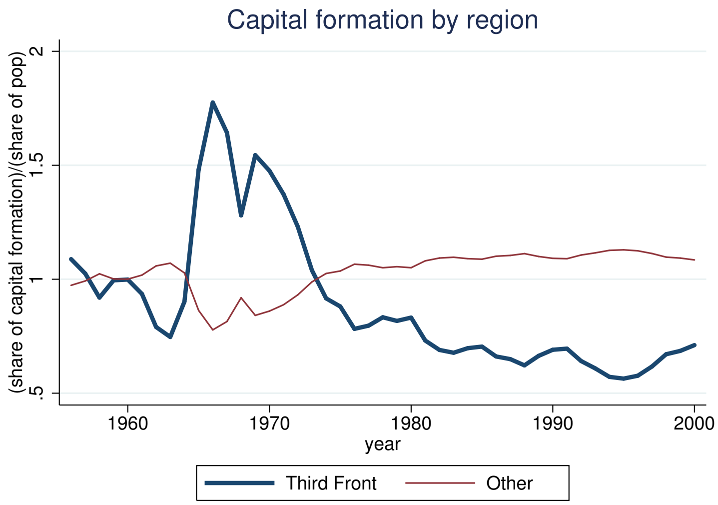
Figures

Figure 1: Third Front Region and Geography



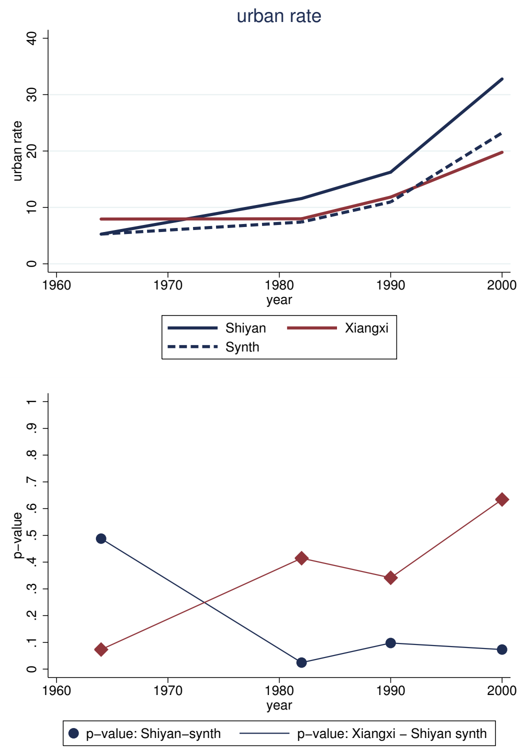
Note: The map on top shows the boundary of the Third Front Region. The map on the lower left shows the average slope for each prefecture, with darker blues indicating higher ruggedness. The map on the lower right shows the average elevation of each prefecture, with darker blues indicating higher elevation.

Figure 2: Intensity of Investment by Region



Note: Investment intensity is measured as the region's share of national investment divided by its share of national population. Source: 60-year Statistical Summary constructed by the National Bureau of Statistics of China.

Figure 3: Urban Rate in Shiyan and Its Comparisons over Time



Note: The graph on top depicts the trajectories of urban population rate in Shiyan (solid blue), Xiangxi (solid red), and synthetic Shiyan (dotted blue) from 1964 to 2010. The graph on the bottom shows the $p-$values for the differences between Shiyan and the synthetic Shiyan (blue dots), and the differences between Xiangxi and the synthetic Shiyan (red diamonds).

Tables

Table 1: Characteristics of Firms by Year of Opening

	nationwide			Third Front Region		
year of opening	before TF	during TF	(2)-(1)	before TF	during TF	(5)-(4)
	(1)	(2)	(3)	(4)	(5)	(6)
County characteristics						
in Third Front Region	.16	.41	.25			
	(.37)	(.49)	(.01)			
in provincial capital city	.44	.21	-.24	.34	.15	-.18
	(.50)	(.41)	(.01)	(.47)	(.36)	(.021)
average slope (ruggedness)	1.23	1.92	.69	2.30	2.82	.42
	(1.42)	(1.76)	(.04)	(1.97)	(1.98)	(.10)
log mean elevation (meters)	4.29	5.27	.97	6.37	6.48	.11
	(1.88)	(1.72)	(.05)	(.94)	(.96)	(.05)
log density in 1964 (# per km^2)	6.68	5.76	-.92	5.93	5.39	-.54
	(1.49)	(1.35)	(.04)	(1.17)	(.94)	(.05)
log distance to provincial capital (km)	2.71	3.93	1.22	3.4	4.27	.87
	(2.49)	(2.11)	(.06)	(2.46)	(1.92)	(.11)
log distance to 1962 rail (km)	.6	1.24	.64	1.00	1.46	.46
	(1.28)	(1.84)	(.04)	(1.66)	(2.00)	(.09)
log industrial output in ’36	8.68	4.28	-4.40	5.90	2.18	-3.72
	(8.54)	(7.03)	(.20)	(7.04)	(5.04)	(.30)
Firm sectors						
mining	.06	.04	-.02	.09	.03	-.05
	(.23)	(.20)	(.01)	(.28)	(.18)	(.01)
light industries	.30	.22	-.08	.28	.22	-.06
	(.46)	(.42)	(.01)	(.45)	(.41)	(.02)
power/water	.07	.06	-.01	.10	.05	-.05
	(.25)	(.24)	(.01)	(.30)	(.22)	(.01)
chemical	.14	.15	.02	.11	.11	0.00
	(.35)	(.36)	(.01)	(.31)	(.31)	(.02)
ferrous and non-ferrous metal	.1	.06	-.03	.09	.06	-.03
	(.3)	(.24)	(.01)	(.29)	(.25)	(.01)
machinery	.25	.29	.04	.25	.34	.09
	(.43)	(.46)	(.01)	(.43)	(.48)	(.02)
electric and electronic	.09	.16	.08	.08	.19	.11
	(.28)	(.37)	(.01)	(.27)	(.39)	(.02)
number of plants	4927	2049		809	842	

Note: Data on firms are from the directory of large- and medium-sized manufacturing plants in the Manufacturing Census of 1985. Year range indicates years in which the plant started operating, “before TF” indicates years between 1949 and 1964, and “during TF” indicates years between 1965 and 1978. In columns 1, 2, 4, and 5, standard deviations are in parentheses. In columns 3 and 6, standard errors are in parentheses. County characteristics are from various population censuses and manufacturing censuses.

Table 2: Summary Statistics for Counties in the Third Front Region

	mean	s.d.	$p10$	median	$p90$
Panel A: Initial industrial presence					
emp from 1985 key manufacturing plants per 100 residents	0.33	1.61	0.00	0.00	0.68
Panel B: Initial conditions					
log population density 1964 (# per sqkm)	4.32	1.06	3.06	4.43	5.71
urban rate 1964 (%)	5.59	2.02	3.11	5.33	8.66
log distance to existing and planned railway 1962 (km)	3.43	1.79	0.00	3.95	5.36
log distance to nearest provincial capital (km)	5.33	0.50	4.63	5.41	5.92
log average elevation (meters)	7.00	0.64	6.08	7.05	7.78
average slope (degrees)	4.44	2.78	1.37	3.86	8.22
industrial employment in 1936 per 10k 1964 resident	0.07	1.49	0.00	0.00	0.00
Panel C: Post-reform outcomes (2000s)					
urban rate (%)	16.24	11.22	6.99	13.85	27.44
non-state manufacturing emp per 100 residents	1.24	1.89	0.17	0.74	2.72
from firms established after 1985	1.13	1.64	0.16	0.68	2.56
service emp per 100 1982 resident	12.76	7.36	7.25	10.85	19.21
log population density (# per sqkm)	4.92	1.03	3.71	4.99	6.23
percent of adults with middle school diploma and above	31.36	11.26	15.75	31.55	45.27
percent of adults with college degrees	1.28	0.91	0.61	1.07	2.18

Note: There are 509 counties in the sample.

Table 3: Structural Transformation

	(1) urban rate	(2) manu/emp rate	(3) service/emp rate
Panel A: 1990 levels			
manu emp in 1985	1.555***	1.097***	0.908***
	(0.364)	(0.233)	(0.237)
mean dep var	9.354	3.224	8.409
Panel B: 2000 levels			
manu emp in 1985	2.177***	1.161***	0.724***
	(0.566)	(0.296)	(0.203)
mean dep var	16.242	5.196	10.626
Panel C: 90-00 change			
manu emp in 1985	1.708**	0.543*	0.230
	(0.702)	(0.311)	(0.195)
mean dep var	8.086	1.464	2.973
initial conditions	X	X	X
N	509	509	509

Note: Initial conditions include a dummy indicating prefecture center city, geography (log average elevation, log average slope, log distance to the nearest provincial capital), initial economic development (share of urban population in 1964, number of manufacturing workers in 1936 per 1000 1964 resident, population growth between 1953 and 1964), natural resources (number of workers per 100 residents working in the mining sector), and infrastructure (log distance to the existing and planned railway). Outcome variable for each column is as follows: Column 1: urban population rate (%). Column 2: share of employment in manufacturing (%). Column 3: share of employment in service (%). Panels A and B show 1990 and 2000 levels, respectively. Panel C shows changes between 1990-2000. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Shiyan and Its Comparisons

	(1) Shiyan (treated)	(2) Xiangxi (comparison)	(3) Synth	(4) (1)-(3) $p-$value	(5) (2)-(3) $p-$value
Panel A : initial conditions (1964)					
log population density 1964 (count per sqkm)	4.48	4.50	4.48	0.66	0.20
urban rate 1964 (%)	5.26	7.93	5.27	0.49	0.07
log distance to existing and planned railway 1962 (km)	5.23	4.30	4.88	0.17	0.88
log distance to nearest provincial capital (km)	5.56	5.78	5.56	0.68	0.02
log average elevation (meters)	6.60	6.30	6.54	0.54	0.85
average slope (degrees)	4.67	3.22	4.67	0.44	0.95
industrial employment in 1936 per 10,000 1964 resident	14.51	14.07	13.95	0.22	0.44
Panel B: before the market reform (1982)					
manu emp from key industrial plants (per 100 residents)	2.59	0.06	0.12	0.00	0.54
non-ag emp rate (%)	11.58	7.99	7.40	0.00	0.39
Panel C: post-reform outcomes					
urban rate in 2000	32.78	19.78	23.22	0.05	0.63
manu/emp rate in 2000	14.31	5.32	5.01	0.00	0.34
service/emp rate in 2000	19.93	17.18	15.92	0.07	0.22
growth in urban rate in 90-00	17.76	9.40	13.24	0.17	0.73
growth in manu/emp rate in 90-00	5.26	1.61	1.50	0.00	0.39
growth in service/emp rate in 90-00	4.47	5.84	3.91	0.24	0.12

Note: Conditions for Shiyan are reported in Column 1. Conditions for the natural comparison, Xiangxi, are reported in Column 2. Conditions for the synthetic Shiyan are reported in Column 3. Column 4 reports the $p-$values of the differences between Shiyan and synthetic Shiyan. Column 5 reports the $p-$values of the differences between Xiangxi and synthetic Shiyan. The $p-$values are obtained using the permutation-like method. Panels A, B, and C report conditions in 1964, 1982, and 2000s, respectively.

Table 5: Coefficient Stability

	dep var: urban population rate in 2000					
Panel A: TF Region	(1)	(2)	(3)	(4)	(5)	(6)
manu emp in 1985	2.36***	2.22***	2.14***	2.18***	2.07***	2.09***
	(0.60)	(0.57)	(0.58)	(0.57)	(0.55)	(0.52)
initial conditions	none	+ geo, mining	+ initial econ conds	+ infra, dist	quadratic	prov dummies
N	509	509	509	509	509	509
R^2	0.27	0.34	0.42	0.42	0.43	0.46
Panel B: Non-TF Region	(1)	(2)	(3)	(4)	(5)	(6)
manu emp in 1985	2.25***	2.01***	1.51***	1.47***	0.81***	0.84***
	(0.26)	(0.28)	(0.30)	(0.29)	(0.28)	(0.25)
initial conditions	none	+ geo, mining	+ initial econ conds	+ infra, dist	quadratic	prov dummies
N	1489	1489	1489	1489	1489	1489
R^2	0.42	0.44	0.50	0.50	0.60	0.67

Note: Manufacturing employment in 1985 (key independent variable) is divided by 1982 population then $\times$100. The sample in Panel A includes counties in the Third Front Region with urban rates in 1964 below 10% in 1964. The mean dependent variable is 16.24 (11.22), and the mean explanatory variable of interest is 0.33 (1.61). The sample in Panel B includes counties to the east of the Third Front Region. Mean dependent variable is 31.68 (22.02), and the mean explanatory variable of interest is 0.97 (2.80). All columns include a dummy variable indicating whether the county is the central city of the prefecture. Column 1 adds geographic and natural resources conditions: mining sector employment per 100 residents in 1982 as a proxy of natural resource reservation, log average elevation, average slope, log distance to the nearest provincial capital. Column 3 adds initial economic conditions: urban population rate in 1964, industrial sector employment in 1936 per 1,000 residents in 1964, log population density in 1964, and population growth between 1953 and 1964. Column 4 adds access to infrastructure: the log distance to the existing or planned railways. Column 5 includes all quadratic terms of these covariates. Column 6 adds provincial dummies. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Migration and Urbanization

	(1) urban pop increase 90-00	(2) mig pop from outside of county 95-00	(3) imputed urban grth due to migration 90-00
manu emp in 1985	1.71**	0.20***	0.43
	(0.70)	(0.04)	
initial conditions	X	X	
mean dep var	8.09	0.96	
N	509	509	

Note: In Column 1, the dependent variable is the percent increase of urban population (urban population in 2000 minus that in 1990, then divided by 1990 population and $\times 100$). In Column 2, the dependent variable is the number of urban residents who migrated from other counties between 1995 and 2000, divided by 1990 population. The set of initial conditions is the same as in Column 4, Table 5. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Column 3 reports the imputed urban growth rate due to cross-county migration based on linear projection and a simple demographic model.

Table 7: Dynamics of the Manufacturing Sector

	(1)	(2)	(3)
	all manu emp	non-state sector manu emp	
		no add'l control	+ SOE grth
manu emp in 1985	1.207***	0.346***	0.387**
	(0.127)	(0.113)	(0.157)
N	508	508	508
mean dep var	2.153	0.922	0.922
	(4)	(5)	(6)
	non-state manu sector emp from firms established		
	since 85	since 00	(5), small
manu emp in 1985	0.312***	0.250**	0.023***
	(0.100)	(0.107)	(0.003)
N	508	508	508
mean dep var	0.838	0.505	0.098
	(7)	(8)	(9)
	non-state manu sector emp efficiency		
	TFP	labor prod	ln earning
manu emp in 1985	0.014*	0.021**	0.012**
	(0.008)	(0.009)	(0.006)
N	480	480	427
mean dep var	0.044	0.045	0.038

Note: Firm-level data from the industrial part of the first Economic Survey in 2004 are matched with 2004 annual survey of scale-and-up manufacturing firms. If not otherwise specified, the controls are the same as in Column 4 of Table 5. In the first 6 columns, outcome variables are manufacturing employment in 2004, all divided by the 1982 population. The coefficient has the direct level-to-level interpretation. In Column 1 the outcome variable is the manufacturing employment from all firms in 2004. In Columns 2 and 3, the outcome variable is the manufacturing employment in the non-state sector in 2004. Column 4 includes employment from firms that were established after 1985; Column 5 includes employment from firms that were established after 2000; Column 6 includes employment from firms with 25 or fewer employees that were established after 2000.

Column 7 to Column 9 use measures of efficiency in the non-state manufacturing firms as outcome variables. In Column 7, the outcome variable is TFP. In Column 8, the outcome variable is log labor productivity. In Column 9, the outcome variable is log earnings. Scale-and-up manufacturing firms in 2004 are used to calculate TFP and log labor productivity. See Appendix B2 for details of how these variables are constructed. Log county average earnings are from individual level data of the 2005 mini-census. Robust standard errors are in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Industrial Linkages

	(1)	(2)	(3)	(4)	(5)
emp in the same sector	0.385***	0.390***	0.386***	0.385***	0.389**
	(0.136)	(0.143)	(0.133)	(0.137)	(0.081)
input linkage			-0.034**		
			(0.016)		
output linkage			0.049***		
			(0.016)		
labor linkage				0.000	
				(0.002)	
emp in other manu sector					-0.004*
					(0.002)
industry FE	X	X	X	X	X
initial conditions	X		X	X	X
county FE		X			
N	7620	7620	7620	7620	7620

Note: Each observation is a county-industry. There are 508 counties and 15 industries in the sample. The dependent variable is non-state sector manufacturing employment in a specific industry in 2004 per 100 residents in 1982. The mean dependent variable is 0.0614 (0.266). The key independent variable is manufacturing employment in 1985 per 100 residents in 1982 in the same 2-digit industry. The mean of the key independent variable is 0.02 (0.32). The mean average manufacturing employment in 1985 per 100 residents in 1982 in other industries is 0.45 (1.91). The mean of the input linkage is 0.039 (0.301) and the mean of the output linkage is 0.035 (0.253). The mean of labor linkages is 0.297 (2.316). Standard errors are clustered at the county level. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Intermediate Factors

Dep var: non-state manufacturing employment in 2004 per 100 residents								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
conditions in early 80s	none	none	pref	transport	human K	physical K	pop den	all
manu emp		0.346***	0.340***	0.347***	0.158	0.294*	0.340***	0.187
		(0.113)	(0.113)	(0.114)	(0.145)	(0.150)	(0.112)	(0.127)
sophisticated manu	0.481***							
	(0.114)							
material manu	0.119							
	(0.080)							
light manu	-0.173							
	(0.259)							
initial conditions	X	X	X	X	X	X	X	X
N	508	508	508	508	508	508	508	508
R^2	0.219	0.204	0.436	0.204	0.280	0.204	0.208	0.786

Note: Initial conditions as covariates are the same as in Column 4, Table 5. The outcome variable is non-state manufacturing employment in 2004, divided by 1982 population (then $\times 100$). All columns control for county initial conditions, while each column controls for additional prefecture conditions in the 1980s. Column 1 uses the same set of baseline controls as in Column 2, Table 7, but breaks the 1985 industrial employment into sophisticated manufacturing (including machinery, transportation equipment, electric devices, electronic products, and instruments), raw material manufacturing (including ferrous and non-ferrous metal products, oil refinery, electricity, etc.), and light manufacturing (including textile, paper, etc). Column 2 includes no additional covariates; this is a replication of the result in Column 2, Table 7. Column 3 includes dummy variables for prefectures. Column 4 adds transportation conditions in the early 1980s, which is measured by log distance to railroad in 1980. Column 5 controls for human capital characteristics, which includes percent of the adult populationthat is illiterate, has a middle school diploma, and has a college degrees in 1982. Column 6 controls for per capita physical capital in 1985. Column 7 includes log population density in 1982. Column 8 includes all the covariates from Column 2 to Column 7. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Efficiency Loss and Welfare Implications

	(1)	(2)	(3)	(4)
	non-state manufactruing efficiency		log wage in	
	TFP	labor prod	non-state manufacturing	agricultural
in Third Front	-0.122**	-0.139**	-0.147***	-0.323***
	(0.054)	(0.057)	(0.043)	(0.034)
N	1585	1585	1128	1128

Note: The regression includes counties in the baseline county sample (variable “in Third Front” takes value 1), plus counties to the east of the Third Front Region (variable “in Third Front” takes value 0). For log average county wages in Column 3 and Column 4, there is an additional sample restriction: each county should have at least two observations in non-state-owned manufacturing sector workers. No additional covariates are controlled. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendix

Appendix A: Data Sources

Data sources used in this paper include:

1. *Second Industrial Census* in 1985. We use the statistics from the 1985 Industry Census published by the National Bureau Statistics (NBS). Industry is defined in all surveys here to include mining, manufacturing, and public utilities. We use mainly two volumes of the publication. The first volume lists all key industrial firms in 1985. Virtually all of them are state-owned. For each key firm, we observe its name, address, 2-digit industry, employment, output, capital, year of opening, and main products. We use year of opening and the location to determine whether a plant belongs to the Third Front Movement. The second volume lists county-level numbers of establishment, industrial output, and employment for years 1980, 1984, and 1985. We use this second volume to construct the overall conditions of the industrial sector right before the market reform.

2. *County-level tabulation of population censuses in 1953, 1964, 1982, 1990 and 2000*. These include all population censuses conducted in China after the establishment of the People's Republic in 1949. All county-level tabulations include population. The availability of other information varies by census. Size of urban population is available in 1964, 1990, and 2000. Employment by sector and population by education level are available after 1982. We also use the 1/1000 micro sample of the 2000 census for information on migration.

3. *Firm-level panel data for "above-scale" manufacturing firms, 1998-2007*. The dataset is collected by the NBS. "Above-scale" is defined as annual sales above 5 million *yuan* (830 thousand USD under current exchange rate). The data have comprehensive information on firm ownership, labor and capital input, industry, output, and financial conditions. It is mainly used to construct firm efficiency measures such as total factor productivity and labor productivity.

4. *Industrial firms of Economic Census* in 2004. This includes the firm-level data on all 1.4 million industrial firms in China. For each firm, we observe its ownership, labor, capital, output, industry, and location.

5. *1936 Industry Survey*. The 1936 Industry Survey is a firm-level dataset conducted by the National Party (*Kuomingdang*). It is the only existing nationwide industry survey prior to the Third Front Movement.[46] The Survey includes summary characteristics of capital, worker, product, machinery, and output for each firm. It includes data on 146 counties that have a significant industry presence, which covers all of China except for the Northeast.[47] We aggregate the firm-level data to get city- (county-) level industrial output and employment.

6. *GIS maps of county boundaries from China Historical GIS project*.[48] The GIS maps include boundaries of county-level jurisdictions in each year the population census was conducted. The area covered by each county is calculated from the polygons. Overlaying these polygons, we define counties with consistently defined boundaries.

7. *Digital Elevation Model (DEM) data* for China's geographic characteristics. The DEM map is overlaid with GIS maps with county boundaries to calculate a county's average elevation and ruggedness.

8. *GIS maps for roads, railroads, and highways* in 1962, 1980, 1990, 1995, 2005, and 2010. This dataset is collected in Baum-Snow et al. (2012) and is generously provided by the University of Toronto library.

A list of key variables used in the study and their sources are listed in Table G.

Appendix B: Details of Variable Construction

B.1 Consistently Defined Counties

County boundaries have changed over the decades. We convert county-level measures in other years into 1982 counties. Counties with consistently defined boundaries are created comparing GIS maps from population censuses. Specifically, geographic characteristics such as elevation, ruggedness, distance to rivers, etc., are measured continuously across space; we simply aggregate them to the 1982 county level. County characteristics from industry and population censuses are based on current county boundaries. We match counties to the

[46] There is a census of industrial plants in 1950. However, disaggregated data at the county or industry levels are not available to the public.

[47] These provinces were controlled by the Japanese in 1936. These provinces are not in our sample either.

[48] Available at: http://www.fas.harvard.edu/~chgis/

nearest year for which a GIS map is available, and then convert it to the 1982 boundary using a weighted average of intersecting counties. For example, if 1982 county A's territory is split into county A_1 and county A_2 in 1990, then α share of the territory of county A is in A_1 and $(1-\alpha)$ share of the territory of county A is in A_2, and the characteristics of county A in 1990 are calculated as the weighted average of the characteristics of A_1 and A_2, with the areas of the overlapping territories serving as weights.

B.2 Geographic Characteristics

We construct two main variables for county geographic characteristics. The first variable is county average elevation. The second variable is county average slope. Both variables are constructed from a DEM (Digital Elevation Model) file. A DEM file contains elevation information about a point in space. We first overlap the DEM file with the shape file containing county boundaries. The average elevation is calculated as the average elevation of all points in the DEM data that fall within the boundaries of the county. Slope thus measures the ruggedness of the terrain.[49] To calculate the county average slope, the county polygon is first divided into a grid of 1 km by 1 km squares. For each square, the slope is calculated as the maximal elevation divided by the minimal elevation. The average slope of a county is thus the average slope of all squares that lie within the polygon of the county. If a sqaure falls only partly within a county polygon, the slope of that square is given the weight proportional to the percent of its area that intersects with the county polygon.

B.3 TFP and Log Labor Productivity

Consider the following production function

$$Y_{ijs} = A_{ijs} K_{ijs}^{\alpha_s} L_{ijs}^{\beta_s}, \tag{7}$$

where Y_{ijs} is the value added of firm i in sector s operating in location j, K_{ijs} is physical capital input, and L_{ijs} is labor input. A_{ijs} is the firms' TFP, which in turn can be expressed as

$$A_{ijs} = R_j S_s \epsilon_{ijs}, \tag{8}$$

[49] See Dell (2010) and Nunn and Puga (2012) for discussion and application of slope.

where R_i is the regional productivity, S_s is the sectoral level productivity, and ϵ_{ijs} is the firm ijs's deviation from local average productivity in the same sector. Our goal is to estimate $\ln R_i$, log of the regional component of TFP.

Taking the natural logarithm on both sides of the production function we have

$$\ln Y_{ijs} = \ln R_j + \ln S_s + \alpha_s \ln K_{ijs} + \beta_s \ln L_{ijs} + \ln \epsilon_{ijs}. \tag{9}$$

$\ln R_i$ is recovered in two steps. In the first step, we estimate this equation separately for each sector s, with a dummy variable indicating region:

$$\ln Y_{ijs} = \ln S_s + \alpha_s \ln K_{ijs} + \beta_s \ln L_{ijs} + \xi_{ijs}.$$

$\ln S_s$ is a constant term. The residual, $\hat{\xi}_{ijs}$, is thus the log productivity of firm i relative to other firms in the same sector j. In the second step, we calculate $\widehat{\ln R_j} = \sum \hat{\xi}_{ijs} / N_i$, where N_j is the number of total firms in region j.

For log labor productivity, we first calculate log value added per worker $\ln(y_{ijs}) = \ln(Y_{ijs}/L_{ijs})$. Then for each sector s, estimate

$$\ln y_{ijs} = \gamma_s + \varepsilon_{ijs},$$

and get residual $\hat{\varepsilon}_{ijs}$. This measures log productivity of firm i relative to other firms in the same sector j. Then the average log labor productivity of region j is calculated as $\bar{\varepsilon}_j = \sum \hat{\varepsilon}_j / N_i$.

B.4 Input and Output Linkages

Let matrix OUT be a $J \times J$ lower matrix with element $\rho_{jj'}^{output}$. $\rho_{jj'}^{output}$ is the share of industry j''s sales that is bought by industry j. The diagonal elements are assigned to be zero; therefore we are only capturing the output linkages across industries. Let matrix IN be a $J \times J$ lower matrix with element $\rho_{jj'}^{input}$, where $\rho_{jj'}^{input}$ is the share of industry j''s purchase in industry j's total sales. Similarly, the diagonal elements are assigned to be zero such that we focus on cross-sector input linkages. The pairwise input share, $\rho_{jj'}^{input}$, and the pairwise output share, $\rho_{jj'}^{output}$ are both from 1995 input-output tables published by the (NBS).[50] Let R be an $I \times J$ matrix with element $R_{ij'}$. $R_{ij'}$ is the 1985 output from key industrial firms in industry j' in county i, divided by the 1982 population. Let I be a $J \times J$ identity matrix. Define the $I \times J$ input-linkage matrix $INLINK = (I - IN)^{-1} \cdot R$ with element $inlink_{ij}$ capturing the input linkages to industry j in

[50] The NBS input-output tables provide output flows between any pair of 24 2-digit industries. We group them into 19 industries to match the 1985 data. The results are similar when using any input-output table (available for 1987, 1990, 1992, 1995, 1997, 2002).

prefecture i. Similarly, define the $I \times J$ output-linkage matrix $OUTLINK = (I - OUT)^{-1} \cdot R$ with element $outlink_{ij}$ capturing the output linkages to industry j in county i.

Appendix C: Additional Robustness Checks

Effects on Human Capital and Population

Table A uses the same specification as in Table 3 while using human capital and population as outcome variables. The Third Front investment increases local human capital and population.

Propensity Score Matching

Matching provides a non-parametric approach to take into account observable characteristics, and propensity score matching is a dimension-reduction approach to balance the covariates. One disadvantage of the matching approach is that it reduces a continuous treatment to a binary treatment. Table B reports the results for various methods of propensity score matching. In order to save space, only results using the urban population rate in 2000 as the outcome variable are reported here; other results are all qualitatively robust to the findings in the baseline. Methods used across columns vary by how the propensity score is constructed. For the nearest neighbor matching, there is a choice of whether replacement is allowed and how many neighbors are chosen. For the kernel matching, there is a choice of what type of kernel is used. Results are all similar and remain statistically significant throughout.

Covariates Reweighing

Alternative to the matching approach, one can allow more flexibility in functional forms by reweighing each observation such that the moments of the distribution of the covariates are similar for the treated group and the control group. We use the Blinder-Oaxaca reweighing method developed by Kline (2011). We assign counties with positive industrial investment to have weight 1 and find a set of weights for counties that do not receive significant industrial investment such that the weighted moments of distribution of the two groups are similar. We then estimate the baseline equation with the weights but drop the covariates. Table C reports the results. These results are very similar to those in the baseline as reported in Table 3.

Prefecture Level

Table D repeats specifications in Table 3 in a sample of prefectures. Sample prefectures are those in the Third Front Region with an urban population rate less than 10% in 1964. There are 63 prefectures in the sample. Note that these prefectures may include a different set of counties than used in the baseline. We prefer the county-level sample for two reasons. First, most of our data are at the county or individual levels. Second, because prefectures typically consist of counties separated by farmlands with no commuting between them, counties are closer to the notion of local labor markets.

The county-level sample has two main drawbacks relative to the prefecture-level sample. First, county-level measures may fail to capture spillovers across the county border. In fact, prefectures, as political units, transfer revenue across counties within their jurisdictions. Second, the data may be measured with noise and aggregating them into the prefecture level alleviates the measurement error. Both channels imply that our results from the county-level sample might be conservative estimates of the true effects of the Movement. Indeed, our estimate using the prefecture-level sample results in quantitatively larger effects than the county-level estimates. The estimates using prefecture level data also line up quantitatively well with the case study based on Shiyan. (Multiplying the average treatment in Shiyan by the estimated coefficient, we arrive at the same estimates from the synthetic control.)

Cutoff Values and Outliers

The original sample is restricted to counties with an urban population rate less than 10 percent in 1964. That cutoff is arbitrary. However, the results are not sensitive to a large range of the cutoff values. The graph on the left in Figure A shows the coefficients associated with existing manufacturing employment when we choose different cutoff values. First we note that most counties are clustered right below the 10 percent urban populaton rate (red solid line, right axis). The coefficient remains stable and statistically significant (blue lines, left axis), unless we choose a too small a cutoff value to obtain a precise and stable estimate. The graph on the right repeats the same exercise when counties in the top 1% of the treatment are dropped from the sample. The results are not altered.

Exploiting the Geographic Cutoff with the "Second Front"

Finally, we provide an alternative identification strategy by exploiting a geographic cutoff. China's existing industrial clusters before the Third Front Movement were along the East Coast and the Northeast, while during the Third Front Movement, industrial investment concentrated in the Third Front Region. The "Second Front" Region, sandwiched between the two, did not receive much industrial investment throughout the command economy era. We use this cutoff to compare counties on the eastern boundary of the Third Front Region with counties in the "Second Front" Region.

The Beijing-Guangzhou railway line serves as the de factor eastern border of the Third Front Region, which roughly coincides with the 113-degree longitudinal line. Figure B shows the local polynomials of the level of manufacturing employment as of 1985 on both sides of the cutoff longitudinal line. There is a clear increase in the presence of manufacturing when we cross the cutoff longitudinal line from east to west.

We form a new sample that includes counties in the Third Front Region that are within two degrees of longitude from the cutoff line, and counties in the Second Front. We use a binary variable indicating a county is to the west of the cutoff (in the Third Front Region) as an instrument for the size of 1985 manufacturing. Table E checks the initial conditions of counties in the sample before the Third Front Movement. Compared to counties in the Second Front, counties to the west of the cutoff longitudinal line had similar urban population rates, population density, early-stage industrial development in 1936, and access to the railway. Unsurprisingly, their terrain tends to be higher in elevation and more rugged, and they are farther away from the nearest provincial capital. But by 1985, Third Front counties have much higher levels of manufacturing employment. To the extent that these conditions affect subsequent economic development after the market reform, the estimate using the cutoff as an identification strategy will still be biased. We also show two sets of results with and without adjusting for the effects of these geographic conditions.

Formally, we estimate the following model with the Two-Stage Least Squares estimator:

$$\begin{aligned} y_{it} &= \beta ManuEmp_{i,85} + \mathbf{X}_{1i,64} \cdot \rho + \xi_{it} \\ ManuEmp^{IV}_{i,85} &= \mathbf{1}\{longitude \leq 113\}, \end{aligned} \tag{10}$$

where $\mathbf{X}_{1i,64}$ includes 1964 initial conditions except for those geographic conditions. We can also adjust for the effects of the geographic conditions. Specifically, we estimate

$$y_{jt} = \mathbf{X}_{2j,64} \cdot \gamma + v_{jt}$$

using OLS in a sample of counties outside of the Third Front Region. $\mathbf{X}_2$ includes elevation, slope, and distance to the nearest provincial capital. We then extrapolate the effect $\hat{\gamma}$ in the sample counties. The second stage of the estimate thus becomes

$$y_{it} - \mathbf{X}_{2j,64} \cdot \hat{\gamma} = \beta ManuEmp_{i,85} + \mathbf{X}_{1i,64} \cdot \rho + \xi_{it}.$$

Table F shows the results of the 2SLS estimations. Panel A shows the results that are not adjusted for the geographic conditions, and Panel B shows the adjusted results. The first stage F-statistics are at around 9. Both panels yield similar results, except for the effect on the non-state sector employment, population, and TFP, which switch signs. The adjusted effects are, in general, bigger than the unadjusted effects, reflecting the fact that better geographic conditions are favorable to economic development. These counties have much better development records after the market reform than those in the baseline sample, as is evident in the means of the development variables. The effects of initial manufacturing employment are thus also much larger than those in the baseline, reflecting that the investment could yield higher return in an environment with better geographic and economic conditions. Overall, the results in this alternative specification using a different identification strategy and a different sample are qualitatively similar to the baseline results.

Appendix D: Discussion on Welfare

This appendix expands our discussion on poverty trap in Section 7 and relates implications of different types of poverty traps to our findings.[51] The first broad class of poverty trap includes those relying on assumptions about financial constraints that prevent entry into the modern sector (Banerjee and Newman, 1993), and those based on nutrition—if households are too poor to purchase enough food, they cannot be productive at work (Dasgupta and Ray, 1986). The common prediction of these types of poverty trap is that poverty exists in absolute terms—the poor regions are permanently poor and show no signs of growth. This prediction is inconsistent with our findings. As shown in Table 2, the average urbanization rate among the counties in the Third Front Region increased from 5% to 16% between 1982 and 2000. Even the bottom 10% of counties in terms of urbanization rate experienced an average growth of 4% during the same period. Therefore, a poverty trap of this type is unlikely in our context.

The second broad class of models of poverty trap builds on the hypothesis of increasing returns to scale in the industrial sector. These models typically rest on the assumption that through either input-output linkages, technological spillovers, or other types of spillover effects, the social return to the structural transformation might be larger than the private return.

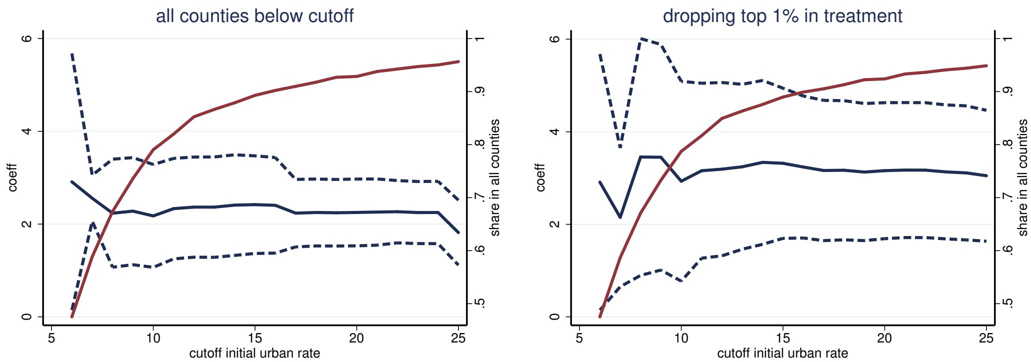
[51] See Kraay and McKenzie (2014) for a review of studies on poverty trap.

A region might be trapped in low income levels due to a lack of coordination in individuals' behaviors, and therefore fail to achieve another Pareto superior equilibrium. Such poverty trap typically predicts some sort of "threshold effect": if a government policy could push the local economy over some threshold, then economic players in the local economy could coordinate to build a better economy.[52] Our evidence, however, suggests that such poverty trap is unlikely to be present, either. As Table 8 shows, our results are concentrated within the same two-digit industry, and there is no evidence that input-output linkages or the overall size of the industrial sector play an important role in the industrialization. Although our data do not allow us to directly test the existence of a threshold in the magnitude of investment only above which the economy is able to escape the poverty trap, results in Table 9 show that the effect is not driven by physical investment in the form of either infrastructure or physical capital of firms. Finally, although the treated counties grew slightly faster than the comparison counties, there was no significant diverging trends in growth. We therefore interpret our results as not in support of a regional poverty trap.

[52] See a review on this by Azariadis and Stachurski (2005). Studies on government interventions that can help the economy coordinate to achieve a better equilibrium include the "Big Push Strategy" (Murphy et al., 1989), and the growth through input-output linkage hypothesis (Hirschman, 1958, Rodriguez-Clare, 1996).

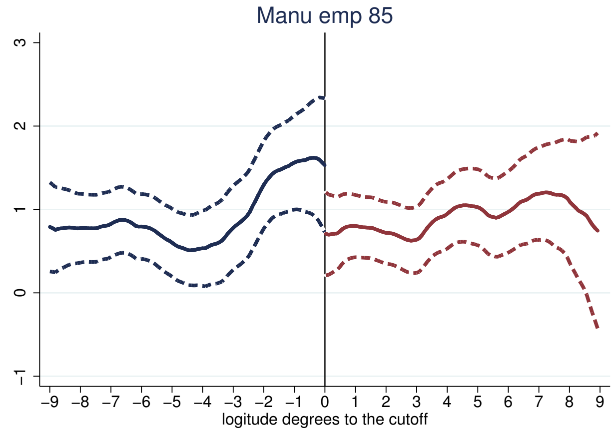
Appendix Figures and Tables

Figure A: Cutoff Values and Outliers



Note: Dependent variable is urban population rate in 2000. Percentiles of initial industrial employment in all 644 counties are as follows: 50^{th} percentile: 0; 75^{th} percentile: 0.22; 90^{th} percentile: 1.34; 95^{th} percentile: 3.77; 99^{th} percentile: 13.49; max: 35.2. The graph on the left includes all counties under the specified urban rate cutoff. The graph on the right drops counties in the top 1% of the treatment.

Figure B: Third Front and Second Front



Note: The figure shows the local polynomials of the probability of having a key manufacturing plant by 1985, on both sides of the East 113 degree longitudinal line.

Table A: Effects on Human Capital and Population

	(1) mid schl +	(2) college rate	(3) log pop den (×100)
Panel A: 1990 levels			
manu emp in 1985	1.130***	0.153***	0.979
	(0.213)	(0.047)	(1.310)
mean dep var	23.969	0.496	486.237
Panel B: 2000 levels			
manu emp in 1985	1.137***	0.272***	1.996
	(0.209)	(0.073)	(1.342)
mean dep var	31.357	1.285	491.704
Panel C: 90-00 change			
manu emp in 1985	0.819***	0.248***	1.187***
	(0.250)	(0.082)	(0.277)
mean dep var	6.506	9.330	0.883
initial conditions	X	X	X
N	509	509	509

Note: See Table 3 for the details of the specification. Outcome for each column is as follows: Column 1: share of adult population with middle school diploma and above. Column 2: share of adult population with college degree. Column 3: log population (×100). Panels A and B show 1990 and 2000 levels, respectively. Panel C shows changes between 1990 and 2000. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B: Third Front Treatment and Urban Population Rate in 2000
Propensity Score Matching

	(1)	(2)	(3)	(4)	(5)	(6)
TF county	5.684***	6.068***	3.946*	4.919***	4.771***	4.598**
	(1.863)	(1.830)	(2.260)	(1.810)	(1.724)	(2.260)
propensity score eqn						
initial conditions	x	x	x	x	x	x
initial conditions sqr		x				
method	nn	nn	nn	3 nn	kernel	llr
replacement	no	no	yes	yes	yes	yes
N	485	485	485	485	485	485

Note: The sample includes counties with urban population rates less than 10% in 1964. Counties with mining industries (with non-zero key mining firms in 1985) are dropped from the sample since they cannot be balanced. Third Front county is the treatment dummy. It equals one if there was positive employment from key industrial plants in non-mining industries in 1985. There are 100 counties in the treatment group and 385 counties in the control group. The outcome variable is urban population rate in 2000. Methodology: (1) variables used to predict the propensity score include counties' initial conditions in 1964, and in some specifications, their quadratic terms; (2) matching methods used include: nn = nearest neighbor, 3nn = 3 nearest neighbors, kernel = Epan kernel, llr = local linear regression; (3) methods also vary by whether selection of control units allows for replacement. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C: County-Level Outcomes (Reweighing)

	(1) urban rate	(2) manu/emp rate	(3) service/emp rate
Panel A: 1990 levels			
manu emp in 1985	1.795***	1.206***	1.032***
	(0.405)	(0.250)	(0.278)
mean dep var	9.354	3.224	8.409
Panel B: 2000 levels			
manu emp in 1985	2.692***	1.230***	0.893***
	(0.684)	(0.311)	(0.253)
mean dep var	16.242	5.196	10.626
Panel C: 90-00 change			
manu emp in 1985	2.129***	0.565*	0.322
	(0.799)	(0.296)	(0.197)
mean dep var	8.086	1.464	2.973
weights	X	X	X
N	63	63	63

Note: Data sources are county tabulations of censuses. Outcome for each column is as follows: Column 1: urban population rate (%). Column 2: share of employment in manufacturing (%). Column 3: share of employment in service sector (%). Panels A and B show 1990 and 2000 levels, respectively. Panels C shows changes between 1990 and 2000. Weights are used. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table D: Prefecture-Level Outcomes

	(1) urban rate	(2) manu/emp rate	(3) service/emp rate
Panel A: 1990 levels			
manu emp in 1985	4.421***	2.720***	2.872***
	(0.776)	(0.387)	(0.535)
mean dep var	11.211	4.206	8.999
Panel B: 2000 levels			
manu emp in 1985	5.360***	2.303***	2.002***
	(0.845)	(0.484)	(0.300)
mean dep var	19.824	6.134	11.466
Panel C: 90-00 change			
manu emp in 1985	1.781	-0.120	-0.500
	(1.111)	(0.469)	(0.429)
mean dep var	10.122	2.404	3.356
initial conditions	X	X	X
N	63	63	63

Note: Data are from county tabulations of population censuses. Controls are the same as in Column 4 of Table 5, except that, for this sample, the prefecture center dummy is not included. Outcome for each column is as follows: Column 1: urban population rate in 2000 (%). Column 2: share of employment in manufacturing in 2000 (%). Column 3: share of employment in service sector in 2000 (%). Panels A and B show 1990 and 2000 levels, respectively. Panel C shows changes between 1990 and 2000. Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table E: Geographic Discontinuity - Initial Conditions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln dis to rail	ln dist to prov cap	elevation	slope	urban rt	log pop den	ind emp in '36	manu emp in '85
west	0.08	0.19***	0.65***	0.34**	0.91	0.05	-1.37	0.89**
	(0.21)	(0.05)	(0.10)	(0.14)	(1.14)	(0.06)	(1.35)	(0.35)
mean dep var	2.48	5.040	4.92	1.47	9.28	5.43	1.74	1.04

Note: 368 counties in the sample. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table F: Geographic Discontinuity - Post-Reform Conditions

	urban rate 00	urban growth 90-00	share of ind emp	share of service emp	log pop den 00	share of mid schl+	share of college	non-state emp	non-state TFP
A: no adjustment	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$ManuEmp_{i,85}$	5.04**	12.60*	1.52*	1.75**	-0.05	8.57***	0.60***	-0.37	-0.01
	(2.08)	(7.04)	(0.89)	(0.84)	(0.04)	(2.79)	(0.23)	(0.38)	(0.08)
B: with adjustment	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$ManuEmp_{i,85}$	6.42***	14.84**	2.58**	1.36	0.36***	8.99***	0.69***	2.00**	0.11
	(2.44)	(7.46)	(1.12)	(0.85)	(0.13)	(2.91)	(0.25)	(0.95)	(0.10)
mean dep var	25.55	15.36	10.23	14.64	6.04	48.84	2.12	2.83	0.06

Note: 368 counties in the sample. A dummy indicating that the county is to the west of the cutoff is used as IV. The first stage F statistics is 9.15. In Panel B, the dependent variables are adjusted for initial conditions. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table G: Data Sources

data source	information
’85 Manufacturing Census	- location, employment, capital and output for key industrial firms
	- county-level industrial employment, capital and output
’04 Economic Census	- firm-level location, employment, capital, output, sector, and ownership
’36 National Industrial Survey	- employment, capital and output for firms in ’36 by county
Population Censuses (county tabulation)	- population (’53,’64,’82,’90,’00,’10)
(’53,’64,’82,’90,’00,’10)	- urban population (’64,’82,’90,’00,’10)
	- employment by sector (’82,’90,’00,’10)
	- educational attainment (’82,’90,’00,’10)
Population Censuses (individual level)	- migration history, income by sector
(’82,’90,’00,’05)	
Baum-Snow et al. (2015)	- roads and railways (’62,’80)
CHGIS maps	- jurisdiction boundaries
	- elevation and slope