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Ting Wang
Louisiana State University

Areendam Chanda
Louisiana State University

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Department of Economics
Louisiana State University
Baton Rouge, LA 70803-6306
http://www.bus.lsu.edu/economics/

Manufacturing Growth and Local Multipliers in China

Ting Wang and Areendam Chanda*

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Abstract

We investigate the impact of manufacturing employment growth on the non-tradable sector for prefecture-level cities in China. Using the 2000 and 2010 Censuses of Population, we apply the shift-share approach to isolate the exogenous change of employment growth in manufacturing. We find that adding ten manufacturing jobs creates 3.4 additional jobs in the non-tradable sector. We also show that the effect is heterogeneous along a number of dimensions. More specifically, new jobs in high-technology manufacturing is responsible for the entire effect with low-tech manufacturing showing no significant effect. Among the non-tradable industries, the effect is largest for wholesale, retail, and catering with no effects on utilities and construction. We find that the effect is also geographically heterogeneous, with the multiplier being greater for inland provinces.

JEL Classification: O14; O18; R11; N95

Keywords: Structural transformation; Local labor markets; Regional spillovers; China

*Wang: Citizens Bank, Boston, MA. Email address: ting.wang@citizensbank.com. Chanda (Corresponding Author): Department of Economics, Louisiana State University, Baton Rouge, LA 70803, USA. Email address: achanda@lsu.edu. We thank Ozkan Eren, Fang Yang, Bulent Unel, Seunghwa Rho, Naci Mocan, Dachao Ruan, Han Yu, Kui-Wai Li, Hao Guo, Phanindra Goyari, Scott Rozelle, Binzhen Wu, Di Mo, participants at the 2015 SEA Conference in New Orleans, and seminar participants at REAP-FSI (Stanford) and LSU for their comments. We are responsible for all errors.

1 Introduction

Economic growth in China has been accompanied by remarkable structural transformation since 1978. Figure 1 documents the labor reallocation from the agricultural sector to non-agricultural sectors from 1978 to 2010. During this period, the share of employment in agriculture declined from 70.5% to 36.7%. The share of employment in the tertiary sector (services) has increased steadily, but that in the secondary sector (manufacturing, mining, utility, and construction) only grew rapidly after 2000. The growth of employment in the secondary sector was primarily due to the extraordinary growth in manufacturing, which is also reflected in China's rise to dominance in world manufacturing. As shown in Figure 2, in 1991, China's share of value-added in global manufacturing was only 2.7%. It started to rise in the early 1990s but has increased radically since 2000 aided by China's accession to the WTO in 2002. By 2013, China's share of world manufacturing output reached 24.5%. Between 2000 and 2010, the number of manufacturing firms increased from 146,399 to 424,542 while total manufacturing employment increased from 44 million to 84 million.[1]

In this paper, we use the 2000 and 2010 Censuses of Population to examine how many jobs in the non-tradable sector (utility, construction, and services) are created when one job is created in manufacturing for prefecture-level cities in China. Quantifying the multiplier effects of manufacturing on employment growth in other sectors has been an enduring research question in the context of local and regional economic growth (Bivens, 2003; Moretti, 2010; Park and Chan, 1989; Valadkhani, 2005). In addition to the direct absorption of labor, the manufacturing sector can create jobs in other sectors through different channels. First, services like finance, transportation, and information technology contribute to the production process as intermediate inputs in the manufacturing sector. These productive linkages lead to new jobs created in other sectors when manufacturing grows. Second, increased labor demand in manufacturing raises wages as long as labor supply is not perfectly elastic. Higher wages lead to increased spending on local services like haircuts, restaurants, health care, etc. The income-induced demand for local services also begets new jobs in the service sector. The impressive growth of manufacturing in China makes it a natural setting to examine this question.

We find that for every ten jobs created in manufacturing, 3.4 additional jobs were created in the non-tradable sector. Moreover, about 12.6% of employment growth in the non-tradable sector can be attributed to employment growth in manufacturing. We estimate the multiplier

[1]These are based on data from China Industrial Economy Statistical Yearbooks (2001 and 2011). It covers state-owned and non-state owned firms with annual sales above 5 million RMB.

of manufacturing employment growth by using a reduced form popularized by Moretti (2010). He investigates the impact of employment in the tradable sector on the non-tradable sector in the U.S. during 1980-2000.[2] To deal with endogeneity, Moretti constructs an instrumental variable based on the shift-share approach (McGuire and Bartik, 1992) to isolate sources of exogenous variation in manufacturing employment growth. The instrumental variable is the manufacturing employment growth that would have occurred had employment grown at the national growth rate. It captures the manufacturing employment growth caused only by national shocks, purging local endogenous factors that affect employment. This approach has been applied to estimate the employment multiplier effects in England, Italy, Sweden, and OECD countries (Faggio and Overman, 2014; de Blasio and Menon, 2011; Moretti and Thulin, 2013; van Dijk, 2014). As far as we are aware no parallel study exists for China. Compared to other regions of the world, China is more well suited for this approach given the extent of centralization of industrial policy making.

The shift-share approach, exploits local variation in initial shares of the independent variable of interest (manufacturing employment shares, in our case) combined with national growth rates. While the approach arguably gets rid of local factors affecting manufacturing employment growth, one might still be concerned that this is correlated with other initial conditions that might be conducive to employment growth in non-tradable industries. Such potential variables may include local educational attainment rates, demographic patterns, proximity to a major city, etc. Furthermore, an initially large manufacturing share of employment may also mean a relatively low service sector employment share. In such a scenario, finding a large effect on service sector employment growth might simply reflect sectoral convergence across regions rather than any true multiplier effect. We extend our analysis to control for a wide range of such potentially confounding effects. While they have varying degrees of importance, our main result continues to hold. We also show that the extent of state ownership in manufacturing does not drive our results.

In the later part of the paper we investigate the heterogeneous effects of the multiplier along different dimensions. First, by separating industries into high- and low-technology manufacturing, we find that employment growth in the former creates service sector jobs while employment growth in low-technology industries do not significantly generate additional jobs. Second, we introduce heterogeneity, in the dependent variable by examining the multiplier for each non-tradable industry. The non-tradable sector includes utilities,

[2]Moretti (2010) defines manufacturing as the tradable sector. In this paper, we will use manufacturing and tradable sector interchangeably.

construction and a range of service industries. While labeled as non-tradables, there is obviously some degree of trade in these industries across regions. Reassuringly, we find that the multiplier effect is the largest for wholesale, retail and catering - one of the more "non"-tradable sectors. Third, we study the multiplier effect across regions. During the earlier reform period (pre-2000), the central government designed preferential policies to develop industrial clusters at coastal cities, mainly relying on location advantages (Zheng et al., 2014). However, industrial agglomeration in coastal cities began to decline since the mid-2000s. The decline has been attributed to rising land and labor costs (Li et al., 2012) in these cities, and favorable investment policies provided by the governments of inland provinces. (Zheng et al., 2014). Indeed, our result suggests a smaller multiplier effect in coastal provinces.

Our choices of data and research period are dictated largely by consideration of data quality. Population censuses provide a more comprehensive information on employment in China.[3] We focus on the period from 2000 to 2010 because the population census began using the same standard to aggregate data since 2000. The aggregate employment data at the city level in 1990 Census of Population included all workers who stayed in the city for more than one year at the time of the census. In 2000 and 2010 Censuses of Population, employment data were collected from 10% of households, and the aggregate employment data at city level included workers who stayed in the city for more than six months at the time of the census. Employment data from Population Census 1990 are not comparable to that from 2000 and 2010 Censuses of Population. Last but not the least, as Figure 1 indicates, it was only after 2000 that China experienced a clear jump in its manufacturing employment share making this period more relevant.

The remainder of the paper is structured as follows. In Section 2 we provide a brief description of the dataset. Section 3 describes the empirical strategy. In Section 4, we report our main results. Section 5 concludes.

2 Data

In this section, we briefly provide some background regarding the definitions and construction of administrative regions and industrial classification system.

[3] Using employment data from other sources like City Statistical Yearbooks underestimates the size of employment by omitting many self-employed workers (Li and Gibson, 2015).

2.1 Administrative Regions

China's administrative divisions comprise of five levels. At the broadest level, the country is divided into 27 provinces and four province-level municipalities.[4] Second is the prefecture level. It includes prefecture-level cities (dijishi), prefectures (diqu), leagues (meng) and autonomous prefectures (zizhizhou).[5] Third is the county level, including districts (qu), county-level cities (xianjishi), and counties (xian). Fourth is the township (zhen) level. Fifth is the village (cun) level. We illustrate the administrative structures at the provincial level in Figure 3. Figure 4 provides the administrative divisions at the prefecture level.

The unit of analysis in this paper is a prefecture-level city. A prefecture-level city consists of districts (qu), counties (xian), and county-level cities (xianjishi). The districts within a prefecture-level city form an urban core area (shixiaqu), which is usually more industrialized than the rest, and is the nearest Chinese analog to a standard city like a U.S. metropolitan area (Alder et al., 2015; Baum-Snow et al., 2015). The government of a prefecture-level city is responsible for the economic development within its administrative region, leading the administrative affairs of the urban core area, and governance of counties and county-level cities. We focus on prefecture-level cities for two main reasons. First, manufacturing activities could take place either in the urban core area or outside the urban core area. The urban core area benefits firms through its better infrastructure and market access, the agglomeration advantages from technological externalities (Duranton, 2007) and labor market pooling (Breinlich et al., 2014). The remaining areas, instead, benefit firms via lower labor and land costs. Baum-Snow et al. (2013) find that radial railroads have decentralized industrial activities in China. Investigating the whole prefecture-level city, therefore, provides an average multiplier at the local level. Second, both one- and two-digit employment data are available for prefecture-level cities, which allows us to examine narrower industries.

Due to administrative reforms between 2000 and 2010, the prefecture-level cities reported in the censuses of 2000 and 2010 are not identical. In Appendix A.1 we discuss details about the adjustments made to construct comparable prefecture-level cities. The final sample includes 277 prefecture-level cities, covering 91.6% of total population at the prefecture level.

It is important to reiterate that the unit of analysis in this paper is based on administra-

[4] A provincial-level municipality is a "city" with "provincial" power. The four province-level municipalities are Beijing, Tianjin, Shanghai and Chongqing.

[5] A prefecture-level city is administered by a province. Prefectures used to be the most common division at the prefecture level, but have gradually converted to prefecture-level cities since 1983. Leagues and autonomous prefectures have more ethnic minorities.

tive divisions. China's National Bureau of Statistics defines urban areas in the 2010 census as areas located in or contiguous to the area where the local government is located (Chen and Song, 2014). Although the definition is a bit different from that used in the 2000 census, the difference is negligible (Chen and Song, 2014). As a result, a prefecture-level city may include both urban (chengzhen) and rural (xiangcun) areas. For simplicity, we will refer to the prefecture-level city as a city.

2.2 Data on Employment

Following Moretti (2010), the tradable sector is defined as manufacturing while the non-tradable sector includes utilities, construction, and services. The aggregate employment in both tradable and non-tradable sectors are comparable across two censuses. However, employment in sub-industries in the two censuses ares not perfectly comparable due to the different industry classification systems. Take transportation as an example. Employment in transportation reported in the 2010 Census included workers in public transportation like taxies and public buses. However, employment of public transportation was included in social services in the 2000 Census. In order to compare employment changes for sub-industries, adjustments are needed to construct comparable industries. We discuss the details in appendix A.2 and the Table A.1 lists the comparable industries from the two years. Further, we construct comparable 1-digit industries in the non-tradable sector. appendix Table A.2 illustrates the classification in the non-tradable sector.

3 Empirical Strategy

Our primary focus is to investigate the causal relationship of employment growth in the tradable sector on the non-tradable sector. Following Faggio and Overman (2014), total employment growth in a city c between year $t-\tau$ and t can be written as

$$\frac{E_{c,t}-E_{c,t-\tau}}{E_{c,t-\tau}}=\frac{E^{NT}_{c,t}-E^{NT}_{c,t-\tau}}{E_{c,t-\tau}}+\frac{E^{T}_{c,t}-E^{T}_{c,t-\tau}}{E_{c,t-\tau}}+\frac{E^{o}_{c,t}-E^{o}_{c,t-\tau}}{E_{c,t-\tau}}. \tag{1}$$

$E_{c,t}$ is the total employment in city c at time t. It includes employment in the non-tradable sector (utilities, construction, and services) $E^{NT}_{c,t}$, employment in the tradable sector (manufacturing) $E^{T}_{c,t}$, and employment in other sectors (agriculture, mining, and governments jobs) $E^{o}_{c,t}$. $(E^{NT}_{c,t}-E^{NT}_{c,t-\tau})/(E_{c,t-\tau})$ is the contribution of non-tradable sector to total employment

growth. $(E^T_{c,t} - E^T_{c,t-\tau})/(E_{c,t-\tau})$ is the contribution of tradable sector to total employment growth. To investigate to what extent the change of employment in the tradable sector affects that in the non-tradable sector, we regress the contribution of non-tradable sectors employment on contribution of tradable sector employment using the following specification:

$$\frac{E^{NT}_{c,t} - E^{NT}_{c,t-\tau}}{E_{c,t-\tau}} = \alpha + \beta \frac{E^T_{c,t} - E^T_{c,t-\tau}}{E_{c,t-\tau}} + \gamma X_{t-\tau} + e_{c,t}. \tag{2}$$

The specification is a modification of the direct difference method used in Moretti and Thulin (2013), where the dependent and independent variables are the change of employment in the non-tradable and tradable sectors respectively. In our specification above, we follow Faggio and Overman (2014) by normalizing the change by the total initial employment level. This facilitates the interpretation of estimated coefficients for other control variables.

In Equation 2, the dependent variable $(E^{NT}_{c,t} - E^{NT}_{c,t-\tau})/(E_{c,t-\tau})$ is employment growth contributed by the non-tradable sector, and the independent variable $(E^T_{c,t} - E^T_{c,t-\tau})/(E_{c,t-\tau})$ is employment growth contributed by the tradable sector. $X_{t-\tau}$ includes a set of city characteristics that can potentially affect employment growth in the non-tradable sector. $e_{c,t}$ is the error term. The coefficient β is the multiplier, capturing the effect of tradable sector employment growth on non-tradable sector employment growth. In other words, β is the employment change in the non-tradable sector when there is one more additional worker in the tradable sector. If $\beta > 0$, a new job created in the tradable sector will generate β jobs in the non-tradable sector, indicating a multiplier effect of employment growth in the tradable sector on the non-tradable sector. If $\beta < 0$, one more worker in the tradable sector will reduce $-\beta$ jobs in the non-tradable sector, indicating a crowding effect of employment growth in the tradable sector on the non-tradable sector.

In Figure 5, we present a a scatter plot of employment growth in the tradable vs non-tradable sectors. As one can clearly see there is a positive correlation. However, estimating equation (2) using ordinary least squares will bias the estimate of β if there are unobserved factors that can affect employment growth in both tradable and non-tradable sectors. On one hand, a city may create new employment in both manufacturing and non-tradables due to its location advantages or better investment opportunities. If so, the OLS estimate of β will be biased upwards. On the other hand, a city may attempt to expand its manufacturing sector in response to an overall decline in employment. This will bias the estimate of β downward.

In order to infer the causal relationship between manufacturing employment growth and non-tradable sector employment growth, we construct an instrumental variable based on the shift-share approach (McGuire and Bartik, 1992), which is widely used in regional economics literature for causal inference.[6] The idea is to isolate variation in manufacturing employment that only come from national shocks, so endogenous local factors that drive variations in employment will be purged. More specifically, we use the national employment growth rate in manufacturing and the initial share of manufacturing employment in the city to capture the exogenous employment growth contributed by the manufacturing sector. The instrument is calculated as:

$$\frac{E^T_{c,t-\tau}}{E_{c,t-\tau}} \times \frac{E^T_{-c,t} - E^T_{-c,t-\tau}}{E^T_{-c,t-\tau}}, \tag{3}$$

where $(E^T_{-c,t} - E^T_{-c,t-\tau})/(E_{-c,t-\tau})$ is the national growth rate of manufacturing employment *excluding* city c. Although the national employment growth rate constructed for each city is different, the main source of variance in the instruments is the initial share of manufacturing employment (Baum-Snow and Ferreira, 2014).

The validity of the instrument is subject to critique that the initial share may correlate with other factors which in turn affect the non-tradable sector employment. To alleviate this concern, we use a rich set of control variables capturing the starting period demographic and labor composition that may affect employment at the city level. We control for the share of urban hukou population in 2000. Hukou is the household registration system in China that classifies people to agricultural (rural) and non-agricultural (urban) hukou.[7] It has been increasingly documented in the literature as a source of labor mobility restriction, undersized cities, and unexploited gains from agglomeration (Au and Henderson, 2006; Bosker et al., 2012). The share of urban population increased from 18% to 50% from 1978 to 2010, while the share of urban hukou population increased from 16% to 34%. Controlling for the urban hukou population share captures the original residence of the city's labor force. The second control variable is share of the population with college education above age 6 in 2000. It captures human capital at the starting period, a common control variable in the urban and

[6] The shift-share approach is also used in the labor economics literature to approximate peer effects.

[7] Hukou was used to restrict rural-urban migration before 1978. Nowadays a person is free to move, but the type of hukou determines the level of welfare to which is he entitled, including education, health care, and pension (Song, 2014). In addition, rural hukou can only be converted to urban hukou after meeting requirements imposed by local governments such as holding a college degree, purchasing a local house, etc. (Chan and Buckingham, 2008).

regional growth literature (Glaeser et al., 2015)

We further include a region dummy variable indicating whether the city lies in coastal provinces. Policies to develop industrial clusters targeted coastal areas at the beginning of the reform period. As a result, the initial share of manufacturing employment is likely to be related to the region where the city is located. A city is assigned a region dummy taking a value of 1 if it is in the coastal provinces of Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, and Guangdong. We also use a dummy variable identifying whether a city is the capital city of the province. Capital cities are usually more developed compared to others, which may affect employment growth differently (Chanda and Ruan, 2017). To account for the concern that employment growth may be correlated to city size, we control for the log value of initial employment. In addition, the initial unemployment rate is also used to capture labor surplus.[8]

Initial sectoral composition may affect subsequent employment growth. A city with an initially higher share of non-tradable employment may experience slower growth in that sector. A city with a larger government employment may demand more non-tradable goods, inducing the growth of non-tradable employment. We add both the share of non-tradable employment and share of government employment to control the potential effect of the initial sectoral composition.

We perform robustness checks via several strategies. First, to consider spatial effects we use three additional controls - (i) a dummy taking a value of 1 if the city has a border with one of the province-level municipalities (ii) log of average nighttime light density from 1995 to 1999 in neighboring cities, and (iii) proximity to the nearest port city to capture the effects of neighboring regions and access to world markets.[9] Second, we add geographical controls including temperature, rainfall, and altitude to see if our results hold.[10] Third, we conduct a falsification test to show the result is not driven by some long-run common factors. Fourth, to address the concern that the result may be driven by employment growth in state owned enterprises, we exclude tobacco, and petroleum processing and coking from the manufacturing sector and reestimate our model. The output share of SOEs in these two industries were at 99& and 70% respectively. All other manufacturing industries had shares

[8] Feng et al. (2015) document that official statistics understate Chinese unemployment rate. It is less of a concern in this paper. Official unemployment rates only account for unemployed people with local hukou, but unemployment rates calculated from population census covers all people with and without local hukou.

[9] Two cities are neighbors if they share a common border. Night lights data are from the National Geophysical Data Center. The distance to the nearest port city is the great circular distance calculated by geodist in Stata.

[10] Geographic data such as rainfall, temperature, and altitude are from Global Climate Data.

lower than 50%. [11]

In the second part of the paper, we examine heterogeneous effects along a number of dimensions. First, we examine the multiplier effect of high- and low-technology manufacturing industries. The details regarding the classification are introduced in Section 4. Following Moretti (2010), we estimate a model,

$$\frac{E_{c,t}^{NT} - E_{c,t-\tau}^{NT}}{E_{c,t-\tau}} = \alpha + \beta_1 \frac{E_{c,t}^{TH} - E_{c,t-\tau}^{TH}}{E_{c,t-\tau}} + \beta_2 \frac{E_{c,t}^{TL} - E_{c,t-\tau}^{TL}}{E_{c,t-\tau}} + \gamma X_{t-\tau} + e_{c,t}, \tag{4}$$

where $E_{c,t}^{TH}$ and $E_{c,t}^{TL}$ are the employment in the high- and low-technology manufacturing industries respectively. We use instruments constructed specific to each group to estimate consistent β_1 and β_2. Second, we investigate the multiplier effect for each non-tradable industry. Third, we investigate whether the multiplier effect varies with region. We interact the tradable sector employment growth contribution with indicators of whether the city lies in a coastal province.

3.1 Baseline Results

In Table 1 we present the descriptive statistics for 277 prefecture-level cities. From 2000 to 2010, the contribution of manufacturing and non-tradable sector to total employment growth were 4.98% and 13.15% respectively.[12] The mean of share of urban hukou population was 26.67% and its standard deviation was 14.99%. The share of population with a college education had a mean of 3.56% and a standard deviation of 2.49%. The unemployment rate had a mean of 4.02% and standard deviation of 2.9%. 20.5% of people worked in non-tradable sector. Government employment made up 2.53% of total employment.[13] Of the 277 cities, 35% are located in coastal provinces, 9% are capital cities, and 6.13% have a border with one of the four provincial municipalities. We calculate the proximity to the nearest port city as the reciprocal of one plus distance in thousands of kilometers.[14] A value of 1 indicates the city is one of the biggest port cities. Luminosity in neighboring cities had a mean of 0.52 and its standard deviation was 1.44.

In Table 2, we present ordinary least squares estimates regressing the contribution of

[11] Unfortunately, we do not have government employees by industry.

[12] From 2000 to 2010, total employment grew by 6.58%. During this period, agricultural employment declined, with a negative contribution (-11.9%) to employment growth.

[13] 11.86% of people worked in manufacturing in 2001.

[14] The port cities used are the 10 biggest port cities in China, including Shanghai, Shenzhen, Qingdao, Zhoushan, Xiamen, Yingkou, Guangzhou, Ningbo, Dalian, and Lianyungang.

non-tradable sector employment on the contribution of manufacturing employment. In column (1), we control for initial demographic characteristics (urban hukou population and share of population with college education), region dummy, capital city dummy, log value of initial employment, and unemployment rate. The point estimate implies that each additional job in manufacturing creates 0.499 additional jobs in the non-tradable sector. The coefficient of urban hukou population share is significantly negative, suggesting cities with a greater share of urban hukou population experienced smaller increase in non-tradable sector employment. This might seem counter-intuitive at first. However, if a city has greater urban hukou population share, by definition it will have a smaller share of rural labor and fewer rural migrants. In other words, less labor is available for relatively low-end non tradable industries.[15] Some indirect evidence in support of this comes from Combes et al. (2015) who find that rural migrants complement rather than crowd out local urban hukou workers, mainly working in labor-intensive industries. Rural migrants usually take jobs urban hukou workers don't want to take (Meng, 2012; Zhao, 2000).

The estimate for share of population with college education is significantly positive, suggesting cities with higher human capital stock were associated with higher contribution of the non-tradable sector to total employment growth. Although a city with a greater share of urban hukou population has a higher proportion of college educated people, the two variables measure different characteristics. The former captures the original residence of the local population, while the latter captures human capital. Given the low level of college attainment rates, most people with an urban hukou did not have a college education. Finally, the coefficient of the region dummy is significantly negative, implying cities in coastal areas are associated with smaller contribution of the non-tradable sector to total employment growth.

In column (2), we add initial share of non-tradable employment as an additional control to ensure that our main result is not picking up a structural convergence effect. The multiplier estimate decreases only slightly. The estimate of initial non-tradable employment share is significantly positive, suggesting that cities with more people working in the non-tradable sector experience greater contribution of the non-tradable sector to total employment growth. In column (3), we consider the effect of initial government employment on employment growth in the non-tradable sector. The coefficient is significantly positive, indicating cities with a greater share of government employment experience greater contribution of the non-tradable sector to total employment growth. One explanation is that workers in government

[15] Rural migrants are defined as people who stay in urban areas while holding a rural hukou.

are usually more educated and earn more than non-government workers, so more government jobs will lead to increased demand in local non-tradable goods and services. Going forward, we will use column (3) as our baseline model.

3.2 Instrumental Variable Estimation

Table 3 presents the IV estimates for the same three specifications as Table 2. The instrumental variable is constructed based on Equation 3. The first stage estimates are reported in Appendix Table B.1. The coefficient of the instrument is positive and significant at 1 percentage level in each specification, suggesting local manufacturing employment growth closely correlates to national manufacturing employment growth. The Kleibergen-Paap rk Wald F statistic from weak identification test is reported in the last row, showing the instrument is strong in every specification. Column (3) in Table 3 is the baseline result. The coefficient of manufacturing employment contribution is 0.339, suggesting that for every ten jobs created in manufacturing, about 3.4 additional jobs are generated in the non-tradable sector. In addition, the result indicates that about 12.6% of employment growth in the non-tradable sector can be attributed to employment growth in manufacturing.[16] For the average multiplier estimated in this section, the IV estimate is about 1.3 jobs lower. Thus, while different it is not dramatically different from that of the OLS specification. However, when investigating the heterogeneous effects in the next section, we will show that there are significant differences between OLS and IV estimates.

Based on the estimated coefficients in the baseline model, a 1 percentage point increase in urban hukou population share decreases the non-tradable employment contribution by 0.3 percentage points, and a 1 percentage point increase in share of population with college education increases the non-tradable employment contribution by 1.8 percentage points. Employment growth contributed by the non-tradable sector in coastal cities is on average 2 percentage points lower than that in non-coastal cities. When the initial share of government employment increases 1 percentage point, the employment growth contribution by the tradable sector increases 0.85 percentage points.

[16] 12.6% is calculated by 4.89*0.339/13.15, where 4.89 is the mean of manufacturing contribution to total employment growth, and 13.15 is the mean of non-tradable sector contribution to total employment growth.

3.3 Robustness Tests

3.3.1 Spatial and Geographical Characteristics

Employment growth in a city may not only be affected by characteristics like demographic composition, city size, and labor market conditions, but also influenced by other factors like development in its neighboring areas, access to world markets, and physical geographical advantages. We investigate these factors in Table 4. We first use controls including a dummy variable identifying whether a city has a border with one of the four provincial municipalities - Beijing, Shanghai, Chongqing and Tianjin, log level of night light density in neighboring cities, and inverse distance to the nearest port city. The first two variables intend to control for the effect of neighboring regions, while the last variable captures access to world markets. We further control for geographic variables including rainfall, temperature and altitude. The total number of observations drop to 276 since the city of Zhoushan does not have neighboring cities and hence no nighttime light data.

Columns (1) and (2) in Table 4 are OLS estimates, and corresponding IV estimates are in columns (3) and (4). Appendix Table B.2 shows the first stage estimates. The estimated coefficients of the instrument variable are significant at 1 percent. The F statistics from the weak identification test indicate the instrument remains strong after controlling for additional variables. In column (1) of Appendix Table B.2, being located near a port city increases employment growth in manufacturing. However, the effect disappears when further controlling for geographical characteristics. The estimated coefficient of altitude is negative and significant at 1 percent level, showing that cities with lower altitudes experience greater contribution by manufacturing to employment growth. Sharing a border with one of the four provincial municipalities does not affect manufacturing employment growth.

In columns (3) and (4) of Table 4, our estimates suggest that one additional job in manufacturing increases non-tradable employment by between 0.38 to 0.39. The coefficients of urban hukou population share, share of population with college education share, region dummy, and government share dummy remain significant and have the same signs as the baseline model. One exception is the unemployment rate, which becomes significant at the 10 percent level after controlling for geographical characteristics, suggesting that cities with a higher unemployment rate have greater employment growth in the non-tradable sector. Adjacency to one of the four provincial municipalities increases contribution by the non-tradable sector to employment growth - the estimate is significant at 10 percent. The estimates of development in neighboring cities, proximity to the nearest port city, and

other geographical characteristics, are insignificant.

One may be concerned that each province may have province-specific features that affect the cities within its jurisdiction, which may affect employment in both tradable and non-tradable sectors. In Appendix Table B.3, we address this concern by controlling for province fixed effects (instead of the coastal region dummy). Columns (1) to (3) are fixed effects estimates, and columns (4) to (5) are corresponding IV estimates. The observations in IV regressions drop by 1 because Xining city, the only prefecture-level city in Qinghai province, is dropped. The F-statistics in the first stage suggest the instrument is strong. The multiplier effect is 0.36 and significant at 5 percent.

The evidence above suggests that our results are robust after considering potential effects from neighboring areas, access to the world market, physical geographical characteristics, and province fixed effects.

3.3.2 Falsification Test

During the period that we study, both tradable and non-tradable sectors experienced a secular rise. Despite including a large set of control variables, one concern for the analysis is that some other unknown long-run common causal factors, such as trade or population growth, may drive the increase in employment in both sectors. To verify that our result captures the causal effect of manufacturing employment growth on employment in the non-tradable sector, we conduct a falsification test by regressing past employment growth in the non-tradable sector on future employment growth in manufacturing. We report our results in Table 5. The variable of interest is contribution of manufacturing to employment growth from 2010 to 2013.[17] Column (1) reports OLS estimates for the baseline model. The coefficient of future manufacturing employment growth contribution is insignificant. The IV estimates of the baseline model are presented in column (4) of Table 5. However, the instrument is weak; the F statistics from first stage is 3.5. Although the IV estimates are not informative, the OLS estimates suggest little correlation between future manufacturing employment growth and past employment growth in the non-tradable sector. This finding can alleviate the concern that some long-run factors driving employment in both sectors might overestimate the multiplier effect.[18]

[17] Employment data are from China City Statistical Yearbook 2011 and 2014.

[18] We also conducted a falsification test using the contribution of other sectors to total employment growth as dependent variable and find that there is no multiplier effect.

3.3.3 Role of State Owned Enterprises (SOEs)

The growth of the Chinese economy has been accompanied by a dramatic transformation of SOEs. In the late 1990s, a policy named "Grasp the Large, Let go of the Small" was adopted for reforms in SOEs. Small SOEs were closed or privatized, large SOEs in strategic sectors (such as infrastructure construction, oil, and utilities) were merged and formed large conglomerates controlled either by central or local governments (Li et al., 2015; Hsieh and Song, 2015). The large SOEs earn more profits because of their monopoly power and remain dominant in the market. In 2010, output share of SOEs in both tobacco and petroleum processing and coking exceeded 50%. One may be concerned that the multiplier effect might be driven by employment growth in SOEs since their employees earn higher wages than non-SOE employees, creating higher demand for non-tradable goods and services.

We investigate this concern in Table 6. We reconstruct the manufacturing sector by excluding tobacco and petroleum processing and coking. The OLS and IV estimates for the baseline model are in columns (1) and (4) respectively. The F statistics in the first stage demonstrate the strength of the instrument. The multiplier effect is 0.346, with standard deviation 0.137. Other controls like share of urban hukou population, college population share, region dummy, and government employment share also have an effect similar to the baseline model in Table 3. When we add further controls for effects of neighboring areas, access to world markets, and geographical characteristics, the results remain robust.

4 Heterogeneous Effects

In this section, we study several heterogeneous effects of the multiplier. We first investigate the multiplier effect of high and low-technology manufacturing employment growth. We then look at the multiplier effect on different industries in the non-tradable sector. Lastly, we analyze whether the multiplier effect is different across regions.

4.1 Multipliers by High- and Low-Technology Manufacturing Employment Growth

Moretti (2010) and Moretti and Thulin (2013) find the multiplier effect is heterogeneous in terms of types of new jobs created in manufacturing. New jobs in high-technology manufacturing generate more jobs in the non-tradable sector than do low-technology jobs. We estimate equation 4 to allow the effect of adding a job in high-technology manufac-

turing industries to be different from adding a job in low-technology ones. Based on High-Technology Industry (Manufacturing Industry) Classifications (2013) of the China Statistical Yearbook, we define high-technology manufacturing industries as manufacturing of medicines; machinery industry; transport equipment; manufacture of communication equipment, computers and other; manufacture of measuring instruments and machinery for cultural activity and office work.[19] Since it is not clear exactly how the government defines high-tech and low-tech manufacturing, in Appendix Table B.8, we list the percentage of employment with high school education and above for 2-digit manufacturing industries.[20]. The first thing that one can observe from the table is that some of the industries which the government defines as low tech: petroleum related industries, tobacco, and manufacture of chemicals - have some of the highest education attainment rates. However, as we noted in section 3.3.3, the first two were dominated by state owned enterprises even in 2010. Since state owned enterprises might offer better compensation packages, they are likely to attract more educated workers. At the other end of the spectrum we see more consistency. Industries that are plausibly low tech based on educational attainment are also low skilled as per the government definition.

We present our results in Table 7. Columns (1) to (3) are OLS estimates, showing that adding a job in high-technology manufacturing generates more jobs in the non-tradable sector. The specification in equation 4 has two endogenous variables: employment growth contributed by high- and low- technology manufacturing respectively. We construct group-specific instruments to infer causal analysis, and report results in columns (4) to (6). To save space, we only report the first stage in appendix Table B.4 for IV regressions in columns (4) and (6) of Table 7. In columns (1) and (2) of appendix Table B.4, the two endogenous variables are regressed on two group-specific instruments and other baseline controls respectively. Employment growth in high-technology manufacturing is positively correlated to the high-technology group instrument, while the low-technology group instrument is insignificant. Employment growth in low-technology manufacturing is negatively correlated to the high-technology group instrument, and is positively correlated to the low-technology group instrument. The results indicate that high-technology manufacturing employment may crowd out low-technology manufacturing employment. The first stage F-statistics are

[19] High-Technology Industry (Manufacturing Industry) Classification (2013) is available in 2013 China Statistics Yearbook on High-Technology Industry. It provides 4-digit high-technology industries. Due to data limitations, we define high-technology industries based on 2-digit industries.

[20] We mainly use high school education level to define high- and low-technology manufacturing, but using college education, as one can see, gives similar classifications.

reported in last row, indicating the instruments are strong. Columns (3) and (4) give similar results when adding more controls. The estimated coefficients from IV regressions in column (4) of Table 7 suggests that adding a job in high-technology manufacturing increases 0.53 jobs in the non-tradable sector, but each new job created in low-technology manufacturing does not have significant multiplier effects. The results hold when using additional controls in columns (5) and (6).

Next, we use different cutoffs for which industries are classified as high tech and which ones we define for low tech. We first define manufacturing industries as high-technology if the share of workers with high school education exceeded 45% in 2010. We further use 40% and 35% as cutoff. [21] We present the results for baseline model in Table 8. Columns (1) to (3) are the OLS estimates when using 45%, 40%, and 35% as cutoff respectively. Columns (4) to (6) display the IV estimates. In column (4), the magnitude of multiplier for high-technology manufacturing industries is higher than that for low-technology manufacturing industries, but both multiplier effects are insignificant. This may because the first stage is not strong. The F statistics from the weak identification test is 6.6, and weak instruments increase standard errors of estimates. Another potential explanation is that the 45% cutoff may be too strong to define the high tech manufacturing industries. Columns (5) and (6) present IV estimates for 40% and 35% cutoff respectively. Both show a significant multiplier effect for high-technology manufacturing, but not so for low-technology manufacturing. Under the 40% cutoff, one new job created in high-technology manufacturing creates 0.575 additional jobs in the non-tradable sector.

Since we have used high school attainment as our cut off, it is important to check whether these effects actually reflect heterogeneity because of the nature of the industry or simply, the initial human capital of the local area. While all our regressions control for college attainment rates, one might plausibly argue, that for a developing country like China, it is the initial high school completion rates that are more important. In Appendix Tables B.5 and B.6, we add the initial share of high school population in the city as an additional control. However, controlling for the initial share of high school population does not significantly affect the results. If anything, it slightly increases the effect of the contribution of high-tech manufacturing. Further, it also raises the effect of initial college attainment rates.

[21] When using 50% as the cutoff, high-technology manufacturing include tobacco; petroleum processing and coking; manufacture of medicines. Not surprisingly, the instruments are weak in first stage, and the F statistics of it is 1.06. If we choose 30% as a cutoff, rubber products will instead be classified as high-technology. It does not alter our results. Since the average percentage of workers with high school education and above in manufacturing is 30%, we do not use cutoffs below 30%.

We should conclude this section by noting that the estimated coefficient for high-technology manufacturing in China (about 0.62), however, is below the multipliers estimated in the US (2.5) and Sweden (1.1). One possible explanation is that workers in the high-technology manufacturing industries in China have an average lower level of education compared to workers in the US or Sweden and thus high-tech is not as high tech. Second, given that per capita incomes are obviously lower in China, the effect might be lower too.

4.2 Multipliers in Different Non-Tradable Industries

The baseline model result indicates that one additional job in the manufacturing sector creates 0.34 additional jobs in the non-tradable sector. The non-tradable sector is defined to include utilities, construction, and all service sectors. In order to have a better understanding of manufacturing employment growth effect on the non-tradable employment growth, we estimate the multiplier effect for each non-tradable industry. Since the sectoral classification system in the censuses of 2000 and 2010 are different, we construct 11 comparable non-tradable industries as listed in Appendix Table A.2.

We present the results in Table 9. Each row is a separate regression and the dependent variable is the employment growth contributed by each non-tradable industry. All controls in the baseline model are included. OLS estimates suggest a significant multiplier effect for every non-tradable industry except utilities. The multiplier is the largest for wholesale, retail and catering. The IV estimate of the multiplier in wholesale, retail, and catering is also the largest- the coefficient of it is 0.192, with a standard deviation 0.059. The estimate shows that when one additional job created in the manufacturing sector, about 57% (0.192 divided by 0.339) of the new jobs go to wholesale, retail, and catering. There is no multiplier effect for utilities. The utility industry, including electric power, steam and hot water, gas production and supply, and tap water production and supply is still highly regulated by the government.[22] In addition, the utility industry is more capital-intensive. These two factors are possible causes for the insignificant multiplier. As for construction, land use in China is strictly controlled by the government. Employment growth therefore may not be significantly driven by market forces. The fact that wholesale and retail trade have the highest value is not surprising since by 2010 it accounted for more than a third of the non-tradable sector's employment and had doubled its share in overall employment during

[22] According to the 2011 industry statistical yearbook, the SOEs share of output was 92% in electric power and steam and hot water, 44.14% in gas production and supply, and 68.71% in tap water production and supply in 2010.

this ten year period. At the same time, other sectors that also saw their share increase such as residential services was not impacted by manufacturing employment growth. Finally, while the education, culture and entertainment sector did not increase its overall share in employment, it clearly benefitted in areas with high manufacturing employment growth.[23] Thus we see considerable heterogeneity here as well.

4.3 Multipliers by Region

The estimated coefficient of the region dummy in the baseline model shows that cities located in coastal provinces have, on average, less employment growth in the non-tradable sector. Whether the multiplier is heterogeneous across regions requires further investigation. Consider coastal and inland cities: the average wage in coastal cities is higher, which can generate more spending on local service goods, increasing the multiplier effect. However, the higher living cost in coastal areas could offset the labor supply, reducing the multiplier effect. We therefore interact the variable of interest and region dummy to examine the coefficient of the interaction term. If the estimate is significantly negative, the multiplier effect is smaller in coastal cities.

There are two endogenous variables in the regressions, so at least two instruments are needed. We follow Wooldridge (2010) to construct an instrument for the interaction term.[24] We present the results in Table 10. Columns (1) to (3) are OLS estimates, and columns (4) to (6) are IV estimates. To save space, we report the first stage in Table B.7 for IV regressions in columns (4) and (6) of Table 10. The F-statistic in the first stage demonstrates the instruments are strong.

Column (4) of Table 10 present the IV regression including baseline controls. The coefficient of manufacturing employment contribution 0.842 measures the multiplier effect for non-coastal cities, suggesting that one additional manufacturing job in inland cities generates 0.842 new jobs in the non-tradable sector. The estimate for interaction term is -0.5, with significance at 10 percent. The significant negative estimate for the interaction term indicates a smaller multiplier effect in coastal cities. When adding more controls in columns (5) and (6), the results still show a smaller multiplier effect in coastal regions.

[23] According to our data sources, the share of education, culture and entertainment, fell a little from 2.48 to 2.25 percentage points of total employment.

[24] Wooldridge (2010, p.145-146) suggests following steps to construct instrument for the interaction term. First, obtain the fitted value by regressing the endogenous variable on all the other control variables. Second, construct the instrument for the interaction term by interacting the fitted value with the dummy variable. Third, take the fitted value and the newly constructed IV for interaction term as instruments.

5 Conclusion

In this paper, we examined the impact of employment growth in manufacturing on employment in the non-tradable sector during 2000-2010 at prefecture-level cities in China. While, the average multiplier of 0.34, we also found substantial heterogeneity along skill intensity of manufactures, specific service industries, and geography. The multiplier is robust to a large variety of initial conditions, geographic controls and other characteristics.

Given the current trend of a slowdown in Chinese manufacturing, an obvious question that arises is whether the point estimate is useful for future analysis. While the slowdown itself need not reduce the size of the multiplier, the overall economic impact would be certainly lower due to slower job creation in manufacturing. In terms of thinking more long term, assuming that average incomes in China will continue to increase, even if it happens at a slower rate, Engel's law implies that the demand for services will increase. Hence, so should the size of the multiplier. Moreover, this effect might be reinforced as China continues to develop and is more and more likely to focus on high technology industries which, as we have seen already, has a higher spillover. On the other hand, while inland regions have clearly benefitted from rapid manufacturing growth over the decade of our analysis, this advantage is likely to diminish over time. In other words, given that all these factors are at play, one should be cautious in extrapolating for the future. At the same time this also indicates that further investigating the various channels of the spillovers remains a ripe area for future research.

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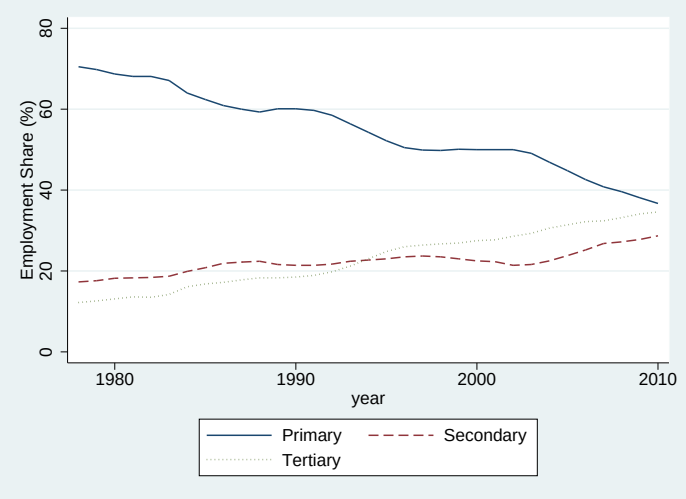

Figure 1: Employment Share by Sector: 1978-2010

The primary sector is agricultural sector. The secondary sector includes manufacturing, utility, mining, and construction. The tertiary sector is service sector.

Source: 2011 China Population and Employment Statistics Yearbook

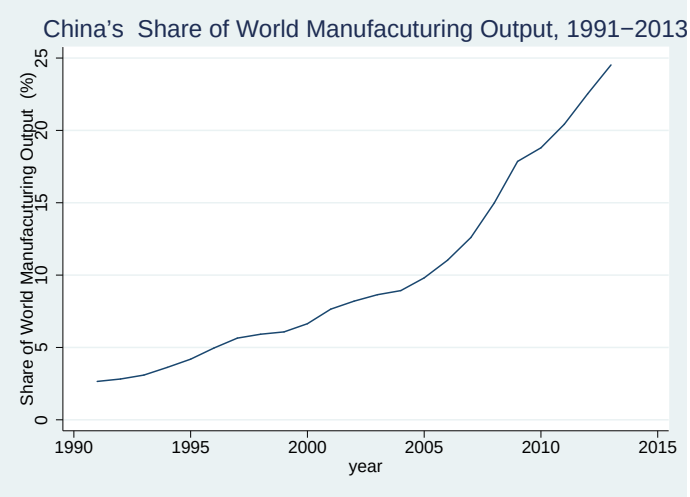

Figure 2: China's Share of World Manufacturing Output: 1991-2013

Source: Authors' calculation based on data from World Bank World Development Indicators.

Figure 3: Administrative Divisions in China-Province Level

Note: This figure displays the administrative divisions at province-level in China based on data from GADM database of Global Administrative Areas. Source: http://www.gadm.org/

Figure 4: Administrative Divisions in China-Prefecture Level

Note: This figure displays the administrative divisions at prefecture-level in China based on data from GADM database of Global Administrative Areas. Source: http://www.gadm.org/

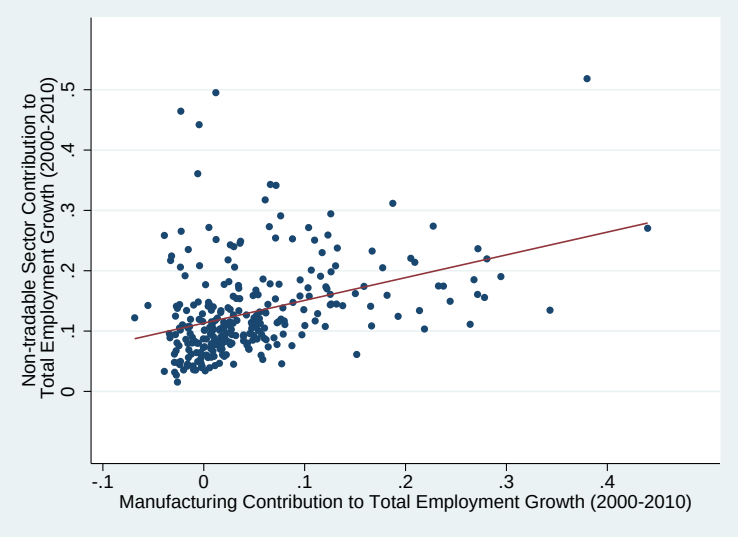

Figure 5: Manufacturing vs Non-tradable Sectors' Contribution to Total Employment Growth
Correlation: 0.38 (p-value: 0.00).

Note: Each point represents a prefecture-level city.

Table 1: Summary Statistics

Variable	Mean	Standard deviation	Min	Max
Non-tradable sec. contri. to total employ. growth (%)	13.15	7.81	1.54	51.83
Manu. contri. to total employ. growth (%)	4.89	7.8	-6.85	43.99
Share of urban hukou pop.(%), 2000	26.67	14.99	7.42	83.17
Share of college pop. (%), 2000	3.56	2.49	.74	16.61
Coastal Province	.35	.48	0	1
Province Capital	.09	.29	0	1
Log employment,2000	12.05	.69	9	13.34
Unemployment rate(%), 2000	4.02	2.9	.62	21.47
Share of non-tradable employ. (%), 2000	20.5	9.69	5.6	62.5
Share of gov. employ. (%), 2000	2.52	1.1	.89	12.53
Nearby provincial municipality	6.13	24.0	0	1
Log night light density 1995-1999 in nbr. areas	.52	1.44	-5.33	2.98
Proximity to nearest port city	.69	.17	.27	1
Rainfall (meter)	.98	.47	.08	2.05
Temperature (Celsius)	13.34	5.48	-2.29	23.38
Altitude (100 meters)	5.18	6.02	.01	30.98

Note: The unit of observation is a prefecture-level city. There are in total 277 cities. Manufacturing contribution to total employment growth: change in manufacturing employment 2000-2010 normalized by total 2000 local employment. Non-tradable sector contribution to total employment growth: change in non-tradable sector employment 2000-2010 normalized by total 2000 local employment. Region: a dummy variable that equals to 1 if the prefecture-level city is in the coastal provinces of Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, and Guangdong. Capital: a dummy variable that equals to 1 if the prefecture-level city is the capital of the province. Nearby provincial municipality: a dummy variable that equals to 1 if the prefecture-level city has a common border with one of provincial municipalities including Beijing, Shanghai, Tianjin, and Chongqing. Log night light density 1995-1999 in nbr. areas: average night light density in neighboring regions; night light data are from National Geographical Data Center. Proximity to nearest port city: reciprocal of one plus distance to the nearest port city in thousands of kilometers. Rainfall, temperature, and altitude are from Global Climate Data.

Table 2: Impact of Manufacturing on Employment Growth in the Non-tradable Sector, OLS Estimates

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010		
	(1)	(2)	(3)
Manufacturing contri. (2000-2010)	0.499***	0.445***	0.470***
	(0.052)	(0.065)	(0.064)
Share of urban hukou pop., 2000	-0.258***	-0.293***	-0.314***
	(0.070)	(0.071)	(0.072)
Share of college pop., 2000	2.255***	1.964***	2.038***
	(0.426)	(0.425)	(0.429)
Coastal Province	-0.019***	-0.023***	-0.026***
	(0.007)	(0.007)	(0.007)
Province Capital	0.053**	0.049*	0.044
	(0.027)	(0.027)	(0.027)
Log(employment), 2000	-0.022***	-0.016**	-0.014**
	(0.007)	(0.007)	(0.007)
Unemp. rate, 2000	0.504*	0.442	0.424
	(0.260)	(0.290)	(0.286)
Share of non-tradable employ., 2000		0.168*	0.133
		(0.098)	(0.094)
Share of gov. employ., 2000			1.008***
			(0.344)
Constant	0.340***	0.266***	0.220**
	(0.087)	(0.087)	(0.085)
N	277	277	277
Adjusted R Square	0.55	0.55	0.56

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. Descriptions of variables are in Table 1.
$p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Impact of Manufacturing on Employment Growth in the Non-tradable Sector, IV Estimates

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010		
	(1)	(2)	(3)
Manufacturing contri. (2000-2010)	0.451***	0.287**	0.339**
	(0.078)	(0.132)	(0.136)
Share of urban hk pop., 2000	-0.263***	-0.334***	-0.344***
	(0.070)	(0.078)	(0.075)
Share of college pop., 2000	2.279***	1.799***	1.894***
	(0.440)	(0.445)	(0.444)
Coastal Province	-0.016**	-0.019**	-0.022***
	(0.008)	(0.008)	(0.008)
Province Capital	0.051*	0.043	0.039
	(0.027)	(0.031)	(0.030)
Log(employment), 2000	-0.022***	-0.011	-0.010
	(0.007)	(0.008)	(0.007)
Unemp. rate, 2000	0.498*	0.380	0.377
	(0.259)	(0.320)	(0.312)
Share of non-tradable employ., 2000		0.296**	0.242*
		(0.143)	(0.145)
Share of gov. employ., 2000			0.849**
			(0.336)
Constant	0.339***	0.208**	0.180**
	(0.086)	(0.096)	(0.091)
N	277	277	277
First Stage F-statistic	43.77	23.88	21.84

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. Descriptions of variables are in Table 1. The instrumental variable is equal to the 2000 share of manufacturing employment for a given city multiplied by the 2000-2010 growth rate in national manufacturing employment (exclude own city). Corresponding first-stage estimates are reported in Appendix Table B.1.
* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$.

Table 4: Impact of Manufacturing on Employment Growth in the Non-tradable Sector, Robustness to Spatial and Geographical Characteristics

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010			
	OLS		IV	
	(1)	(2)	(3)	(4)
Manufacturing contri. (2000-2010)	0.481***	0.524***	0.383***	0.390***
	(0.066)	(0.072)	(0.142)	(0.151)
Share of urban hukou pop., 2000	-0.316***	-0.326***	-0.334***	-0.331***
	(0.072)	(0.082)	(0.073)	(0.082)
Share of college pop., 2000	2.180***	2.058***	2.056***	1.897***
	(0.428)	(0.431)	(0.436)	(0.457)
Coastal Province	-0.023***	-0.029***	-0.023***	-0.029***
	(0.009)	(0.010)	(0.009)	(0.010)
Province Capital	0.038	0.040	0.036	0.037
	(0.027)	(0.026)	(0.028)	(0.028)
Log(employment), 2000	-0.012*	-0.010	-0.010	-0.007
	(0.007)	(0.008)	(0.007)	(0.008)
Unemp. rate, 2000	0.480*	0.648**	0.420	0.561*
	(0.277)	(0.268)	(0.309)	(0.298)
Share of non-tradable employ., 2000	0.097	0.117	0.178	0.206
	(0.098)	(0.106)	(0.152)	(0.142)
Share of gov. employ., 2000	1.100***	0.988***	0.976***	0.904***
	(0.371)	(0.334)	(0.369)	(0.303)
Nearby provincial municipality	0.023*	0.020	0.024**	0.022*
	(0.012)	(0.012)	(0.012)	(0.012)
Ln(light density) 1995-99 in nbr. areas	-0.007*	-0.008	-0.007*	-0.008
	(0.004)	(0.006)	(0.004)	(0.006)
Proximity to port city	0.018	0.053	0.031	0.062
	(0.038)	(0.046)	(0.039)	(0.046)
Rainfall (meter)		-0.030*		-0.027
		(0.017)		(0.017)
Temperature (celsius)		0.001		0.002
		(0.001)		(0.001)
Altitude(meter)		0.001		0.001
		(0.001)		(0.001)
Constant	0.186**	0.145	0.158*	0.097
	(0.088)	(0.110)	(0.093)	(0.120)
N	276	276	276	276
First Stage F-statistic			19.60	18.99

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. The instrumental variable is equal to the 2000 share of manufacturing employment for a given city multiplied by the 2000-2010 growth rate in national manufacturing employment (exclude own city). Corresponding first-stage estimates for columns (3) and (4) are reported in Appendix Table B.2. Descriptions of variables are in Table 1.

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

Table 5: Impact of Future Manufacturing on Past Employment Growth in the Non-tradable Sector, Falsification Tests

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Manufacturing contri. (2010-2013)	-0.000	0.000	-0.001	0.032	0.034	0.032
	(0.005)	(0.005)	(0.005)	(0.031)	(0.032)	(0.031)
Share of urban hukou pop., 2000	-0.415***	-0.394***	-0.339***	-0.416***	-0.403***	-0.369***
	(0.101)	(0.096)	(0.105)	(0.099)	(0.095)	(0.103)
Share of college pop., 2000	1.487***	1.525***	1.400***	1.606***	1.699***	1.566***
	(0.563)	(0.551)	(0.539)	(0.559)	(0.548)	(0.536)
Coastal Province	-0.012	-0.025**	-0.027**	-0.014*	-0.023**	-0.024**
	(0.009)	(0.010)	(0.011)	(0.008)	(0.010)	(0.011)
Province Capital	0.029	0.032	0.029	0.030	0.029	0.028
	(0.035)	(0.034)	(0.034)	(0.034)	(0.033)	(0.032)
Log(employment), 2000	-0.001	-0.003	0.001	-0.005	-0.005	-0.002
	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)
Unemp. rate, 2000	0.209	0.123	0.265	0.259	0.217	0.367
	(0.414)	(0.383)	(0.394)	(0.412)	(0.390)	(0.401)
Share of non-tradable employ., 2000	0.530***	0.503***	0.471***	0.478***	0.445***	0.434***
	(0.086)	(0.091)	(0.108)	(0.091)	(0.096)	(0.109)
Share of gov. employ., 2000	0.445	0.501	0.661**	0.639**	0.737**	0.859***
	(0.362)	(0.377)	(0.307)	(0.323)	(0.332)	(0.292)
Nearby provincial municipality		0.028*	0.029*		0.031**	0.031**
		(0.016)	(0.015)		(0.015)	(0.015)
Ln(light density) 95-99 in nbr. areas		-0.006	-0.006		-0.009*	-0.010
		(0.005)	(0.007)		(0.005)	(0.006)
Proximity to port city		0.085*	0.088		0.078*	0.081
		(0.044)	(0.055)		(0.042)	(0.052)
Rainfall (meter)			-0.017			-0.021
			(0.019)			(0.018)
Temperature (celsius)			0.003**			0.003**
			(0.001)			(0.001)
Altitude(meter)			0.001			0.000
			(0.001)			(0.001)
Constant	0.076	0.047	-0.044	0.113	0.071	0.002
	(0.092)	(0.093)	(0.119)	(0.090)	(0.090)	(0.115)
N	276	275	275	276	275	275
First Stage F-statistic				3.50	3.27	3.32

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. Descriptions of variables are in Table 1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Impact of Manufacturing on Employment Growth in the Non-tradable Sector, Excluding Industries Dominated by State Owned Enterprises

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Manufacturing contri. (2000-2010)	0.463***	0.475***	0.517***	0.346**	0.391***	0.403***
	(0.064)	(0.066)	(0.072)	(0.137)	(0.143)	(0.153)
Share of urban hukou pop., 2000	-0.317***	-0.319***	-0.329***	-0.343***	-0.334***	-0.332***
	(0.072)	(0.072)	(0.083)	(0.074)	(0.072)	(0.082)
Share of college pop., 2000	2.035***	2.178***	2.051***	1.905***	2.071***	1.913***
	(0.431)	(0.430)	(0.433)	(0.444)	(0.437)	(0.458)
Coastal Province	-0.026***	-0.023***	-0.029***	-0.022***	-0.023***	-0.028***
	(0.007)	(0.009)	(0.010)	(0.008)	(0.009)	(0.010)
Province Capital	0.043	0.037	0.040	0.039	0.036	0.037
	(0.028)	(0.027)	(0.026)	(0.030)	(0.028)	(0.027)
Log(employment), 2000	-0.014**	-0.012*	-0.010	-0.011	-0.010	-0.007
	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)
Unemp. rate, 2000	0.427	0.484*	0.659**	0.384	0.432	0.581*
	(0.284)	(0.276)	(0.268)	(0.310)	(0.310)	(0.300)
Share of non-tradable employ., 2000	0.141	0.105	0.126	0.237	0.174	0.201
	(0.094)	(0.099)	(0.107)	(0.145)	(0.152)	(0.142)
Share of gov. employ., 2000	0.999***	1.095***	0.987***	0.857**	0.988***	0.915***
	(0.340)	(0.368)	(0.333)	(0.339)	(0.375)	(0.308)
Nearby provincial municipality		0.024**	0.021		0.024**	0.022*
		(0.012)	(0.012)		(0.012)	(0.012)
Ln(light density) 95-99 in nbr. areas		-0.007*	-0.008		-0.007*	-0.008
		(0.004)	(0.006)		(0.004)	(0.006)
Proximity to port city		0.018	0.053		0.030	0.061
		(0.038)	(0.046)		(0.039)	(0.045)
Rainfall (meter)			-0.031*			-0.028
			(0.018)			(0.017)
Temperature (celsius)			0.002			0.002
			(0.001)			(0.001)
Altitude(meter)			0.001			0.001
			(0.001)			(0.001)
Constant	0.220**	0.185**	0.142	0.184**	0.161*	0.101
	(0.086)	(0.088)	(0.110)	(0.092)	(0.094)	(0.121)
N	277	276	276	277	276	276
First Stage F-statistic				22.44	20.06	19.38

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. The manufacturing sector is reconstructed by excluding tobacco; petroleum processing and coking. Descriptions of variables are in Table 1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Impact of High- and Low-Technology Manufacturing on Employment Growth in the Non-tradable Sector

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
High tech manu. contri. (2000-2010)	0.596***	0.606***	0.641***	0.526**	0.572**	0.621**
	(0.137)	(0.148)	(0.158)	(0.239)	(0.244)	(0.265)
Low tech manu. contri. (2000-2010)	0.438***	0.466***	0.492***	-0.016	-0.029	-0.061
	(0.078)	(0.083)	(0.088)	(0.135)	(0.157)	(0.164)
Share of urban hukou pop., 2000	-0.318***	-0.335***	-0.345***	-0.372***	-0.379***	-0.359***
	(0.073)	(0.076)	(0.084)	(0.087)	(0.085)	(0.093)
Share of college pop., 2000	2.015***	2.182***	2.041***	1.373**	1.387**	1.174**
	(0.458)	(0.452)	(0.449)	(0.541)	(0.549)	(0.572)
Coastal Province	-0.026***	-0.022**	-0.027**	-0.018*	-0.025**	-0.026**
	(0.009)	(0.010)	(0.011)	(0.010)	(0.011)	(0.013)
Province Capital	0.052*	0.042	0.044	0.057	0.056	0.057
	(0.031)	(0.030)	(0.028)	(0.037)	(0.035)	(0.035)
Log(employment), 2000	-0.015**	-0.011	-0.009	-0.009	-0.009	-0.005
	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Unemp. rate, 2000	0.411	0.525*	0.696**	0.344	0.358	0.494
	(0.302)	(0.301)	(0.298)	(0.326)	(0.328)	(0.333)
Share of non-tradable employ., 2000	0.092	0.064	0.091	0.396**	0.403**	0.407**
	(0.105)	(0.109)	(0.111)	(0.157)	(0.170)	(0.159)
Share of gov. employ., 2000	1.497**	1.709**	1.632**	0.376	0.478	0.825
	(0.742)	(0.773)	(0.760)	(0.910)	(1.004)	(0.905)
Nearby provincial municipality		0.025*	0.021		0.027*	0.025*
		(0.013)	(0.013)		(0.014)	(0.014)
Ln(light density) 95-99 in nbr. areas		-0.009**	-0.011*		-0.009*	-0.012*
		(0.005)	(0.006)		(0.005)	(0.007)
Proximity to port city		0.015	0.042		0.063	0.068
		(0.038)	(0.046)		(0.046)	(0.053)
Rainfall (meter)			-0.031*			-0.026
			(0.018)			(0.018)
Temperature (celsius)			0.002			0.003**
			(0.001)			(0.001)
Altitude(meter)			0.001			0.000
			(0.001)			(0.001)
Constant	0.229**	0.173*	0.132	0.180*	0.137	0.063
	(0.093)	(0.099)	(0.122)	(0.099)	(0.104)	(0.133)
N	260	259	259	260	259	259
First Stage F-statistic				25.37	22.25	18.46

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. The high- and low-technology manufacturing industries are classified based on NBS High-Technology Industry (Manufacturing Industry) Classifications (2013). Details of the classification are in Appendix Table B.8. Instruments are group specific. Corresponding first-stage estimates for columns (4) and (6) are reported in Appendix Table B.4. Descriptions of variables are in Table 1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: Impact of High- and Low-Tech Manu. on Employment Growth in the Non-tradable Sector, Alternative Definition of High- and Low-Tech Manu. Industries

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
High tech manu.contri.	0.625***			0.823		
(45% cutoff)	(0.170)			(0.609)		
Low tech manu. contri.	0.463***			0.181		
(45% cutoff)	(0.074)			(0.182)		
High tech manu. contri.		0.652***			0.575**	
(40% cutoff)		(0.121)			(0.270)	
Low tech manu. contri.		0.396***			-0.087	
(40% cutoff)		(0.082)			(0.136)	
High tech manu. contri.			0.558***			0.395**
(35% cutoff)			(0.111)			(0.197)
Low tech manu. contri.			0.422***			-0.167
(35% cutoff)			(0.089)			(0.190)
N	260	260	260	260	260	260
First Stage F-statistic				6.64	26.31	21.15

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. All baseline controls are included. The high- and low-technology manufacturing industries are classified based on education level. Details of the classification are in Appendix Table B.8.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: Impact of Manufacturing on Employment Growth in Specific Non-Tradable Industries

Non-tradable Industry	OLS	IV
Utility	0.003	0.007
	(0.004)	(0.010)
Construction	0.101***	-0.071
	(0.022)	(0.063)
Transport, post and telecom services;	0.035**	0.046
adminstration of water,	(0.014)	(0.030)
environment, and public facilities		
Whole sale,retail, catering	0.209***	0.192***
	(0.024)	(0.059)
Finance	0.009***	0.022***
	(0.003)	(0.007)
Real estate	0.019**	0.022***
	(0.004)	(0.006)
Health care,sports and welfare	0.011***	0.014***
	(0.002)	(0.004)
Education, culture and entertainment	0.023***	0.039***
	(0.004)	(0.008)
Scientific research, polytechnic services,	0.010***	0.018**
and geological prospecting	(0.002)	(0.007)
Resident and other services	0.023***	0.001
	(0.008)	(0.014)
Others	0.045***	0.068***
	(0.007)	(0.015)

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. Each row is a separate regression and the dependent variable is the employment growth contributed by each non-tradable industry. Each regression includes the baseline controls.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: Impact of Manufacturing on Employment Growth in the Non-tradable Sector, Coastal vs Inland Effects

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Manufacturing contri.	0.557***	0.551***	0.667***	0.842***	0.913***	0.886***
	(0.087)	(0.093)	(0.109)	(0.287)	(0.310)	(0.277)
Manu. employ. contri. x Coastal	-0.137	-0.110	-0.207*	-0.500**	-0.520**	-0.489**
Province	(0.112)	(0.117)	(0.125)	(0.232)	(0.238)	(0.200)
Share of urban hukou pop., 2000	-0.308***	-0.312***	-0.311***	-0.278***	-0.280***	-0.288***
	(0.075)	(0.075)	(0.087)	(0.087)	(0.085)	(0.089)
Share of college pop., 2000	1.985***	2.131***	1.954***	1.904***	2.079***	1.844***
	(0.458)	(0.456)	(0.468)	(0.449)	(0.448)	(0.479)
Coastal Province	-0.020**	-0.018*	-0.022**	-0.007	-0.000	-0.013
	(0.009)	(0.011)	(0.011)	(0.011)	(0.013)	(0.011)
Province Capital	0.043	0.038	0.040	0.044	0.040	0.041
	(0.028)	(0.028)	(0.026)	(0.030)	(0.029)	(0.027)
Log(employment), 2000	-0.013*	-0.011	-0.008	-0.012	-0.012	-0.007
	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)
Unemp. rate , 2000	0.386	0.454	0.612**	0.303	0.420	0.580**
	(0.299)	(0.287)	(0.273)	(0.305)	(0.319)	(0.288)
Share of non-tradable employ., 2000	0.160	0.121	0.155	0.185	0.127	0.190
	(0.097)	(0.102)	(0.106)	(0.150)	(0.160)	(0.139)
Share of gov. employ., 2000	0.979***	1.068***	0.894***	0.971**	1.078**	0.783***
	(0.338)	(0.367)	(0.308)	(0.388)	(0.442)	(0.294)
Nearby provincial municipality		0.023**	0.020*		0.023**	0.020*
		(0.012)	(0.012)		(0.010)	(0.012)
Ln(light density) 95-99 in nbr. areas		-0.006	-0.005		-0.002	-0.001
		(0.004)	(0.006)		(0.004)	(0.006)
Proximity to port city		0.012	0.052		-0.024	0.049
		(0.039)	(0.045)		(0.045)	(0.043)
Rainfall (meter)			-0.031*			-0.034*
			(0.017)			(0.017)
Temperature			0.001			0.001
			(0.001)			(0.001)
Altitude(meter)			0.001			0.002*
			(0.001)			(0.001)
Constant	0.205**	0.181**	0.115	0.180*	0.190*	0.084
	(0.088)	(0.088)	(0.114)	(0.092)	(0.097)	(0.122)
N	277	276	276	277	276	276
First Stage F-statistic				12.74	11.96	12.49

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. A prefecture-level city is assigned a region dummy taking a value of 1 if it is in the coastal provinces of Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, and Guangdong. Corresponding first-stage estimates for columns (4) and (6) are reported in Appendix Table B.7. Descriptions of variables are in Table 1.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

A Harmonizing Regions and Industries

A.1 Harmonizing Administrative Regions across Censuses

Due to administrative reforms between 2000 and 2010, the prefecture-level cities reported in the censuses of 2000 and 2010 are not identical. In order to have a larger sample, we use prefecture-level cities in 2010 as a benchmark, track each prefecture-level city to its corresponding areas in 2000, and study the employment growth during this period. [25] Here we illustrate four main types of administrative changes and methods employed to adjust the unit of analysis. First, a city in the census of 2010 that was a county or a county-level city in the census of 2000. For example, Zhongwei city was a prefecture-level city in Ningxia province in 2010, but it was a county administrated under Wuzhong city in 2000. The census of 2000 reports the employment data for Wuzhong city, which includes Zhongwei county. The census of 2010 reports the employment for Wuzhong and Zhongwei cities. We combine Wuzhong city and Zhongwei city in 2010 to compare to Wuzhong city in 2000. Secondly, a city in 2010 was expanded from a prefecture-level city and its surrounding prefecture in 2000. For example, Nanning city in Guangxi province in 2010 consists of the Nanning city and part of Nanning diqu in 2000. The rest part of Nanning diqu in 2000 becomes Chongzuo city in 2010. We combine Nanning city and Nanning diqu in 2000 to compare to the combination of Nanning City and Chongzuo City in 2010. Thirdly, a city in the census of 2010 was a prefecture in 2000. For example, Baoshan city in Yunnan province in 2010 was Baoshan prefecture in 2000. This type of change usually doesn't occur in expanding or declining areas, so they are comparable. Fourth, a city in the census of 2010 administered more or fewer counties. This change is mainly because some counties were administered by different upper prefecture-level cities in the two censuses. In fact, most types of changes between 2000 and 2010 are of the third variety, which is not a concern to compare the data between the two censuses. We adjust the unit of analysis for the first two types. We exclude cities in Hainan province because the government restricts manufacturing industries to protect the local environment for tourism development. We also drop Tibet due to data limitations. The final sample includes 277 prefecture-level cities.

A.2 Harmonizing Industrial Classification Systems

In China, GB/T4754 is the industries classification system. The first formal classification was issued in 1984, called GB/T4754-1984 (Holz, 2013). The classification standards were later revised in 1994, 2000, and 2011, and the labels are GB/T47540-1994 (GB94), GB/T4754-2002 (GB02), and GB/T4754-2011 (GB11) respectively. The 2000 Population Census used GB/T4754-1994, and the 2010 Population Census used GB/T4754-2002. Following Holz (2013), and documentation of GB94 and GB02, we first construct comparable 2-digit industries in manufacturing. Table A.1 illustrates the classification used in the paper. We

[25] Different administrative reforms at the prefecture level began in 1983, including converting a prefecture to a prefecture-level city, promoting a county-level city to a prefecture-level city, expanding the current prefecture-level city by absorbing nearby counties or prefectures.

reclassified the crafts and art production to other in the census of 2010 because this term was included in the "other" category in the census of 2000.

Table A.1: Comparable 2-digit Manufacturing Industries

	Census 2000	Census 2010
1	13. food processing 14. food manufacturing	12. processing of food from agric. products 13. manufacture of foods
2	15.manufacture of beverages	14. manufacture of beverages
3	16.manufacture of tobacco	15. manufacture of tobacco
4	17.textile industry	16. manufacture of textiles
5	18. garments and other fiber products	17. manufacture of textiles, apparel, footwear and caps
6	19. leathers, furs, down and related products	18. manufacture of leather, fur, feather and related products
7	20. Timber processing, bamboo, canes, palm, fiber and straw products	19. Timber processing, bamboo, canes, palm, fiber and straw products
8	21.furniture manufacturing	20. furniture manufacturing
9	22. papermaking and paper products	21. manufacture of paper and paper prod.
10	23. printing industry	22. printing and recorded media
11	24. cultural, education and sports good	23. cultural, education and sports good
12	25. petroleum processing and coking	24. processing of petroleum, coking, nuclear fuel
13	26. raw chemical materials and chemical products chemical products	25.manufacture of chemical raw materials and
14	27. medical and pharmaceutical products	26. manufacture of medicines
15	28. chemical fiber	27. manufacture of chemical fiber
16	29.rubber products	28. rubber products
17	20. plastic products	29. plastic products
18	31. nonmetal mineral products	30. nonmetal mineral products
19	32. smelting and pressing of ferrous metals	31. smelting and pressing of ferrous metals
20	33. smelting and pressing of nonferrous metals	32. smelting and pressing of nonferrous metals
21	34. metal products	33. metal products
22	35. ordinary machinery 36. special purpose equipment 38. weapons and ammunition manufacturing	34. manufacture of general purpose machinery 35. manufacture of special purpose machinery
23	37. transport equipment	36. transport equipment
24	39. electric equipment and machinery	37. electric equipment and machinery
25	40. electronic and telecommunications equipment	38. manufacture of communication equipment, computers and other
26	41. instruments, meters, cultural and office equipment	39. manufacture of measuring instruments and machinery for cultural activity and office work
27	42. other manufacturing	40. manufacturing of artwork and other manufacturing 41. recycling and disposal of waste

Note: The No. listed in the first column indicate a category constructed by the author. The No. listed in the second and third columns are from population census 2000 and 2010 by each province, representing two-digit industry. The english titles are from Holz (2013).

Table A.2: Comparable 1-digit Non-tradable Sector

industry	Census 2000	Census 2010
1	IV.utilities	IV.utilities
2	V. construction	V. construction
3	VII. transport, storage, post and telecommunication services VI50.water management XI71. Public Services	VI.transport, storage, and postal services XIV. adminstration of water, environment, and public facilities
4	VIII. wholesale and retail trades, and catering services	VIII. wholesale and retail trades IX. accommodation and catering *less* IX63. accommodation
5	IX. finance and insurance	X. finance
6	X. real estate	XI. real estate
7	XII. health care, sports, and social welfare	XVII. health care, social insurance/welfare XVIII88. sports
8	XIII. education, culture and arts, radio, film, and television	XVI. education XVIII. culture, sports and entertainment *less* XVIII89.entertainment *less* XVIII88.sports
9	XIV. scientific research and polytechnic services VI46.geological prospecting	XIII. scientific research, polytechnic services, and geological prospecting
10	XI72. residence Services	XV. resident and other services
11	XI.social service *less* XI71. public services *less* XI72. residence services	VII. information transfer, computer services, and software XII. leasing and commercial services IX63. accommodation XVIII89.entertainment

Note: The No. listed in the first column indicate a category constructed by the author. The roman number listed in the second and third columns are from population census 2000 and 2010, which represents 1-digit industry. The numeric number listed in the second and third columns represents 2-digit industry. The english titles are from Holz (2013).

B Appendix Tables

Table B.1: First Stage Regressions For Table 3,
Impact of Manufacturing on Employment Growth in the Non-tradable Sector

	Dependent Variable: Manufacturing's Contribution to Total Employment Growth, 2000-2010		
	(1)	(2)	(3)
Instrument	1.118***	0.916***	0.891***
	(0.169)	(0.188)	(0.191)
Share of urban hukou pop., 2000	-0.133	-0.187**	-0.176**
	(0.082)	(0.083)	(0.081)
Share of college pop., 2000	-0.640	-1.051**	-1.072**
	(0.539)	(0.492)	(0.483)
Coastal Province	0.012	0.007	0.008
	(0.009)	(0.008)	(0.008)
Province Capital	0.008	-0.003	-0.001
	(0.025)	(0.025)	(0.024)
Log(employment), 2000	0.001	0.012*	0.011
	(0.006)	(0.007)	(0.007)
Unemp. rate, 2000	-0.109	-0.218	-0.211
	(0.215)	(0.189)	(0.190)
Share of non-tradable employ., 2000		0.325***	0.345***
		(0.105)	(0.110)
Share of gov. employ., 2000			-0.448
			(0.506)
Constant	0.035	-0.116	-0.098
	(0.078)	(0.083)	(0.086)
N	277	277	277
First stage statistics	43.77	23.88	21.84

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. The instrumental variable is equal to the 2000 share of manufacturing employment for a given city multiplied by the 2000-2010 growth rate in national manufacturing employment (exclude own city). Descriptions of variables are in Table 1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.2: First Stage Regressions for Table 4,
(Robustness to Spatial and Geographical Characteristics)

	Dependent Variable: Manufacturing's Contribution to Total Employment Growth, 2000-2010	
	(1)	(2)
Instrument	0.851***	0.831***
	(0.192)	(0.191)
Share of urban hukou pop.,2000	-0.151*	-0.095
	(0.078)	(0.081)
Share of college pop.,2000	-1.122**	-1.065**
	(0.472)	(0.447)
Coastal Province	-0.009	0.003
	(0.010)	(0.009)
Province Capital	0.004	0.001
	(0.023)	(0.024)
Log(employment),2000	0.008	0.007
	(0.007)	(0.007)
Unemp. rate,2000	-0.369**	-0.346*
	(0.187)	(0.203)
Share of non-tradable employ.,2000	0.357***	0.284***
	(0.113)	(0.105)
Share of gov. employ.,2000	-0.444	0.090
	(0.538)	(0.267)
Nearby provincial municipality	0.012	0.014
	(0.017)	(0.017)
Ln(light density) 1995-99 in nbr. areas	-0.005	-0.010**
	(0.004)	(0.004)
Proximity to port city	0.106***	0.028
	(0.034)	(0.033)
Rainfall (meter)		0.004
		(0.013)
Temperature (celsius)		0.003***
		(0.001)
Altitude(meter)		-0.002***
		(0.001)
Constant	-0.134	-0.113
	(0.089)	(0.098)
N	276	276
First Stage F-statistic	19.60	18.99

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. The instrumental variable is equal to the 2000 share of manufacturing employment for a given city multiplied by the 2000-2010 growth rate in national manufacturing employment (exclude own city). Descriptions of variables are in Table 1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.3: Impact of Manufacturing on Employment Growth in the Non-tradable Sector, Province Fixed Effects Estimates

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Manufacturing contri. (2000-2010)	0.480***	0.487***	0.476***	0.363***	0.366**	0.361**
	(0.094)	(0.098)	(0.104)	(0.124)	(0.164)	(0.151)
Share of urban hukou pop., 2000	-0.373***	-0.352***	-0.340***	-0.393***	-0.367***	-0.358***
	(0.089)	(0.100)	(0.092)	(0.093)	(0.092)	(0.094)
Share of college pop., 2000	2.480***	2.451***	2.360***	2.470***	2.423***	2.326***
	(0.550)	(0.560)	(0.512)	(0.556)	(0.544)	(0.526)
Province Capital	0.026	0.034	0.035	0.018	0.027	0.028
	(0.031)	(0.033)	(0.031)	(0.027)	(0.027)	(0.027)
Log(employment), 2000	-0.017**	-0.018**	-0.017**	-0.014*	-0.016**	-0.015**
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.007)
Unemp. rate, 2000	0.946***	0.954***	0.984***	0.922***	0.925***	0.974***
	(0.282)	(0.276)	(0.270)	(0.282)	(0.283)	(0.272)
Share of non-tradable employ., 2000	0.045	0.002	0.004	0.110	0.064	0.065
	(0.093)	(0.110)	(0.113)	(0.122)	(0.133)	(0.137)
Share of gov. employ., 2000	1.051**	0.972**	0.991**	1.008***	0.949***	0.980***
	(0.418)	(0.382)	(0.412)	(0.363)	(0.342)	(0.363)
Nearby provincial municipality		0.013*	0.016*		0.016	0.019
		(0.007)	(0.008)		(0.015)	(0.015)
Ln(light density)95-99 in nbr. areas		-0.008	-0.008		-0.005	-0.007
		(0.006)	(0.007)		(0.007)	(0.007)
Proximity to port city		0.088	0.101		0.100*	0.114**
		(0.070)	(0.063)		(0.058)	(0.055)
Rainfall (meter)			-0.003			-0.007
			(0.025)			(0.021)
Temperature (celsius)			0.004			0.004
			(0.006)			(0.004)
Altitude(meter)			0.002			0.002
			(0.004)			(0.003)
Constant	0.253***	0.212**	0.130			
	(0.087)	(0.091)	(0.136)			
N	277	276	276	276	275	275
First Stage F-statistic				14.67	11.15	13.46

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. All estimates include province fixed effects. Descriptions of variables are in Table 1. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.4: First Stage Regressions for Table 7
(High- and Low-technology Manufacturing Industries Analysis)

	Model 1		Model 2	
	High skill manu. contri.	Low skill manu. contri.	High skill manu. contri.	Low skill manu. contri.
Instrument (high-tech. manu.)	0.718***	-1.048***	0.663***	-1.013***
	(0.169)	(0.239)	(0.160)	(0.227)
Instrument (low-tech. manu.)	0.025	0.912***	0.048	0.827***
	(0.097)	(0.124)	(0.081)	(0.118)
Share of urban hukou pop., 2000	-0.065	-0.078	-0.022	-0.028
	(0.041)	(0.055)	(0.041)	(0.059)
Share of college pop., 2000	-0.201	-0.644*	-0.139	-0.699**
	(0.219)	(0.347)	(0.181)	(0.321)
Coastal Province	0.002	0.006	-0.007	0.001
	(0.003)	(0.007)	(0.004)	(0.008)
Province Capital	-0.022*	0.007	-0.019*	0.008
	(0.011)	(0.016)	(0.010)	(0.016)
Log(employment), 2000	0.006*	0.007	0.004	0.005
	(0.003)	(0.005)	(0.003)	(0.006)
Unemp. rate, 2000	-0.069	-0.171	-0.105	-0.374**
	(0.114)	(0.142)	(0.106)	(0.168)
Share of non-tradable employ.,2000	0.187***	0.256***	0.120**	0.232***
	(0.068)	(0.092)	(0.048)	(0.076)
Share of gov. employ., 2000	-0.292	-1.055**	-0.200	-0.253
	(0.279)	(0.467)	(0.293)	(0.532)
Nearby provincial municipality			0.012	0.003
			(0.011)	(0.008)
Ln(light density) 1995-99 in nbr. areas			0.002	-0.006
			(0.002)	(0.004)
Proximity to port city			0.022	0.026
			(0.014)	(0.029)
Rainfall (meter)			0.001	0.011
			(0.005)	(0.010)
Temperature (celsius)			0.001	0.002*
			(0.000)	(0.001)
Altitude(meter)			-0.000	-0.001**
			(0.000)	(0.001)
Constant	-0.070	-0.047	-0.075	-0.075
	(0.046)	(0.069)	(0.050)	(0.083)
N	260	260	259	259
First Stage F-statistic	25.37		18.46	

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. Descriptions of variables are in Table 1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.5: Impact of High- and Low-Technology Manufacturing on Employment Growth Robustness to Share of High School Pop.

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
High tech manu. contri.	0.663***	0.668***	0.707***	0.675***	0.703***	0.785***
	(0.147)	(0.160)	(0.173)	(0.211)	(0.223)	(0.244)
Low tech manu. contri.	0.440***	0.461***	0.486***	0.018	0.000	-0.026
	(0.075)	(0.082)	(0.087)	(0.132)	(0.154)	(0.161)
Share of urban hk pop.,2000	-0.252***	-0.278***	-0.285***	-0.302***	-0.318***	-0.298***
	(0.078)	(0.079)	(0.085)	(0.086)	(0.084)	(0.089)
Share of college pop.,2000	2.432***	2.495***	2.364***	1.759***	1.721***	1.533**
	(0.506)	(0.499)	(0.490)	(0.572)	(0.584)	(0.610)
Share of high school pop.,2000	-0.451**	-0.369**	-0.390**	-0.388**	-0.346*	-0.387**
	(0.181)	(0.178)	(0.181)	(0.186)	(0.186)	(0.194)
Coastal Province	-0.026***	-0.022**	-0.027**	-0.019*	-0.024**	-0.025**
	(0.009)	(0.010)	(0.011)	(0.010)	(0.011)	(0.012)
Province Capital	0.041	0.034	0.036	0.051	0.050	0.052
	(0.032)	(0.031)	(0.030)	(0.036)	(0.035)	(0.034)
Log(employment),2000	-0.014*	-0.010	-0.008	-0.010	-0.008	-0.005
	(0.007)	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)
Unemp. rate,2000	0.264	0.383	0.554*	0.227	0.247	0.388
	(0.321)	(0.315)	(0.311)	(0.330)	(0.332)	(0.335)
Share of non-tradable employ.,2000	0.094	0.069	0.097	0.349**	0.365**	0.371**
	(0.106)	(0.111)	(0.113)	(0.149)	(0.163)	(0.150)
Share of gov. employ.,2000	1.793**	1.953**	1.895**	0.783	0.866	1.222
	(0.737)	(0.780)	(0.770)	(0.893)	(0.998)	(0.919)
Nearby provincial municipality		0.019	0.015		0.021	0.018
		(0.013)	(0.013)		(0.013)	(0.013)
Ln(light density) 1995-99 in nbr. areas		-0.009**	-0.011*		-0.009*	-0.013*
		(0.005)	(0.006)		(0.005)	(0.007)
Proximate to port city		0.017	0.045		0.059	0.065
		(0.037)	(0.045)		(0.045)	(0.051)
Rainfall (meter)			-0.032*			-0.030
			(0.018)			(0.018)
Temperature (celsius)			0.002			0.003**
			(0.001)			(0.001)
Altitude(meter)			0.001			0.000
			(0.001)			(0.001)
N	260	259	259	260	259	259
First Stage Statistics				21.11	19.88	15.37

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. The high- and low-technology manufacturing industries are classified based on NBS High-Technology Industry (Manufacturing Industry) Classifications (2013). Details of the classification are in Appendix Table B.8. Instruments are group specific.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.6: Impact of High- and Low-Tech Mfg. on Employment Growth
Alternative Definitions of High- and Low-Tech Manu. Industries, Robustness to Share of High School Pop.

	Dependent Variable: Non-tradable Sector's Contribution to Total Employment Growth, 2000-2010					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
High tech manu.contri.	0.690***			0.916		
(45% cutoff)	(0.167)			(0.579)		
Low tech manu. contri.	0.476***			0.288		
(45% cutoff)	(0.073)			(0.176)		
High tech manu. contri.		0.733***			0.772***	
(40% cutoff)		(0.135)			(0.246)	
Low tech manu. contri.		0.389***			-0.066	
(40% cutoff)		(0.078)			(0.135)	
High tech manu. contri.			0.633***			0.545***
(35% cutoff)			(0.115)			(0.182)
Low tech manu. contri.			0.402***			-0.174
(35% cutoff)			(0.086)			(0.193)
N	260	260	260	260	260	260
First Stage Statistics				7.21	8.25	21.88

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. All baseline controls are included. The high- and low-technology manufacturing industries are classified based on education level. Details of the classification are in Appendix Table B.8.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.7: First Stage Regressions for Table 10,
(Coastal vs Inland Effects)

	Model 1		Model 2	
	manu. contri.	manu. contri. × region	manu. contri. manu. contri.	manu. contri. × region
Fitted values	0.895***	-0.098	0.641**	-0.339
	(0.291)	(0.212)	(0.305)	(0.252)
Fitted values × region	0.101	1.061***	0.327*	1.232***
	(0.212)	(0.103)	(0.190)	(0.132)
Share of urban hukou pop., 2000	-0.016	-0.033	-0.024	-0.003
	(0.106)	(0.095)	(0.089)	(0.072)
Share of college pop., 2000	0.002	0.045	-0.013	-0.157
	(0.532)	(0.485)	(0.509)	(0.435)
Coastal Province	-0.003	-0.004	-0.014	-0.022**
	(0.010)	(0.009)	(0.012)	(0.010)
Province Capital	-0.002	-0.015	-0.007	-0.018
	(0.025)	(0.023)	(0.025)	(0.021)
Log(employment), 2000	0.001	0.003	0.001	0.004
	(0.007)	(0.005)	(0.007)	(0.005)
Unemp. rate, 2000	0.008	-0.068	-0.018	-0.030
	(0.199)	(0.158)	(0.229)	(0.180)
Share of non-tradable employ., 2000	0.018	0.074	0.046	0.139
	(0.171)	(0.160)	(0.165)	(0.149)
Share of gov. employ., 2000	-0.007	0.168	0.019	-0.176
	(0.548)	(0.415)	(0.262)	(0.306)
Nearby provincial municipality			0.006	0.018
			(0.017)	(0.015)
Ln(light den.) 1995-99 in nbr. areas			-0.003	0.001
			(0.005)	(0.003)
Proximity to port city			0.016	0.037
			(0.037)	(0.027)
Rainfall (meter)			-0.001	-0.020**
			(0.013)	(0.010)
Temperature (celsius)			0.001	0.003**
			(0.002)	(0.001)
Altitude(meter)			-0.001	-0.000
			(0.001)	(0.001)
Constant	-0.003	-0.037	-0.018	-0.095
	(0.091)	(0.064)	(0.109)	(0.080)
N	277	277	276	276
First Stage F-statistic	12.74		12.49	

Note: The unit of observation is a prefecture-level city. Robust standard errors reported in parentheses. Descriptions of variables are in Table 1.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.8: Classification of High- and Low- Technology Manufacturing Industries

Cat.	Industries	% Employ. above high school	% Employ. above college	High-Technology Manu.			
				NBS	above high school		
					45%	40%	35%
14	26. manufacture of medicines	64	33.5	H	H	H	H
12	24. processing of petroleum, coking nuclear fuel	63	30.4	L	H	H	H
3	15. manufacture of tobacco	61.2	29.9	L	H	H	H
22	34. general purpose machinery	36.4	12.5	H	H	H	H
	35. special purpose machinery	46.6	18.7	H	H	H	H
13	25.manufacture of chemical raw materials and chemical products	45.9	18.4	L	H	H	H
23	36. transport equipment	45.6	18.3	H	H	H	H
25	38. manufacture of communication equipment, computers and other	44.6	16.2	H		H	H
19	31. smelting and pressing of ferrous metals	44.2	16.7	L	L	H	H
20	32. smelting and pressing of nonferrous metals	42.3	15.7	L	L	H	H
26	39. manufacture of measuring instruments and machinery for cultural activity and office work	41.5	17.0	H	L	H	H
2	14. manufacture of beverages	40.5	14.7	L	L	H	H
10	22. printing and recorded media	39.5	12.3	L	L	L	H
24	37. electric equipment and machinery	39.2	14.5	L	L	L	H
15	27. manufacture of chemical fiber	38.9	12.6	L	L	L	H
16	28. rubber products	30.8	9.2	L	L	L	L
21	33. metal products	26.1	7.1	L	L	L	L
9	21. manufacture of paper and paper prod.	29.1	8.0	L	L	L	L
1	12. processing of food from agri. products	22.5	6.0	L	L	L	L
	13. manufacture of foods	29.4	9.7	L	L	L	L
17	29. plastic products	24.2	6.2	L	L	L	L
18	30. nonmetal mineral products	23.1	6.1	L	L	L	L
11	23. cultural, education and sports	21.1	6.1	L	L	L	L
4	16. manufacture of textiles	19.8	4.0	L	L	L	L
8	20. furniture manufacturing	17.6	4.0	L	L	L	L
5	17. manufacture of textiles	15.6	3.1	L	L	L	L
	17. apparel, footwear and caps						
6	18. manufacture of leather	14.6	2.6	L	L	L	L
	18. fur, feather, etc.						
7	19. Timber processing, bamboo, canes, palm, fiber and straw products	14.2	2.6	L	L	L	L
27	40. manufacture of artwork and other manufacturing	18.5	4.7	L	L	L	L
	41. recycling and disposal of waste	12.6	2.6	L	L	L	L

Note: NBS classification is based on High-Technology Industry Classifications (2013). Education data are from National Population Census 2010. H (L) denotes high (low)-technology manufacturing industry.

C Data sources

Table C.1: Variables, Descriptions, and Sources

Variable	Description and Sources
	Variables in regression:
Non-tradable sec. contri. to total employ. growth (%)	Change in non-tradable employment 2000-2010 normalized by total 2000 local employment. Source : Tabulation on the Population Census of the People's Republic of China by County (2000, 2010).
Manu. contri. to total employ. growth (%)	Change in manufacturing employment 2000-2010 normalized by total 2000 local employment. Source : Tabulation on the Population Census of the People's Republic of China by County (2000, 2010).
Manu. contri. to total employ. growth (%)	Change in manufacturing employment 2010-2013 normalized by total 2000 local employment. Source : China City Statistical Yearbook (2011, 2014).
High (low) tech manu. contri. to total employ. growth (%)	Change in high (low) manufacturing employment 2000-2010 normalized by total 2000 local employment. Source: Tabulation on the Population Census, published by province (2000, 2010).
Share of urban hukou pop.(%), 2000	Population with urban hukou divided by local population. Source : Tabulation on the Population Census of the People's Republic of China by County (2000).
Share of college pop. (%), 2000	Population with college education and above divided by age 6+ population. Source :Tabulation on the Population Census of the People's Republic of China by County (2000).
Coastal Province	A dummy variable equals one if the prefecture-level city is in the coastal provinces of Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, and Guangdong.
Province Capital	A dummy variable which equals one if the prefecture-level city is the capital of the province.
Log employment,2000	Log value of local employment in 2000. Source : Tabulation on the Population Census of the People's Republic of China by County (2000).
Unemployment rate(%), 2000	Unemployment rate in 2000. Source : Tabulation on the Population Census, published by province (2000).
Share of non-tradable employ. (%), 2000	Non-tradable employment divided by local employment. Source : Tabulation on the Population Census of the People's Republic of China by County (2000).
Share of gov. employ. (%), 2000	Government employment divided by local employment. Source : Tabulation on the Population Census of the People's Republic of China by County (2000).
Nearby provincial municipality	A dummy variable that equals to 1 if the prefecture-level city has a common border with one of provincial municipalities including Beijing, Shanghai, Tianjin, and Chongqing.
Log night light density 1995-1999 in nbr. areas	Log value of average light density in neighboring areas from 1995-1999. Neighboring cities are identified in ArcGIS. Source: National Geographical Data Center;Center for International Earth Science Information Network.
Proximity to nearest port city	Reciprocal of one plus distance to the nearest port city in thousands of kilometers. Distance to the nearest port city are calculated in ArcGIS.
Rainfall (meters)	Average precipitation from 1950-2000. Source: Global Climate Data.
Temperature (Celsius)	Average temperature from 1950-2000. Source: Global Climate Data.
Altitude (100 meters)	Average altitude in each city. Source: Global Climate Data.
	Variables not in regression
Employment Share by Sector	Source: China Population and Employment Statistics Yearbook (2011).
China's Share World Manufacturing Output	Manufacturing output in China divided by World manufacturing output. Source: World Bank World Development Indicators.
Manufacturing Growth in China	Annual growth of firms and employment from 2000-2010. Source: Industrial Economy Statistical Yearbook (2001-2011).
SOE output by industry	SOE output divided by total output by industry (2000, 2010). Source:China Regional Statistical Yearbook (2001, 2011).
Education by industry	Source: National Population Census (2010).