Trade Liberalization and Economic Development: Evidence from China's WTO Accession*

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Abstract

We study the effect of improvements in foreign market access brought by China's WTO accession on Chinese local economies. We exploit cross-city variation in these improvements stemming from initial differences in sectoral specialization and exogenous cross-industry differences in US trade liberalization that originate from the elimination of the threat of a return to Smoot-Hawley tariffs for Chinese imports. We find that Chinese cities that experience greater improvement in their access to US markets following WTO accession exhibit faster population, output and employment growth as well as increased investment and FDI inflows. The benefits of WTO membership for Chinese local economies are augmented by significant local spillovers. These spillovers operate both from the tradable to the nontradable sector and within the tradable sector. Within the tradable sector, spillovers are transmitted primarily via labor market linkages. We find important local demand linkages from the tradable to the nontradable sector. Most local service sectors benefit from trade liberalization. In particular, our evidence suggests that increased investment demand caused by trade liberalization drives financial sector growth. We find little effect of trade liberalization on local wages. Alongside our results on population and employment, this indicates that local labor supply elasticities are high in our setting. Our findings can be explained by a Lewis model of urbanization that combines geographic mobility with an abundant reserve of labor.

JEL classification: E22, E23, E24, F13, F15, F16, F63, F66, J61, O18, O19, R12, R23

Keywords: trade liberalization, development, China, WTO, local economies

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1 Introduction

China's integration into the world economy has been one of the defining economic events of the past three decades. Between 1990 and 2010 China's exports at current prices expanded almost 35-fold while the world's share of imports from China increased from 2 to 11 percent. The liberal international trading environment of recent decades and China's integration into the institutions of world trade, most notably the World Trade Organization (WTO), likely played a role in its trading success (Ghosh and Rao 2010). Much of China's export boom took place after its WTO accession in 2001, with China's export to GDP ratio expanding from 20% to more than 36% between 2001 and 2007.

Most of the existing literature has analyzed China's integration into the world economy through the prism of its trading partners. Chinese import competition has been particularly explored: a number of studies have identified negative effects on import competing industries and regions in both developed and developing economies (Autor, Dorn and Hanson 2013; Costa, Garred and Pessoa 2015; Pierce and Schott 2015). However, the impact of trade integration on China itself is of equal consequence. As it integrated into the world economy, China experienced sustained rapid economic growth, structural transformation, and the largest episode of rural-to-urban migration ever recorded. Given the size of China's economy and the magnitude of its international trade, the effects of integration into the world economy on China itself may be quantitatively important from a global perspective. Moreover, if the trade regimes of China's main trading partners during this period played a role in its exporting and overall economic success, any assessment of the global welfare impacts of these policies needs to take into account their effect on economic outcomes in China.

In this paper, we study the effects of improvements in foreign market access caused by China's WTO accession on Chinese local economies. We focus our analysis on cities because they represent integrated local economies and labor markets. We relate changes in local economic outcomes from 1998 to 2007 across Chinese cities to changes in their foreign market access. Identifying variation emerges from two sources. First, cities differ in their initial industry specialization. Second, China's WTO membership improved its access to US markets, and the magnitude of this US trade liberalization exhibits plausibly exogenous variation across industries (Pierce and Schott 2015).

Chinese local economies display substantial variation in sectoral composition. The share of local employment in manufacturing ranges from 26% in the bottom quartile to more than 43% in the top quartile. Within manufacturing there is also broad geographic variation in sectoral specialization, and many manufacturing sectors display a high degree of spatial concentration. For example, in 1998, 32% of employment in "Ovens and furnaces", 38% of employment in "Industrial process control equipment"and 31% of "Sports goods"employment was concentrated in just 3 cities while the share of local employment in "Games and Toys"across cities ranged from 0% to 17.4%. Following Bartik's (1991) approach we construct city-level measures of improvements in foreign market access as the average of sector-level market access improvements weighted by each industry's initial share of total employment in the city. By construction, our measure of city-level trade liberalization varies with the relative size of the local manufacturing sector and with the relative importance of different industries within manufacturing. As Chinese cities display great variation in the composition of manufacturing and WTO accession was associated with significant variation in the intensity of trade liberalization across sectors, differences in the composition of local manufacturing account for about 70% of the variation of our measure of improvements in access to foreign markets at the local level.

Our identification strategy relies on a source of exogenous cross-industry variation in the benefits of WTO membership first highlighted by Handley and Limao (2015) and Pierce and

Schott (2015). WTO membership brought about a meaningful improvement in China's access to foreign markets even though it was not associated with a substantial reduction in the tariffs applied to Chinese exports by major trading partners. In particular, the level of expected tariffs and the dispersion of the tariff distribution faced by Chinese exporters to the US both declined sharply.[1] This was because membership of the WTO triggered the award of permanent Most Favored Nation (MFN) status by the US to China, which substantially lowered the likelihood that the trading environment between the two countries would deteriorate sharply.

WTO membership eliminated the threat that the US would revert to imposing the punitive Smoot-Hawley tariff schedule on Chinese exporters. Before WTO accession, China's Most Favored Nation status and its associated low tariffs were subject to annual renewal in the US Congress. Discussions on this topic were often politically contentious. While Congress never failed to renew China's Most Favored Nation status, the likelihood of non-renewal was perceived as significant and economic agents in both countries cited it as an important barrier to bilateral trade. WTO accession permanently set US tariffs on Chinese goods at low MFN levels. Crucially, the Smoot-Hawley tariff schedule that would have prevailed if China's MFN status had not been renewed displayed broad variation in tariffs across different product categories. This implies that elimination of the threat of MFN non-renewal was much more consequential for some products and sectors than others and resulted in significant cross-industry variation in US market access improvements brought about by WTO membership.

The most important feature of this change in US trade policy is its plausible exogeneity to economic conditions in China at the beginning of the twenty-first century. Most (eighty nine percent) of the variation in US market access improvements at the product level come from variation in the Smoot-Hawley tariff schedule, which was set 70 years prior to China's WTO accession. This effectively rules out any simultaneity concerns that may have arisen if the specifics of the trade policy change were influenced by considerations pertaining to China's comparative advantage and recent economic performance.

Moreover, the improvement in market access caused by permanently fixing tariffs at the low levels applicable to WTO members had an important effect on China's subsequent export activity, as prior work has established (Handley and Limao 2015; Pierce and Schott 2015). This ensures that the US trade policy reform we rely on for identification indeed represented a significant positive shock for Chinese manufacturing sectors. Our identifying variation comes from changes in US trade policy resulting from China's WTO accession, which means we are only able to study the impact of improvements in access to US markets over this period. However, given the US's status as China's largest trading partner (accounting for 19% of China's exports and 8% of its imports), the improvement in US market access we analyze likely had an important contribution to the overall foreign market access improvements experienced by China over this period.

We are, to the best of our knowledge, the first to causally identify the effect of foreign trade liberalization on local economies in China. Our focus on the analysis of local economies allows us to make several contributions to the existing literature. First, it allows us to deliver a more complete assessment of the effects of trade liberalization on economic outcomes in China. We are able to study not only the effects of US market access improvements on the local tradable sector, but also the transmission of these effects to the local nontradable sector. Moreover, our methodology allows us to assess the importance of local spillovers and agglomeration forces within the tradable sector in shaping the overall magnitude of the reform's impact on China's urban economies. Second, detailed firm level data allow us to explore the specific channels of

[1] In the existing literature (Handley and Limao 2012; Handley 2014; Handley and Limao 2014; Pierce and Schott 2015), declines in expected tariffs and reductions in the dispersion of the tariff distribution are typically bundled together and described as reductions in "Trade Policy Uncertainty".

spillover transmission. Finally, studying city-level outcomes offers an answer to the difficulty of mapping industry-specific trade shocks into aggregate outcomes. Looking at country-level quantities creates a degrees-of-freedom problem because there are few observations and many potential confounds. Our focus on differences across cities solves this problem by increasing the number of observations available for study.

We find that WTO accession had substantial positive effects on Chinese local economies. Cities that experienced greater improvements in US market access display faster population, employment and output growth. However, we find no effects of trade liberalization on local wage growth. Our findings are consistent with a simple theoretical framework in which low frictions to geographic mobility and an abundant reserve of rural labor (in the spirit of Lewis 1954) imply that cities most affected by trade liberalization adjust to this positive shock by drawing labor from the surrounding hinterland.

The estimated effects of WTO accession on local economies are large. In our preferred specification, moving a city from the 25th to the 75th percentile of exposure to US trade liberalization is associated with an 11% increase in city population, a 12% gain in city GDP and a 23% increase in broad employment at the city level between 1998 and 2007. Back of the envelope calculations based on our estimates indicate that US trade liberalization can account for up to half of the population growth and three quarters of the manufacturing employment growth recorded by the average Chinese city between 1998 and 2007.

We also study the impact of improvements in access to foreign markets on several other economic outcomes at the city and the (spatially coarser) prefecture levels.[2] Our results indicate that local economies that benefit from greater improvements in market access experience an acceleration of investment activity in the period following WTO accession. Part of the growth in investment activity in these locations is financed via increasing FDI inflows. The number of local exporters also rises. Suggestive evidence indicates that the value of exports and the number of firms in these locations also increase.

We find that local spillovers had an important contribution to the overall effect of US market access improvements on local economies. Our analysis of employment across broad sectors reveals that improvements in market access have the largest impact on the (tradable) manufacturing sector. However, WTO accession also has an important impact on local (nontradable) services. The impact of improvements in US market access for the service sector is more than half as large as for the tradable sector. Given that at the start of our period of analysis the tradable sector accounts for a somewhat larger share of employment in the typical Chinese city than services, our estimates indicate that for each two local manufacturing jobs created or saved by improvements in market access, an additional job is created or saved in the local service sector. This local multiplier is markedly lower than that found by Moretti (2010) for the US, but is nevertheless sizable.

In light of this finding we conduct a detailed analysis of local spillovers from the reform. First, we focus on the effects of market access improvements within the tradable sector. Exploiting our detailed firm-level data we relate outcomes across prefecture-industry cells to US market access improvements affecting co-located sectors. We find that the typical local manufacturing sector benefits across a broad range of performance metrics from being co-located with other sectors that experience important improvements in market access, even when controlling for measures of own-sector US trade liberalization caused by WTO accession.

These within-manufacturing spillovers are large. For the "average" manufacturing sector located in a city with average characteristics, a back of the envelope calculation based on our preferred estimates indicates that only about 40% of the effect of WTO accession on local employment can be attributed to own-sector market access improvements, while the rest is due

[2] A prefecture is an administrative unit that includes a main city and its hinterland.

to local spillovers. Building on the work of Ellison, Glaeser and Kerr (2010) we also study the channels through which local spillovers within manufacturing are transmitted. We find that spillovers transmitted via labor market linkages account for virtually the entire effect of within-manufacturing spillovers identified in our setting.

In the second part of our local spillover analysis we further investigate the transmission of the effects of WTO accession to the nontradable sector. We first confirm that demand linkages from the tradable to the nontradable sector were an important avenue for the transmission of the trade liberalization shock. Tertiary sector employment grew faster in cities with a higher exposure to manufacturing sectors that both experienced important improvements in US market access and were heavy users of services in their input mix. We then proceed to explore which nontradable activities stood to benefit the most from WTO membership. We find that improvements in market access had broad-based effects on the local nontradable sector and entailed substantial benefits for most service sectors, including finance, education, government and catering services.

We complete our study of local spillovers from the tradable to the nontradable sector with a more in-depth analysis of the financial sector. Results concerning the impact of the reform on the financial sector are of particular interest since, when coupled with our findings on local investment, they raise the prospect of an investment- financial development channel in the transmission of the trade shock to local economies. In this interpretation, improvements in market access bring about an increase in investment demand in affected locations, and the local financial sector expands in response. We provide additional evidence supporting the operation of this channel by verifying that financial sector growth was more rapid in cities displaying higher exposure to financially dependent sectors. Using the standard Rajan and Zingales (1998) measure of financial dependence we construct a city-level index of financial dependence. Consistent with an investment-financial development channel, we find that improvements in US market access are, ceteris paribus, associated with larger increases in financial sector employment and in the city-level stock of debt in locations where manufacturing is more financially dependent.

Our findings of high local labor supply elasticities and significant migration in response to WTO accession stand in contrast with the results of much of the existing literature that analyzes the effect of trade shocks on local labor markets (Topalova 2007, 2010; Autor, Dorn and Hanson 2013; Kovak 2013). Moreover, our findings are perhaps surprising given the continued importance of the Chinese *hukou* (or household registration) system during our period of analysis. We provide a brief discussion of the potential drivers of our results and put forward two explanations for why local labor supply elasticities may be high in our setting: (1) particularities of China with respect to labor supply abundance; (2) the nature of the shock under analysis, which differs substantially from those studied in previous work. Existing work mostly focuses on negative, import-competition shocks, while we analyze a positive market-access shock induced by trade policy.

China displays a number of unique features during our period of analysis. The literature analyzing China's labor markets concludes that at least until very recently the Chinese economy has indeed operated in a Lewis (1954)-type regime, in which the abundance of cheap migrant labor from rural areas has limited wage growth and has fueled the growth of the export sector (Yao 2010; Chan 2012).[3] Furthermore, in spite of the strictures of the *hukou* system, China has experienced the largest rural to urban migration in history over the last three decades (Chen, Jie and Yue 2010).

The second potential explanation for the high local labor supply elasticities we find in our setting relates to the sign of the shock we analyze. Unlike most prior studies, we study the impact of a positive trade shock on local labor markets. As Glaeser and Gyourko (2005) noted, housing (and implicitly labor) supply elasticities are likely to be much higher in the face of

[3]In fact, the debate about whether or not China has reached the "Lewis Turning Point"continues even today.

positive shocks than in the face of negative shocks because housing is a durable good. This asymmetry in housing supply elasticities to different types of shocks may in turn help account for the differences between our findings and those of prior work.

To shed additional light on the drivers of our results on population and employment we make use of data at multiple levels of spatial aggregation to study migration patterns. We find that most migration in response to trade liberalization takes place within prefectures, consistent with the fact that the *hukou* system imposes fewer restrictions on within-prefecture migration (Baum-Snow et al. 2015). By contrast, migration across prefectures is limited. These results indicate that the constraints of the *hukou* system are important, but were likely not binding in our setting. Cities had access to sufficient labor in their immediate hinterlands to be able to absorb the trade shock without a sharp increase in local wages. Our results from these checks also indicate that some but not all of the economic effects of market access improvements we detect at the city level reflect within-prefecture reallocation of economic activity towards central cities.

The rest of the paper is structured as follows. Section 2 relates the present study to the existing literature. Section 3 outlines our methodology and data sources, while Section 4 reports and discusses our results on the local economic effects of WTO accession. Section 5 analyzes the contribution of local spillovers to the overall effects of US trade liberalization on local economies in China. Section 6 discusses our finding of large local labor supply elasticities. Section 7 assesses whether improved access to US markets had heterogeneous effects on cities with different initial characteristics. Section 8 implements a series of robustness checks and alternative specifications to address a series of concerns about omitted variable bias, measurement and data quality that may affect our baseline analysis. Section 9 provides concluding remarks.

2 Related Literature

This paper contributes to several strands of existing literature. The first is the literature analyzing China's integration into the world economy, with a focus on the episode of China's entry into the WTO. Much of the work in this strand of literature focuses on the effects of China's entry into the world trading system on its trading partners (Bloom, Draca and Van Reenen 2015; Bloom, Romer, Terry and Van Reenen 2015; Di Giovanni, Levchenko and Zhang 2014; Amiti and Khandelwal 2011; Andersen, Barslund, Hansen, Harr and Jensen 2013; Rumbaugh and Blancher 2004; Walmsley, Hertel and Ianchovichina 2001) though some studies also focus on the effects on China itself (Brandt, Van Biesenbroeck, Wang and Zhang 2012; Khandelwal, Schott and Wei 2012; Ianchovichina and Martin 2004).

Moreover, the current study also fits into a closely related but conceptually broader literature that analyzes the effects of WTO membership and accession on trade and broader economic outcomes (Rose 2004a; Rose 2004b; Subramanian and Wei 2007; Tomz, Goldstein and Rivers 2007; Liu 2009; Rose 2010; Dutt, Mihov and Van Zandt 2013; Grant and Boys 2012; Staiger and Tabellini 1999; Li and Wu 2004; Tang and Wei 2009)[4]. Our paper provides additional evidence that WTO accession (and other episodes of trade liberalization) may have an important impact on trade flows and on economic development in new member countries. Furthermore, our results provide a cautionary note that the magnitude of effective trade liberalization may be large and corresponding economic benefits substantial even in settings in which traditional metrics of trade barriers (such as tariffs or NTBs) remain largely unchanged.

We also contribute to the body of work in labor, trade, and development economics that as-

[4] For a review of the literature on the economic impacts of WTO accession and membership see Anderson (2014).

sesses the local labor market effects of trade liberalizations and other trade related shocks (Borjas and Ramey 1995; Chiquiar 2008; Topalova 2007, 2010; McCaig 2011; Kovak 2013; Autor, Dorn and Hanson 2013; Costa, Garred and Pessoa 2014; Dix-Carneiro 2014; Dix-Carneiro and Kovak 2015)[5]. Relative to this literature contribute the analysis of a novel type of trade policy shock represented by changes in tariff expectations and in the dispersion of the distribution of potential tariffs. This type of reform is likely to be of increasing interest to researchers given the changing nature of modern trade agreements. These tend to increasingly emphasize issues such as investment and intellectual property protection relative to traditional considerations like tariffs and other trade protections, which is unsurprising given the reduced magnitude and diminished role of the latter.

Our paper also adds to the emerging literature on trade policy uncertainty (Handley and Limao 2012,2014; Handley 2014; Pierce and Schott 2015; Limao and Maggi 2015; Feng, Li and Swenson 2014). This literature has focused on industry-level effects of reductions in expected tariffs and in the dispersion of potential tariffs and has mainly investigated outcomes in developed countries, particularly the US. To the best of our knowledge, we are the first to employ a local economies approach to study the implications of improvements in market access brought about by reductions in trade policy uncertainty. Our approach is complementary to that of existing work. It also allows us to study the contribution of local spillovers to the overall impact of trade liberalization on economic outcomes in China.

An additional contribution of our paper in the context of the trade policy uncertainty literature is its focus on a major developing country experiencing a positive shock to its foreign market access as a result of a reduction in trade policy uncertainty. Most of the existing literature has focused on assessing the effects of import competition, spurred by reductions in trade policy uncertainty, on developed country outcomes.

Finally, our study is also related to the broader literatures on investment under uncertainty (Bernanke 1983; Dixit 1989; Bloom et al. 2007; Roberts and Tybout 1997; Impullitti et al 2013) and economic policy uncertainty (Rodrik 1991; Baker et al. 2013.) as well as to the literature assessing the effects of international trade integration on intra-country economic geography (Krugman and Livas Elizondo 1996; Paluzie 2001; Monfort and Nicolini 2001; Behrens, Gaigne, Ottaviano and Thisse 2006*a*, 2006*b*, 2007, 2009; Overman and Winters 2011).

3 Methodology and Data

Our main focus is on assessing the causal impact of improvements in foreign market access brought by China's WTO accession on Chinese local economies. We estimate specifications of the type:

$$y_{ct} = \alpha + \beta TradeLib_{ct} + \gamma_t + \delta_c + \epsilon_{ct} \tag{1}$$

where y_{ct} is a measure of local economic outcomes and $TradeLib_{ct}$ is a measure of local exposure to foreign trade liberalization. This empirical approach has the advantage that it allows us to study the total effects of foreign trade liberalization on economic outcomes in China, inclusive of indirect effects that stem from the transmission of the trade shock to the nontradable sector and of any amplification (dampening) effects caused by local spillovers (i.e., agglomeration or congestion forces).

Our focus on local economies also brings with it a complication that stems from the geographic

[5]In turn, this strand of literature can be seen as part of a wider body of work on local economic dynamics due to local exogenous shocks. Other, non-trade elated papers in this literature include Black et al. (2005), Moretti (2010), Chodorow-Reich et al (2012), Wilson (2012), Shoag (2012), Serrato and Windenger (2014) and Zou (2015).

mobility of factors in a within country setting. In this context it becomes unclear which set of local economic outcomes are most relevant for capturing the economic effects of improvements in foreign market access. To clarify matters, before discussing our empirical strategy we provide a brief theoretical discussion of the expected local effects of trade liberalization. A more formal treatment is provided in the Appendix.

3.1 Theoretical Discussion

Imagine a national economy (China) composed of N local economies or cities. Production in this economy takes place in multiple (S) sectors. Cities are heterogeneous in their sectoral specialization. This heterogeneity may stem from multiple sources. It may result from differences in local natural advantage (i.e. extractive industries and related activities tend to locate close to mineral resources). Alternatively, it may stem from agglomeration forces and path dependence, with a particular industry locating in a particular region "by accident"and remaining there due to agglomeration economies. This distinction notwithstanding, the simplest formalization of heterogeneity in sectoral specialization across cities is provided by a specific factors model, in which each sector requires a sector specific factor in its production function and there is an exogenous geographic distribution of specific factors across space.

In this paper we study a set-up in which, initially, foreign trade restrictions impose sector specific trade barriers given by $\{b_1, b_2, \ldots, b_S\}$, which are eliminated upon China's entry into the WTO. This results in positive trade shocks that are heterogeneous across sectors, with industries that faced higher initial foreign trade barriers standing to benefit more, ceteribus paribus, from WTO membership. Moreover, heterogeneity in sectoral composition across cities coupled with asymmetric shocks to different sectors resulting from trade liberalization imply that the benefits from trade liberalization are also heterogeneous across local economies. We expect local economies that specialize in the sectors most positively affected by trade liberalization to display increases in output and increases in factor demand. Depending on factor mobility, increases in local factor demand in turn lead to increases in local factor prices (wages, rents), increases in local factor quantities (population, employment) or a combination thereof.[6]

The discussion above reveals that improvements in local economic conditions as a result of exposure to foreign trade liberalization should be reflected in (one or more of) increases in output, population, employment, wages and aggregate capital stock (the latter resulting from mobility of capital across space). These are the main local economic outcomes we will focus on in our empirical study of the impact of improvements in foreign market access on Chinese local economies.

3.2 Measuring Local Exposure to Trade Liberalization

To estimate the causal effect of improvements in foreign market access on local economic outcomes via specifications of the type described in equation (1) we require a measure that captures plausibly exogenous variation in trade liberalization across Chinese local economies. To obtain such a measure, we proceed in two steps. In the first, we follow Pierce and Schott (2015) and Handley and Limao (2015) and exploit changes in US trade policy triggered by China's WTO accession to derive an exogenous measure of US trade liberalization at the product level. In the second step, we employ a two stage aggregation procedure to construct a plausibly exogenous measure of improvements in US market access at the level of Chinese local economies. We

[6]Note that in contexts in which factor mobility is important, movements in aggregate measures of factor prices (such as average wages) are difficult to interpret, as they may simply reflect compositional effects brought about by factor migration.

describe these two steps of the construction of our main variable of interest in greater detail below.

3.2.1 WTO Accession, US Trade Policy and Product-Level Trade Liberalization[7]

Policy Background China's WTO accession was not associated with a substantial reduction in the tariffs applied to Chinese exporters by major trading partners. Overall, China already benefited from low tariffs from its partners because it enjoyed Most Favored Nation (MFN) status or due to bilateral trade agreements. However, WTO accession triggered a change in the US trade policy regime towards China that amounted to a significant improvement in access to US markets for Chinese exporters.

The United States operates two different tariff schedules applicable to imports: the MFN tariff schedule and the Smoot-Hawley tariff schedule.[8] The former features low tariffs (about 4% on average) and is applicable to members of the WTO and to countries that have been awarded MFN status. The latter features much higher tariffs (31% on average), originally set under the Smoot-Hawley Tariff Act of 1930, and is applicable to a small set of countries considered to be "non-market"economies.

Since the US trade act of 1974, US presidents have been allowed to grant MFN tariff rates to non-market economies on a temporary basis subject to Congressional approval. China was first awarded MFN status in 1980, and its status was renewed every year until China's WTO accession 2001. Throughout this period, while MFN renewal kept the tariffs faced by Chinese producers low, the need for annual renewal of China's MFN status in the US Congress was an important source of uncertainty surrounding the continuation of the low tariff regime.

The likelihood that Congress would fail to renew China's MFN status was not negligible. In fact, China came close to having its MFN status revoked on a number of occasions. For instance, after the Tiananmen Square protests there was pressure to revoke China's MFN status, and Congress voted on such a bill every year in the 1990s. Bills to revoke China's MFN status were passed by the House of Representatives on three occasions (1990, 1991 and 1992 but were not confirmed by the Senate). The average share of the vote in the House in favor of revoking China's MFN status between 1990 and 2001 was 38%.

Anecdotal evidence from the time indicates that the risk of Congress removing China's MFN status (particularly during periods of tensions between the two countries) was taken seriously by policymakers and market participants in both countries. Thus, in a 1994 report by the U.S. General Accounting Office, U.S. firms "cited uncertainty surrounding the annual renewal of China's most-favored-nation trade status as the single most important issue affecting U.S. trade relations with China "and indicated that "uncertainty over whether the U.S. government will withdraw or place further conditions on the renewal of China's most-favored-nation trade status affects the ability of U.S. companies to do business in China"(U.S. GAO 1994). In a similar vein, in 1997 the Chinese Foreign Trade Minister urged the U.S. to abandon trade status reviews: "The question of MFN has long stymied the development of Sino-U.S. economic ties and trade (...) [It] has created a feeling of instability among the business communities of the two countries and has not been conducive to bilateral trade development".

Measuring Product Level Trade Liberalization Upon its entry into the WTO in 2001, China was granted Permanent Most Favored Nation status by the US, which meant that it would

[7]The discussion of the policy background and some of the anecdotal evidence provided draw on discussions in Pierce and Schott (2015); and Handley and Limao (2014)

[8]The MFN tariff schedule is also sometimes referred to as the "Normalized Trade Relations (NTR)" tariff schedule or as "column 1 tariffs". The non-MFN or Smoot-Hawley tariff schedule is also referred to as the "column 2" or "non-NTR" tariff schedule.

benefit from automatic MFN status without annual renewal by Congress. This finally eliminated the risk of large spikes in tariffs faced by Chinese exporters to the US before 2001. Crucially, while non-MFN tariffs were universally higher than MFN tariffs, the *gap* between the two tariff schedules varied broadly across product categories. As a result, the possibility of non-renewal of China's MFN status was more problematic for exporters of products that stood to experience larger tariff spikes in the event of non-renewal. Conversely, we would expect producers of these commodities to benefit the most from the award of permanent MFN status to China following its WTO accession.

We follow Pierce and Schott (2015) and draw on this feature of the pre-WTO US trade policy regime to construct a measure of the restrictiveness of pre-2001 US trade policy at the level of individual products. This measure, named the "Normalized Trade Relations gap" by Pierce and Schott (2015) quantifies the pre-WTO implicit US trade barriers faced by Chinese exporters at the level of individual products as the gap between the Non-MFN and MFN tariffs applicable to each product. Formally, we define

$$TariffGap_{k1998} = Non\_MFNtariff_{k1998} - MFNtariff_{k1998} \tag{2}$$

Where:

- $TariffGap_{k1998}$ denotes the gap between Smoot-Hawley and MFN tariffs for product k at the start of our period of analysis (1998).
- $Non\_MFNtariff_{k1998}$ denotes Smoot-Hawley tariffs for product k at the start of our period of analysis (1998).
- $MFNtariff_{k1998}$ denotes MFN tariffs for product k at the start of our period of analysis (1998).

This product level measure of the constraints imposed by the pre-WTO US trade regime displays a number of attractive features. As shown in Figure 1, it is characterized by substantial variation across product categories, with a standard deviation above 15 percentage points. It is also plausibly exogenous to product and sector level outcomes in China. This is because most (about eighty nine percent) of the variation in tariff gaps arises from variation in non-MFN rates that were set 70 years prior to China's WTO accession. Even if we believed that MFN tariffs were set to protect US sectors currently more vulnerable to Chinese competition this would bias results against finding an effect of improvements in US market access caused by WTO accession. In this case we would in fact observe that products in which China has comparative advantage would face higher MFN tariff rates and *lower* tariff gaps and thus experience smaller improvements in US market access post-2001.

We define US post-WTO trade liberalization at the product level as the interaction of product tariff gaps and a post-2001 dummy:

$$TradeLib_{kt} = TariffGap_{k1998} * Post_t \tag{3}$$

This measure of the change of US trade policy at the level of individual products is a strong predictor of growth in Chinese exports to the US post-2001 (Pierce and Schott 2015; Handley and Limao 2015), which reassures us that it captures a significant positive trade shock for the manufacturers of affected products.[9]

[9]We also test the relevance of product level tariff gaps for predicting Chinese exports after 2001 and confirm the relevance of the analyzed US trade policy change.

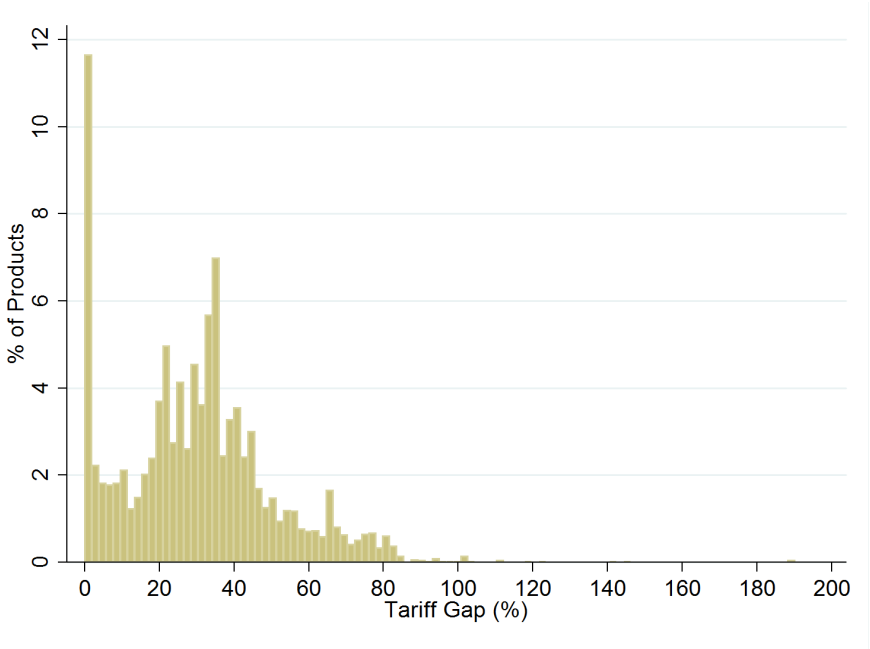

Figure 1: The distribution of product-level tariff gaps

3.2.2 Industry Level and City-Level Trade Liberalization

In the second step of constructing city level measures of exposure to US trade liberalization we first aggregate the product level tariff gaps obtained above to the sectoral level, making use of conversion tables provided by UN Statistics. More formally, we define initial period (1998) tariff gaps at the industry level as the simple mean of the product level tariff gaps, applicable to the products belonging to each sector. Formally,

$$TariffGap_{i1998} = \frac{\sum_{k \in i} TariffGap_{k1998}}{\sum_{k \in i} 1} \tag{4}$$

where $TariffGap_{i1998}$ denotes the average gap between Smoot-Hawley and MFN tariffs at the sector level in the initial period of our analysis (1998). Analogously to the previous section, we define sector level improvements in US market access caused by China's WTO accession as:

$$TradeLib_{it} = TariffGap_{i1998} * Post_t \tag{5}$$

where i indexes industries and $Post_t$ again represents a post-WTO dummy.

We proceed to build city-level measures of exposure to the constraints of the US pre-WTO trade regime by aggregating sectoral-level tariff gaps to the city level via the methodology of Bartik (1991)[10] Using this approach, city-level exposure to market access uncertainty is defined

[10]Strictly speaking, the region-level measure of exposure to initial US trade barriers we define in equation (6) and use throughout our analysis is defined at the spatially coarser prefecture level. We do this for two reasons. First, matching firm locations to prefectures can be performed with less risk of error than matching at the city level. Second, using prefecture level measures of US trade liberalization gives us direct comparability of results between our main specifications and prefecture-level specifications used in the study of some additional outcome variables as well as in our more detailed discussion of migration in section 6. Results are unaffected when we define measure of US trade liberalization at the "city proper" level.

as an index in which sectoral level trade constraints are weighted according to each sector's pre-reform (in our case 1998) share in the city's overall employment.[11] More formally, we define city-level tariff gaps as:

$$TariffGap_{c1998} = \frac{\sum_i Employment_{i,c,1998} * TariffGap_{i1998}}{TotalEmployment_{c,1998}} \tag{6}$$

Where

- $Employment_{i,c,1998}$ is employment in sector i in city c in the initial time period (1998).
- $TotalEmployment_{c,1998}$ is total employment in city c in the initial period (1998).

The city-level measure of pre-WTO US trade barriers defined above has the nature of a scaled index as defined by Topalova (2007, 2011). This is because the sectoral employment numbers used to weight the importance of sector-level market access uncertainty in the construction of the city level measure do not add up to the denominator of the index. Indeed, the sectoral employment figures used in the numerator of our index only sum to total city-level *manufacturing* employment, whereas in the computation of our index we normalize by total city-level employment. As a result, variation in our city level tariff gap measures comes from two sources: variation in the relative size of manufacturing employment in total local employment; and variation in the composition of manufacturing employment. Alternative measures of US trade barriers at the city level that neutralize variation coming from the first source (variation in the size of the manufacturing sector) shall be used in robustness checks performed in Section 8.

We define our measure of improvements in US market access associated with China's WTO accession as

$$TradeLib_{ct} = TariffGap_{c1998} * Post_t \tag{7}$$

where c indexes cities and, as before $Post_t$ represents a post-WTO dummy. This measure represents our main variable of interest when estimating specifications of the type given by equation (1). Figure 2 maps the magnitude of US trade liberalization associated with China's WTO accession across prefectures that are part of our sample. Visual inspection reveals substantial variation in exposure to US market access improvements across Chinese prefectures. While there is some clustering of areas standing to benefit most from WTO accession (particularly in the South-East and South), areas that face substantial exposure to US trade liberalization can be found across multiple provinces in our sample and also in inland regions. All in all, our city-level measure of US market access improvements displays sufficient variation to allow for the effects of trade liberalization to be disentangled from confounding factors pertaining to China's geography.

Our measure of trade liberalization only captures changes in US trade policy resulting from China's WTO accession, which means we are only able to study the impact of improvements in access to US markets over this period. However, given the US's status as China's largest trading partner, the improvement in US market access we analyze likely made an important contribution to the overall foreign market access improvements China experienced over this period.

3.3 Geographic Measurement

To assess the local economic impact of foreign market access improvements we require an appropriate definition of local economies. Conceptually, we are interested in the analysis of integrated local economies or local labor markets, broadly corresponding to the notions of Metropolitan

[11] For a discussion of some of the limitations of this methodology see Monte (2015).

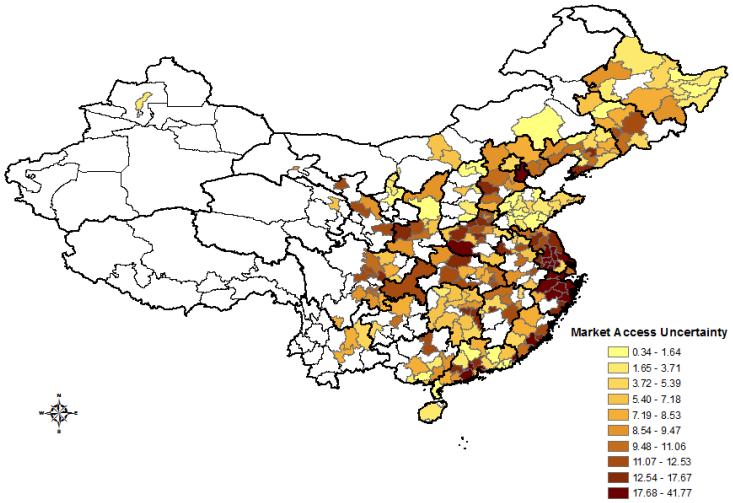

Figure 2: Improvements in market access across prefectures

Statistical Areas (MSAs) or Commuting Zones (CZ) in the United States. Due to the complexity of China's territorial administration system, finding an empirical counterpart for the notion of an integrated local economy in the Chinese context is not straightforward. In this section we clarify a few issues regarding the spatial units that form the object of our analysis.

China's administrative system is structured along five levels of local government: the province, prefecture, county, township and village. Our study is focused on spatial units of analysis that belong to the first three categories, namely provinces, prefectures and counties. China's territory is organized into 33 provincial level units, four of which are represented by the provincial level cities of Beijing, Tianjin, Shanghai and Chongquing.[12] These large cities are included in our main analysis, though we check that our results are robust to their exclusion. Provinces are organized into prefecture level units, with 332 such units covering the entire territory of the country.

Confusingly, most of these prefecture level units (284 out of 332) carry the title of "prefecture-level cities". However, in spite of their name, these administrative units are not in fact cities, but much larger spatial units, often covering areas greater than 10 thousand square kilometers. These units are composed of a large central city and the surrounding hinterland, which may itself contain smaller cities. In order to avoid confusion between "prefecture-level cities"and cities as commonly understood we will revert to the terminology that prevailed before the administrative reforms of the 1980s and call these administrative units *prefectures* for the rest this paper.

Our main source of spatial economic data, the China City Statistical Yearbooks (CSY) contains information at two level of spatial disaggregation: the prefecture and the urban ward of

[12] China's administrative system includes Taiwan as a provincial level unit (the relevant literature often describes Taiwan as a "claimed province"). If Taiwan is excluded, China's administrative system comprises 32 provincial level units.

the prefecture (*shixiaqu*). This latter notion (the *shixiaqu*) is defined by the National Bureau of Statistics (NBS) to correspond to the central city of the prefecture. Urban wards are broadly comparable to the concept of metropolitan statistical area (MSA) used in the urban economics literature focusing on the United States. We follow the existing literature (Anderson and Ge 2005; Soo 2005; Peng 2010; Lin, Cheng and Yang 2013; Lin 2015) in regarding urban wards as the most credible definition of integrated local economies and focus our main analysis on these units.[13] For ease of exposition we call urban wards *cities* for the rest of the paper.[14]

For the purposes of some of our robustness checks that make use of data from the Census it is also important to understand how the spatial units featured in the City Statistical Yearbooks map into China's sub-prefectural administrative units. From an administrative perspective, Chinese prefectures are sub-divided into county level units. These are of three types: counties (*xian*), county-level cities (*shi*) and urban districts. The area constructed by aggregating all urban districts within a prefecture broadly matches the central city (*shixiaqu*) of the prefecture defined by the NBS, for which data is reported in the China City Statistical Yearbooks.

To illustrate the administrative organization of the typical Chinese prefecture, Figure 4 provides the example of the prefecture of Wuhan. The map depicts the 13 county level units of the prefecture of Wuhan, which together had a population of about 9.7 million in 2010. The units numbered 1 to 6 represent the urban districts of the prefecture, and their union constitutes the city of Wuhan which had a population of about 6.4 million in 2010.

Due to data limitations, our final sample contains 226 cities, 4 with provincial level status and 222 central cities of prefectures.

3.4 Estimation

Our main analysis relates changes in economic outcomes at the level of Chinese cities between 1998 to 2007 to US market access improvements caused by China's WTO accession. We employ a standard difference-in-differences research design (see equation 1). While our source of identification should address any simultaneity concerns, our use of the Bartik (1991) methodology in the construction of city-level exposures to US trade liberalization means that our identification strategy is still subject to the threat of omitted variable bias.

Performing a simple balancedness analysis reveals that our city-level measures of US market access improvements are correlated with initial city characteristics (see table A1). We find that cities subject to greater exposure to US trade liberalization were more likely to contain Special Economic Zones, be located on the coast or closer to ports. They also displayed higher GDP and GDP per capita, a higher capital stock, and higher average wages. We find no association between exposure to improvements in US market access and initial population, employment and infrastructure variables (railway and highway density). All in all, our results indicate that WTO accession may have benefited locations that were already wealthier and more developed in 1998.

To mitigate concerns related to omitted variable bias, we augment the simple specification given in equation (1) with a battery of controls. In our preferred city-level specifications we estimate models of the type:

$$y_{ct} = \alpha + \beta TradeLib_{ct} + \rho Z_{ct} + \theta * Post_t * X_{c1998} + \gamma_t + \delta_c + \epsilon_{ct} \tag{8}$$

where $Post_t$ is a dummy that equals 1 for the post-reform period (after 2001) and 0 otherwise, Z_{ct} are time-varying controls at the city level, γ_t and δ_c are respectively time and city fixed effects, while the terms $\theta * Post_t * X_{c1998}$ control for the potentially time-varying effects of initial

[13] Some of our discussion of the growth and reallocation effects of improvements in US market access, as well as our spillover analysis will make use of data at the coarser prefecture level.

[14] When the distinction between prefectures and cities is not important, we often make use of the term *localities*.

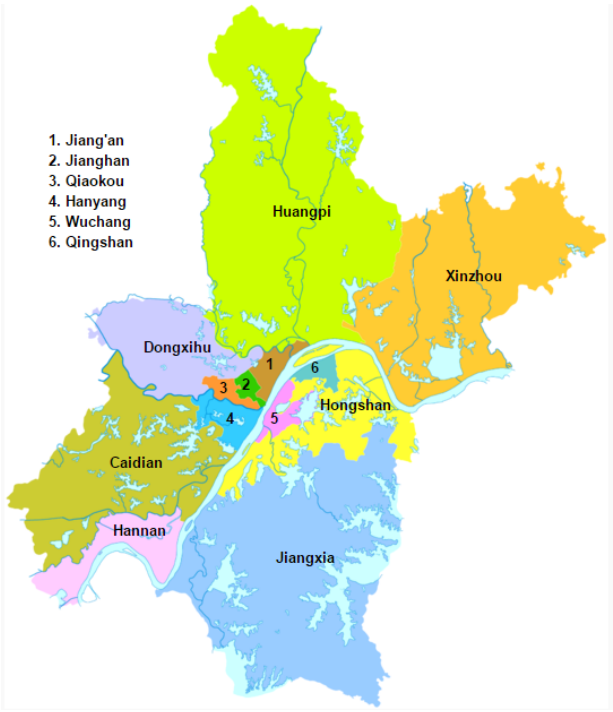

Figure 3: Administrative organization of the prefecture of Wuhan

(1998) city characteristics.
Time-varying controls include an index for the average applied export tariffs at the city-level (computed in a similar way, via the Bartik 1991 methodology, as the city level tariff gaps), and a dummy for a city's special economic zone (SEZ) status aimed at capturing the local economic effects of becoming a SEZ during our period of analysis[15]. Our battery of controls for the time-varying effects of initial city characteristics include the city-level initial manufacturing share of employment, initial SEZ status of the city, a dummy for coastal status, distance to the nearest port, initial highway density, initial railway density, the initial (1998) value of the outcome variable (to control for potential mean reversion) as well as a control for pre-trends in the outcome variable. In all regressions that control for mean reversion in the dependent variable, we instrument for the lagged dependent variable with further lags (1997 values) of the same variable.

Our main outcome variables are those revealed by our simple theoretical framework (and by the urban economics literature) as measures of local economic success: population, employment, output and average wages at the city level. We also study some additional economic outcomes aimed at capturing local investment and the internationalization of local economies. Finally, to control for potential correlation in the error term among neighboring prefectures, standard errors are clustered at the province level in all our city-level specifications. In robustness exercises presented in section 8 we implement several additional checks aimed at addressing concerns related to omitted variable bias.

[15]For a more detailed discussion of the role of SEZ status in fostering development see Wang (2013) and Alder, Shao and Zilibotti (2015).

3.5 Data Sources

Data on actually applied (MFN) and counterfactual (Smoot-Hawley) tariffs for the period 1998 to 2001 is obtained from Feenstra, Romalis and Schott (2002). We complement this with data on actually applied US tariffs for the period 2001 to 2007 obtained from the TRAINS database accessible via WITS. Tariff data from both sources is available at the 8 digit harmonized system (HS) level, and we aggregate it to HS-6 level by taking simple averages.

Measures of manufacturing employment at the city-industry level, required for the computation of the city-level measures of market access improvements, were constructed based on the Annual Surveys of Industrial Firms (ASIF) covering the period 1997-2007. These surveys are designed to include the universe of Chinese manufacturing firms with sales in excess of 5 million RMB or about 800 thousand US dollars. Data include firm sector (4 digit CIC classification), employment, location (6 digit *guo biao* codes - county level units) as well as balance sheet information. Coverage of the surveys is extensive: more than 145 thousand firms are included in the survey in 1998 and more than 311 thousand in 2007. Compared with the universe of of Chinese firms (which can be obtained from the economic censuses for selected years) firms included in the ASIF accounted for 91 percent of gross manufacturing output, 71 percent of manufacturing employment, 97 percent of exports and 91 percent of total fixed assets. Thus, these surveys provide a reasonable basis for determining the sectoral composition of Chinese local labor markets.

To construct city-level measures of US trade liberalization we require that our city-sector employment data and our sector level tariff data are expressed in terms of the same industrial classification. We perform the match between the 4 digit ISIC industrial classification and the 4 digit CIC classification via the conversion table developed by Dean and Lovely (2010).[16]

Finally, data on most outcome and control variables used in this paper is available from Chinese City Statistical Yearbook 1995-2007. The yearbooks contain data at two levels of spatial disaggregation: (1) prefecture level cities (prefectures) and (2) the urban wards of prefecture level cities (cities). We focus our analysis on the city level but employ data at the prefecture level to analyze some outcome variables and in our discussion of migration patterns in section 6. Measures of cities' distance to the nearest port were computed using GIS data from the China City Center at the University of Michigan supplemented with data from the World Port Index. We also construct some additional outcome variables (alternative measure of manufacturing employment, city-level balance sheet variables) by aggregating the firm level data from the ASIF to the prefecture level. For the implementation of some robustness checks concerning our city population findings, we employed county-level census tabulations from the 2000 and 2010 censuses, compiled by China's National Bureau of Statistics (NBS).

4 WTO Accession and Local Growth

4.1 Main Results: Population, Output, Employment and Wages

To obtain an initial assessment of the association between improvements in US market access and local economic performance in China over the period 1998 to 2007 we first implement the simple specification given by equation (1). Table 1 presents our findings on our main variables of interest: population, output, employment and wage growth. We report results for two measures of local employment available from the China City Statistical Yearbooks: "Total Employment"and

[16] Another difficulty related to the process of matching sectors across different industrial classifications emerges from the fact that the CIC industrial classification (which is used in the ASIF) experienced a two changes during the period of our analysis. As a result, in order to obtain a consistent panel of observations at the city-sector level, it was necessary to match CIC codes across time. This match was performed via the conversion tables developed by Brandt, van Biesebroeck and Zhan (2012).

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(Avg. Wage City)
City Trade Lib	0.0203***	0.0167***	0.0406***	0.0149***	-0.00757**
	(0.00308)	(0.00519)	(0.00835)	(0.00463)	(0.00300)
Observations	452	447	452	452	452
R-squared	0.417	0.918	0.403	0.135	0.934
Number of cities	226	226	226	226	226
City FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 1: Baseline Outcomes, No Controls

"Total Staff".[17]

Our results point towards a large effect of improvements in access to US markets on local economic outcomes in China. Cities that benefit from greater improvements in trading conditions with the US experience faster population, output and employment growth in the period following China's WTO accession. Surprisingly, we find a weak but statistically significant negative association between improvements in US market access and local wage growth. The effects of WTO accession are highly statistically and economically significant. Taking a city from the 25th to the 75th percentile of exposure to US market access improvements caused by WTO entry is associated with a 15% increase in city population, 12% increase in GDP and 28% increase in broad employment over the period 1998 to 2007.

A crucial assumption for the validity of our difference-in-differences empirical design is that cities experiencing varying levels of exposure to US trade liberalization were evolving along parallel trends before China's 2001 WTO accession. While data limitations prevent us from rigorously testing this assumption for all our outcome variables, the China City Statistical Yearbooks do contain data on city population and employment going back as far as 1992. We proceed to implement a placebo test by relating the evolution of population and employment at the city level over the period 1992 to 1997 to the intensity of effective trade liberalization brought about by WTO accession at the local level. Effectively we are assuming that China's WTO accession took place in 1992 and we are studying the effects of this "reform"on local population and employment growth.

Our results are presented in Table 2. We find no relationship between exposure to post-WTO improvements in US market access and population and employment growth at the city-level between 1992 to 1997, which lends support to the idea that cities were evolving on parallel trends before WTO accession.

In table 3 we present the results of re-running the analysis above using our preferred specifications given by equation (8). We find similar results to those obtained from the specifications without controls. Employment growth at the city level is strongly related to improvements in US market access, with point estimates somewhat lower than in the prior specification. Improvements in trading conditions with the US also cause faster population and output growth. The magnitudes of the already small coefficients in the wage regressions decline further and become statistically insignificant. This suggests that a substantial fraction of the negative association

[17]The exact definitions of all of the variables used in this paper are available in the Appendix. In the case of the local employment measures, the main difference between the two measures used is that "Employment"constitutes a broader measure of employment than "Total Staff".

VARIABLES	(1) ln(City Pop.)	(2) ln(City Emp.)
City Trade Lib.	0.00399	0.00304
	(0.00239)	(0.00402)
Observations	438	425
R-squared	0.103	0.003
Number of cities	225	225
City FE	Yes	Yes
Year FE	Yes	Yes
Controls	No	No

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Placebo test for pre-trends in outcome variables

between improved US market access and local average wage growth is attributable to omitted variable bias in the previous specifications.[18] The estimated effects of US market access improvements on Chinese local economies remain quantitatively large. Back of the envelope calculations indicate that US trade liberalization caused by China's WTO accession can account for up to half of the growth in population and three quarters of the growth in manufacturing employment of the average Chinese city over the period 1998 to 2007.

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(Avg. Wage City)
City Trade Lib.	0.0156***	0.0165**	0.0320***	0.0174***	-0.00428
	(0.00370)	(0.00642)	(0.00466)	(0.00399)	(0.00377)
City Avg. Export Tariff	0.0137	-0.0921	0.128*	0.0630	-0.143**
	(0.0765)	(0.0943)	(0.0733)	(0.0687)	(0.0717)
Observations	440	428	440	440	440
R-squared	0.550	0.925	0.518	0.415	0.955
Number of cities	220	214	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Baseline Outcomes with Controls

The coefficients on the competing variable measuring cities' exposure to tariff barriers imposed by trading partners across time are most often statistically insignificant and often have counter-intuitive positive coefficients implying that cuts in tariff *levels* bring about detrimental economic effects at the city level.

Relating our findings to the simple theoretical framework developed in section 3.1 points to the conclusion that Chinese cities had access to an abundant supply of labor during our period

[18]The evidence is consistent with mean reversion in average wages at the city level. Given that the intensity of trade liberalization brought by WTO accession was greater for initially more developed cities, this may explain the significant negative association between improvements in US market access and local wage growth.

of analysis. The adjustment of local economies to improvements in US market access occurred primarily on the quantity margins, with population and employment growing strongly. On the other hand, adjustment on the price margin represented by local wages does not seem to have been important. These findings are consistent with a Lewis (1954) type setting in which local labor supply elasticities are high because barriers to geographic mobility are small and cities have access to abundant reserves of labor in their surrounding hinterland. Labor abundance of the type required by a Lewis (1954) framework is a reasonable description of economic realities in China during this period (Yao 2010; Chan 2012). We provide a more detailed discussion of the issue of geographic mobility of labor in section 6.

We need to be careful in interpreting our wage results. In the presence of large migratory responses of the type we find in our setting, it is difficult to disentangle the effect of improvements in market access on wages from any compositional shifts in local labor markets that occur as a result of trade liberalization. Our findings are consistent with a scenario in which improvements in US market access bring about increases in both employment and wages, but the effect on the latter is confounded by compositional changes brought about by migration. For instance, if the sectors that grow most as a result of the reform tend to be low-skilled, low wage sectors, this may bring down city-level average wages even if all individual wages increase.

Moreover, if cities that benefit most from improvements in access to US markets draw increasingly marginal unskilled labor from the surrounding countryside, this may again have the effect of reducing observed average wages at the city level, even in an environment characterized by wage growth for all individuals. Our results suggest that these mechanisms may be important given the surprising negative association we often find between exposure to US trade liberalization and local wage growth. Unfortunately, our aggregate wage data do not allow us to explore these issues further.

4.2 Investment, Exports and FDI

Building on our findings of significant effects of WTO accession on major economic indicators, we seek to identify further markers of its impact on local economies. Given that one of the main effects of China's WTO accession was arguably a reduction in the uncertainty of the economic environment faced by Chinese firms, the results of a large body of work on investment under uncertainty (Bernanke 1983; Dixit 1989; Bloom et al. 2007; Roberts and Tybout 1997; Impullitti et al 2013) would lead us to expect an increase in investment in the locations most affected by improvements in US market access. Using data on the stock of fixed assets at the city level from the China City Statistical Yearbooks, we aim to verify the presence of this effect. Table 4 presents the results.

Our findings confirm that improvements in US market access had a positive effect on local investment. In our preferred specifications including all controls we find that a one standard deviation higher exposure to US trade liberalization is associated with a highly significant 14% increase in the stock of fixed capital at the city level over the period 1998 to 2007.[19] This faster accumulation of fixed capital in cities that benefited more from WTO membership represents indirect evidence of increased investment activity at these locations.

Increased investment activity is not the only effect we would expect from improvements in trading conditions with the US. Reductions in US protection may induce more Chinese firms into paying the fixed costs associated with exporting, and increase corresponding trading activity. It may also increase the propensity of foreign firms to integrate China into their supply chains either by establishing plants in China or by investing in already existing Chinese firms. Both of

[19]The estimates concerning the size of the effects are calculated based on the fact that the standard deviation of our variable of interest, the City-Level trade liberalization, is 7.3 (variable measured in percentage points).

VARIABLES	(1) ln(Fix Assets City)	(2) ln(Fix Assets City)
City Trade Lib	0.0113	0.0196***
	(0.00750)	(0.00538)
City Avg. Export Tariff		-0.202
		(0.124)
Observations	452	440
R-squared	0.738	0.798
Number of cities	226	220
City FE	Yes	Yes
Year FE	Yes	Yes
Controls	No	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Investment

these strategies for integrating China into production chains should be reflected in increases in FDI.

We test these hypotheses in turn with data from two sources. The China City Statistical Yearbooks include a measure of the "Number of new FDI contracts".[20] Using firm level data from the Annual Survey of Industrial Firms (ASIF) we also construct two prefecture level aggregates that are useful in assessing the effects of the US trade liberalization on FDI activity at the level of local Chinese economies: aggregate paid in capital owned by entities from Hong Kong, Macau and Taiwan; and aggregate paid in capital owned by foreign entities.[21] We proceed to relate the evolution of these variables over the 1998 to 2007 period to our city-level measures of improvements in US market access brought by China's entry into the WTO.

VARIABLES	(1) ln(FDI Contr. City)	(2) ln(Pref HK K)	(3) ln(Pref Foreign K)
City Trade Lib	0.0276***	0.0481***	0.0224**
	(0.0104)	(0.00883)	(0.00879)
City Avg. Export Tariff	-0.402	-0.353***	-0.510***
	(0.267)	(0.132)	(0.164)
Observations	378	427	429
R-squared	0.371	0.644	0.811
Number of cities/pref.	189	217	216
City FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 5: FDI Contracts and Foreign Capital

Table 5 outlines the results. Our findings suggest an important role for WTO membership in

[20]This measure is available for a restricted sample of 189 cities.
[21]For the purposes of Chinese statistics, Hong Kong, Macau and Taiwan are not considered foreign territories.

promoting FDI growth. Cities exposed to greater improvements in US market access experience faster growth in the number of local FDI agreements. A one standard deviation increase in exposure to US market access uncertainty before WTO Accession is associated with a more than 20% increase in the number of local FDI agreements. Moreover, prefectures that experience greater improvements in their access to US markets as a result of WTO accession exhibit more rapid growth in the value of equity owned by foreign entities.[22] A one standard deviation greater exposure to US trade liberalization is associated with a 35% increase in the local stock of equity owned by residents of Hong Kong, Macao and Taiwan, and a more than 16% increase in the stock of equity owned by other foreigners.[23]

We also study the impact of improved US market access on exporting. We employ data from the ASIF to construct prefecture level aggregate manufacturing exports. We also track the evolution of the number of local exporting firms over the period 1998 to 2007. Results are reported in table 6. We find only suggestive evidence that reductions in US trade barriers lead to increases in the value of exports at the prefecture level. However, we identify a highly statistically and economically significant relationship between improvements in trading conditions with the US and growth in the number of local firms engaged in exporting activities. These results suggest that improved access to US markets had an effect on the extensive margin of exporting, but did not affect the trading activities of existing exporters. Given that the largest and most productive firms were already likely to export even before WTO accession, our findings are consistent with a scenario in which the relevant margin of adjustment to the trade shock was entry into exporting by smaller and less productive firms. In turn, these firms make a relatively small contribution to the growth of exports, which may explain why our analysis lacks the power to detect a significant impact of improvements in US market access on export volumes.

4.3 The Structure of Local Economies

In this section we investigate whether trade liberalization had an impact on the composition of employment across broad sectors at the level of Chinese local economies. This analysis serves two goals. First, it allows us to assess whether the positive shock to the tradable sector represented by China's WTO accession had a knock on impact on the nontradable sector at the local level. This is important because ignoring spillovers to the nontradable sector may lead to a substantial underestimate of the benefits of trade integration if there are significant local multipliers.

Second, this exercise serves as a consistency check that tests if our results so far can indeed be attributed to WTO accession and its implications for US trade policy. Intuitively, we expect improvements in US market access to be associated with a particular pattern of shifts in sectoral composition at the level of Chinese localities. As the US policy change represented a shock to the tradable sector we expect its effects to be strongest for this sector. Moreover, in the presence of strong local demand linkages we may expect improvements in trading conditions with the US to be associated also with growth in the (largely nontradable) tertiary sector (services). Ex ante, we do not expect the agricultural (primary) sector, in which China lacks comparative advantage, to benefit substantially from improved access to US markets. In fact this sector may contract as

[22] For the dependent variables constructed on the basis of the ASIF, we are only able to obtain a time series covering the period 1998 to 2007. As a result, in the prefecture level regressions reported in table 5 and in the regressions reported in table 6 we do not control for pre-trends in the outcome variables and do not instrument for the lagged dependent variable with further lags of the dependent variable. Results without the lagged dependent variable terms are similar.

[23] While official Chinese data sources clearly distinguish between capital owned by residents from Hong Kong, Macao and Taiwan and capital owned by foreigners, in practice, much of the capital featured as originating from Hong Kong, Macao and Taiwan is likely to be owned by foreigners because investments into China from abroad are often routed through these locations.

VARIABLES	(1) ln(Pref. Exports)	(2) ln(Pref. No. Exporters)
City Trade Lib	0.0106	0.0231***
	(0.00806)	(0.00749)
City Avg. Export Tariff	-0.359*	-0.291***
	(0.191)	(0.0994)
Observations	440	452
R-squared	0.813	0.344
Number of prefectures	221	226
City FE	Yes	Yes
Year FE	Yes	Yes
Controls	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Export Activity

workers and other resources are drawn to other sectors that derive greater benefits from trade liberalization.

We test these hypotheses by employing our preferred empirical specification to study the evolution of city-level employment across broad sectors: primary, secondary and tertiary. We also study in greater detail the evolution of employment in the narrower manufacturing sector.[24]

The results of this exercise are reported in Table 7 and are consistent with our predictions. Within strongly "treated" locations, the secondary sector benefits the most from WTO accession, and manufacturing employment grows strongly. However, we also find evidence of substantial spillovers from tradable to nontradable sectors. Employment in the tertiary sector also expands sharply after WTO accession in cities previously most exposed to US trade protection. Our point estimate in the tertiary sector employment regression is more than half as large as the corresponding coefficient for secondary employment. Given that in the average Chinese city the secondary sector accounted for about 51% of employment while the tertiary sector accounted for 41% at the start of our period of analysis, our estimates imply that for each two jobs created or saved in the tradable sector as a result of WTO accession, one job was created or saved in the local nontradable sector over the period 1998 to 2007.[25] This estimate of the local multiplier is markedly smaller than the one identified by Moretti (2010) for the US. It is still sizable, however, which points to the conclusion that the knock on impact of trade liberalization on nontradable activities may add substantially to the overall economic gains from improved market access.

As expected, the local primary sector does not benefit from the elimination of the constraints imposed by pre-WTO US trade policy. In fact, point estimates suggest that it may have experienced slower growth in locations that benefit from greater reductions in exposure to US market access uncertainty.

[24] Secondary sector employment is a broader aggregate than manufacturing, also including mining activities.

[25] The local (service sector) multiplier is computed as

$$\text{Local Multiplier} = \frac{\text{Tradable Emp Share} \times \text{Coeff Tradable}}{\text{Nontradable Emp Share} \times \text{Coeff Nontradable}} \approx 0.48$$

VARIABLES	(1) ln(Prim. Emp)	(2) ln(Sec. Emp)	(3) ln(Ter. Emp)	(4) ln(Manu. Emp)
City Trade Lib	-0.00898	0.0234***	0.0139***	0.0299***
	(0.0137)	(0.00736)	(0.00501)	(0.00695)
City Avg. Export Tariff	0.342	0.0313	0.173*	0.0366
	(0.447)	(0.122)	(0.105)	(0.119)
Observations	440	440	440	440
R-squared	0.769	0.603	0.702	0.637
Number of cities	220	220	220	220
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Structure of employment

5 Trade Liberalization and Local Spillovers

Building on our finding of sizable spillovers from the tradable to the nontradable sector in the context of the positive trade shock caused by China's WTO accession, in this section we aim to provide a detailed assessment of the role of local spillovers in shaping the propagation of the shock to Chinese urban economies. Our research design focusing on local economies allows us to specifically test for the presence of local spillovers and to obtain estimates of their quantitative importance.

The empirical exercise in this section brings us closer to the literature that estimates the magnitude of local spillovers and agglomeration economies and assesses the effects of place based policies (Black et al. 2005; Greenstone, Hornbeck and Moretti 2010, Moretti 2010; Chodorow-Reich et al. 2012; Wilson 2012; Shoag 2012; Kline and Moretti 2013; Serrato and Windenger 2014; Allcott and Keniston 2015; Zou 2015 etc.). Unlike some of the studies in this literature, in which the shock under analysis can be considered to affect directly only one sector (or a small number of sectors), our setting presents the additional challenge that WTO accession brings about asymmetric shocks to most manufacturing sectors.

We proceed in two parts. In subsection 5.1 we focus on the role of local spillovers in driving the transmission of the shock brought by US trade liberalization within the tradable sector of local economies. In subsections 5.2 and 5.3 we turn our attention to studying the transmission of the effects of improved foreign market access from the tradable to the local non-tradable sectors. Subsection 5.2 provides an overview of nontradable sector responses to WTO accession while subsection 5.3 is dedicated to a more detailed analysis of the impact of US trade liberalization on a non-tradable activity that is of particular interest given some of our earlier findings: the local financial sector.

5.1 Local Spillovers within the Manufacturing (Tradable) Sector

Interactions between manufacturing sectors at the local level can have the nature of agglomeration or congestion forces. The growth of a sector can lead to other sectors being crowded out, to the extent that they are competitors for scarce inputs such as land. On the other hand, growth in some sectors can lead to positive spillovers to other sectors via either forward or backward

VARIABLES	(1) Ln(Emp)	(2) Ln(Output)	(3) Ln(No firms)	(4) Ln(No Exp)	(5) Ln(Fix Asset)	(6) Ln(Exp.)
Industry Trade Lib	0.00438	0.00759	0.00727**	0.00526**	0.000376	0.00434
	(0.00527)	(0.0110)	(0.00347)	(0.00220)	(0.00524)	(0.0113)
Observations	28,378	28,383	28,383	28,383	28,310	28,383
R-squared	0.865	0.880	0.888	0.882	0.863	0.831
Pref-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: All outcomes at the prefecture-industry level
Standard errors clustered at the industry level
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Prefecture-industry effects of industry-level trade liberalization

linkages. In this subsection we provide an assessment of the interaction of these forces with the trade-policy shocks that form the object of this paper.

To assess the importance of local spillovers within the tradable manufacturing sector, we relate changes in outcomes at the level of prefecture-industry cells to both own-sector improvements in US market access and changes in the exposure to US market access uncertainty of co-located sectors. Before we proceed to this exercise, we use the opportunity provided by conducting our analysis at the level of prefecture-industry cells to perform a cross-check concerning the importance of reductions in expected US trade barriers for sector-level outcomes. We thus first estimate specifications of the type:

$$y_{ict} = \alpha + \beta * TradeLib_{it} + \gamma_{ic} + \delta_t + \epsilon_{ict} \tag{9}$$

where y_{ict} represent outcomes at the level of prefecture-industry cells, $TradeLib_{it}$ represents our industry level measure of improvements in US market access brought about by WTO accession (given by equation 5), γ_{ic} represent prefecture-industry fixed effects and δ_t are time fixed effects. We cluster standard errors at the industry level.

The results of this exercise are presented in Table 8. While this analysis suffers from limited power, our findings provide additional evidence in support of the role of improved trading relations with the US in promoting sectoral level growth. The evidence is consistent with the structure of employment, output and exports at the city-level shifting towards sectors that stand to benefit from the largest drops in exposure to US market access uncertainty in light of China's WTO accession. Moreover, we find statistically significant relationships between our sector-level measures of the trade shock brought about by WTO membership and growth in the number of firms and the number of exporters across prefecture-industry cells.

We proceed to a first assessment of the role of local inter-sectoral spillovers within manufacturing. We augment the specification in equation (9) with a term aimed at capturing the extent of US market access improvements experienced by the "neighboring sectors"of each prefecture-industry cell. The "neighbors"of a prefecture-industry cell are defined as other such cells located in the same prefecture. We thus estimate empirical models of the type:

$$y_{ict} = \alpha + \beta_1 * TradeLib_{it} + \beta_2 * TradeLib_{-ict} + \gamma_{ic} + \delta_t + \epsilon_{ict} \tag{10}$$

where the "spillover term" $TradeLib_{-ict}$ is given by

$$TradeLib_{-ic1998} = \frac{\sum_{j \neq i} Employment_{j,c,1998} * TariffGap_{j1998}}{TotalEmployment_{c,1998}} * Post_t$$

VARIABLES	(1) Ln(Emp)	(2) Ln(Output)	(3) Ln(No firms)	(4) Ln(No Exp)	(5) Ln(Fix Asset)	(6) Ln(Exp.)
Industry Trade Lib	0.00405	0.00755	0.00707***	0.00491***	0.000193	0.00362
	(0.00358)	(0.00742)	(0.00236)	(0.00149)	(0.00357)	(0.00761)
Rest of City Trade Lib	0.0180***	0.00258	0.0108***	0.0194***	0.0102**	0.0402***
	(0.00468)	(0.00461)	(0.00391)	(0.00291)	(0.00427)	(0.00855)
Observations	26,142	26,150	26,150	26,150	26,056	26,150
R-squared	0.017	0.538	0.222	0.087	0.166	0.058
Number of pref-ind.	13,071	13,075	13,075	13,075	13,028	13,075
Pref-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: All outcomes at the prefecture-industry level
Standard errors double clustered at the industry and prefecture level
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Spillovers at the prefecture - industry level

All other notation retains its previous meaning. The logic of our "spillover terms" is that each prefecture-industry cell interacts with the surrounding economy, and as a result it is exposed to the trade policy (and other) shocks that affect it. The computation of the spillover measures is analogous to that of our city-level trade liberalization measures (i.e., it is an employment-weighted average of the sector-level market access improvements affecting local industries), but excludes each prefecture-industry's own sector exposure to trade liberalization. When estimating specifications of the type outlined in equation (10) we double cluster standard errors by prefecture and industry. The results of this exercise are presented in table 9.

We find strong evidence of local spillovers that shape the transmission of the trade shock represented by WTO accession to local economies in China. Moreover, these spillovers are positive. The typical prefecture-industry derives substantial benefits when the surrounding local economy experiences significant improvements in US market access. US trade liberalization affecting the surrounding economy leads to faster growth in employment, exports, numbers of firms and exporters as well as increases in investment activity across prefecture-industry cells. We also find suggestive evidence that improvements in US market access affecting the surrounding local economy are associated with output and sales growth at the level of the typical prefecture-industry cell.

Our findings suggest that local spillovers are quantitatively large. The indirect effects of improved US market access, operating via co-located sectors, on the typical prefecture-industry cell dominate the direct effects of the own-sector market access improvements for most outcomes of interest. Back of the envelope calculations suggest that less than 40% of the overall effect of US trade liberalization on employment at the level of the typical prefecture-industry cell are attributable to the own sector trade shock, and the rest can be attributed to local spillovers. The corresponding share of the effects of the own-sector shock for exports is less than 20% while virtually the entire effect of WTO accession on investment at the level of the typical prefecture-industry cell operates via spillovers from "treated" neighboring sectors.[26]

Overall, our results indicate that local agglomeration forces outweigh local congestion and augment the effects of trade liberalization. This finding is consistent with our results from the

[26] We calculate the share of the effects that can be attributed to the "own sector" US trade shock as

$$\text{Direct share} = \frac{\text{Coeff Industry Trade Lib} \times \text{Average Industry Trade Lib}}{\text{Coeff Industry Trade Lib} \times \text{Average Industry Trade Lib} + \text{Coeff Rest of City Trade Lib} \times \text{Average Rest of City Trade Lib}}$$

city level analysis, which found little evidence of important local congestion effects.[27]

While the analysis above provides evidence of large positive local spillovers, it remains silent on the mechanisms through which these spillovers operate. In order to improve identification and shed additional light on the particular mechanisms of inter-sectoral interaction, we proceed to a more detailed investigation of the various channels of transmission of the US trade policy shock that are conflated in our previous spillover specifications. The logic of this exercise is as follows. We expect a local sector to derive major indirect benefits from WTO accession when the neighboring local economy experiences a large improvement in its access to US markets and when the sector under analysis is strongly "linked" with the surrounding local economy.

Following through with this intuition, we build on the work of Ellison, Glaeser and Kerr (EGK, 2010) and construct measures of the indirect shocks affecting local sectors as a result of WTO accession. We separate out the indirect effects transmitted via input-output, labor and technology linkages. To these three types of linkages studied by EGK (2010) we add a fourth, search linkages, that may be relevant in our setting. In what follows we discuss the main channels through which local sectors could benefit indirectly from improvements in US market access and set out our proposed measures of these indirect trade policy shocks. These measures are computed at the level of prefecture-industry cells and allow us to disentangle what type of linkages are most important for the local diffusion of the trade shocks associated with China's WTO accession.

Output Linkages Perhaps the most straightforward way in which a local industry may benefit indirectly from improved trading conditions with the US is if it is a supplier or client of co-located sectors that experience large improvements in their access to US markets. As these nearby sectors grow as a result WTO accession, we can expect their demand for inputs to grow, to the benefit of local suppliers (a similar argument can be made for input linkages). We focus on output linkages and follow EGK (2010) in defining the output link between two sectors, i and j, as the share of sector i's output that is typically sold to sector j. To compute the output shares of various sectors relative to a given sector i we make use of the Chinese input-output tables. We then proceed to compute a measure of the magnitude of the demand linkages we expect a local sector to experience as a result of China's WTO accession as:

$$Outputlink_{ict} = \frac{\sum_{j \neq i} Emp_{jc1998} * TariffGap_{j1998} * Outputshare_{ij}}{\sum_{j \neq i} Emp_{jc1998}} * Post_t \qquad (11)$$

Intuitively, we expect WTO accession to have greater effects on a local sector via the output linkages channel when industries that are traditional clients of that sector have an important local presence and experience large improvements in US market access as a consequence of China's WTO accession.

Labor Linkages Another channel through which local sectors in China could be indirectly affected by WTO accession is via labor linkages. If industries located in the same city and that make use of the same type of labor as a given sector are subject to large positive trade shocks, we may expect that sector to experience some crowding out effects. Conversely, if the growth of surrounding sectors brought about by trade liberalization brings more workers of the type needed by the sector to the city, this could have important positive spillovers, via thick labor market effects. In order to assess the importance of this channel, we follow EGK (2010) and

[27] Our results are also consistent with the analysis of Au and Henderson (2006), who find that a large fraction of Chinese cities were undersized in the run-up to our period of analysis.

measure the labor linkages between each pair of sectors i and j as the correlation between the sectors' occupational share vectors:

$$LaborCorrelation_{ij} = Correl(Share_{io}, Share_{jo}) \tag{12}$$

where $Share_{io}$ is a vector containing the shares of each occupation o in sector i employment. In line with EGK (2010) we use the 1998 version of the US National Industrial-Occupation Employment Matrix (NIOEM) to compute the $Share_{io}$ vectors.[28] Once we've computed pairwise labor linkages between all sectors, we construct a measure of the indirect impact of the reform on a given sector i, mediated via labor linkages as

$$Laborlink_{ict} = \frac{\sum_{j \neq i} Emp_{jc1998} * TariffGap_{j1998} * LaborCorrelation_{ij}}{\sum_{j \neq i} Emp_{jc1998}} * Post_t \tag{13}$$

Intuitively, we expect a sector to be subject to larger spillovers transmitted via labor linkages if industries that usually employ a similar labor force have an important local presence and experience large improvements in US market access as a result of WTO accession.

Technology Linkages Another mechanism through which a local sector may benefit from improvements in US market access affecting the surrounding economy is represented by technology linkages. If nearby industries with which a particular sector shares similar or complementary technology grows as a result of WTO accession, we can expect that sector to benefit from positive technology spillovers. To test for this channel in our setting we follow EGK(2010) and make use of the technology matrix developed by Scherer (1984). This matrix captures how R&D activity in one industry flows out to benefit another industry. Similarly to EGK (2010), we construct a pairwise measure of the technological benefits derived by sector i from R&D activity undertaken in sector j, $Tech_{ij}$.[29] We then build an aggregate measure of the potential benefits a local sector may derive via technology linkages from growth of the surrounding local economy resulting from US trade liberalization:

$$Techlink_{ict} = \frac{\sum_{j \neq i} Emp_{jc1998} * TariffGap_{j1998} * Tech_{ij}}{\sum_{j \neq i} Emp_{jc1998}} * Post_t \tag{14}$$

The logic of the aggregate measure above is similar to the ones developed to capture output and labor linkages: we expect a sector to reap greater benefits from WTO accession via technology linkages if industries that are likely to generate relevant knowledge spillovers have a strong local presence and experience large improvements in their access to US markets.

Search Linkages To the three types of linkages identified in EGK (2010) we add another, "Search Linkages", that may be relevant in our setting.[30] Theory as well as some of the evidence provided in the previous sections suggests that one effect of WTO accession may be the integration of Chinese producers into global value chains. As US market access improves for a particular sector, we can expect foreign firms to engage in search activities aimed at identifying

[28] Industrial-Occupation Employment Matrices similar to the NIOEM are not available for China, and as a result we are forced to use the US NIOEM. However, this could provide the benefit of additional exogeneity to our analysis, as the US NIOEM can be considered a benchmark for the occupational requirements of various sectors.

[29] Our measure of sectoral pairwise technology linkages is akin to the $TechIn_{i \leftarrow j}$ measures constructed by EGK (2010). Again, as in the case of labor linkages, measures of technology linkages for the Chinese case are not available, so we use the linkages measure on US data as a benchmark.

[30] For a more detailed treatment of the role of search frictions in trade see Chaney (2014).

potential Chinese partners in that sector. As a result, cities that have a heavy exposure to sectors that experience large improvements in trading conditions vis-a-vis the United States may be expected to be the object of more intense search activities. Due to these local search activities, we may in turn expect firms located in these cities to have a higher likelihood of being integrated into global value chains, even when conditioning on the own sector improvements in US trading conditions brought about by the WTO accession. Moreover, we may expect these indirect effects to be strongest for firms that have similar clients to the nearby sectors that experience large improvements is US market access.

In order to check for the operation of this mechanism, we first devise a pairwise measure of "client similarity" between sectors. We first construct, for each sector, an "adjusted output share" vector that reflects the proportion of the output sold outside the own sector that is delivered to each of the other sectors.

$$AdjSales\_Share_{ij} = \begin{cases} 0 \text{ if } j = i \\ \frac{Sales\_Share_{ij}}{1 - Sales\_Share_{ii}} \text{ if } j \neq i \end{cases} \tag{15}$$

Then, for each pair of sectors we could construct a $Sales\_Similarity_{ij}$ index according to the formula

$$Sales\_Similarity_{ij} = Correl_{\forall k \neq i,j}(Sales\_Share_{ik}, Sales\_Share_{jk}) \tag{16}$$

According to this measure, two sectors are considered to have similar clients if, ignoring themselves and each other, their adjusted output share vectors are similar. For each prefecture-industry cell we build an aggregate measure of exposure to WTO accession via "search linkages" as

$$Searchlink_{ict} = \frac{\sum_{j \neq i} Emp_{jc1998} * TariffGap_{j1998} * Sales\_Similarity_{ij}}{\sum_{j \neq i} Emp_{jc1998}} * Post_t \tag{17}$$

Intuitively, we expect a prefecture-industry cell to derive larger benefits from WTO accession via search linkages when sectors with which that industry shares a substantial fraction of its clients have a strong local presence and experience large improvements in their access to US markets following China's WTO accession.

After computing the above measures of prefecture-industry cells' indirect benefit from WTO accession via various channels we proceed to assess the importance of these linkages in the transmission of our trade shock. We augment our baseline empirical model in equation (9) above with the four "spillover terms" described above and estimate specifications of the type:

$$\begin{aligned} y_{ict} = \beta_0 + \beta_1 TradeLib_{it} + \beta_2 Outputlink_{ict} + \beta_3 Laborlink_{ict} \\ + \beta_4 Techlink_{ict} + \beta_5 Searchlink_{ict} + \rho Z_{ct} + \gamma_{ic} + \delta_t + \epsilon \end{aligned} \tag{18}$$

The results of this exercise are presented in table 10. Additional results for alternative specifications are presented in tables B1 and B2.[31] We find strong evidence in support of the operation of labor market linkages, with the $Laborlink_{ict}$ terms highly significant across specifications. Prefecture-Industry cells whose surrounding local economies experience large improvements in US market access and which employ similar types of labor as the bulk of the surrounding economy exhibit rapid growth in employment, output, sales and exports. They also experience entry, entry into exporting and increases in investment activity.

Quantitatively, spillovers transmitted through labor linkages account for virtually the en-

[31] Table B1 includes results from specifications that add a battery of sector-specific tariff policy variables as controls, while specifications in Table B2 include both tariff policy controls and lagged dependent variables that control for potential mean reversion. Results are similar.

VARIABLES	(1) Ln(Emp)	(2) Ln(Output)	(3) Ln(No firms)	(4) Ln(No Exp)	(5) Ln(Fix Asset)	(6) Ln(Exp.)
Ind Trade Lib	0.00427	0.00392	0.00455*	0.00233	0.00120	-0.00226
	(0.00403)	(0.00781)	(0.00270)	(0.00154)	(0.00405)	(0.00805)
Lib via Output Link	0.164	-0.360	0.346**	-0.0214	0.323	-0.369
	(0.161)	(0.285)	(0.142)	(0.109)	(0.198)	(0.414)
Lib via Labor Link	0.0537***	0.0368***	0.0303***	0.0529***	0.0318***	0.140***
	(0.0109)	(0.0133)	(0.00882)	(0.00736)	(0.0104)	(0.0221)
Lib via Tech Link	0.0145	-0.291	0.153	0.129	0.200	0.850***
	(0.168)	(0.272)	(0.0988)	(0.0997)	(0.143)	(0.321)
Lib via Search Link	-0.0783**	0.0403	0.00773	-0.00988	-0.0725**	-0.124**
	(0.0319)	(0.0415)	(0.0198)	(0.0141)	(0.0306)	(0.0620)
Observations	24,108	24,114	24,114	24,114	24,036	24,114
R-squared	0.029	0.557	0.242	0.114	0.178	0.068
Number of pref-ind.	12,054	12,057	12,057	12,057	12,018	12,057
Pref-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: All outcomes at the prefecture-industry level
Standard errors double clustered at the industry and prefecture level
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Alternative spillover channels

tirety of the (positive) local spillovers previously identified via the simple specifications given by (10). This finding is somewhat surprising, as labor market linkages were perhaps more likely to produce substantial congestion effects, with sectors crowded out when demand for relevant workers from other industries increases as a result of the reform. We find that the opposite is true, which is nevertheless consistent with some of our earlier findings that indicated a limited role for congestion forces in our setting (e.g., our city-level wage results).

The positive spillovers operating through labor linkages may reflect thick market effects. Labor matches improve for sectors that benefit from bigger local workforces because relevant workers are drawn to the local economy by growth in labor-linked sectors. Our labor linkage findings may also reflect the effects of knowledge spillovers, as workers benefit from being in close proximity with a larger pool of other workers engaged in the same occupations. This type of knowledge spillovers among workers are different in nature from the type of technological spillovers among firms and sectors that we aim to capture with our technology linkages terms. However, it is possible that the $Laborlink_{ict}$ spillover terms capture some of the variation that we would have liked to pick up in our technology spillover terms ($Techlink_{ict}$), which may explain the weaker results found for the latter.

We also find suggestive evidence that output and technology linkages play a role in shaping the transmission of the trade shock brought about by WTO accession to local economies. The evidence is particularly strong in the specifications that include trade policy controls and allow for mean reversion in the dependent variables (see table B2). However, we find little support for search linkages as an important channel of transmission of our trade policy shock of interest to regional economies in China.

5.2 Local Spillovers to the Nontradable (Services) Sector

In this section we explore in greater detail the transmission of the trade policy shock induced by WTO accession to the nontradable sector of local economies. Our results in section 4.3 provide suggestive evidence that local service sectors derive significant benefits from improvements in US

market access affecting nearby manufacturing activities. Here we aim to shed additional light on the mechanism through which spillovers from the tradable to the nontradable sector take place, as well as to assess which nontradable activities stand to benefit the most from WTO membership.

While the availability of data on the service sector is significantly more limited than for manufacturing, we can make use of our detailed data for manufacturing firms to test for the most theoretically salient potential channel of transmission of the trade shock of interest to local services: demand linkages from the manufacturing sector to the local service sector. As local manufacturing grows as a result of improved trading conditions with the US, we can expect the demand for local services by manufacturing firms to increase and bring about growth in these activities.

To test for the operation of this mechanism, we make use of the Chinese Input-Output tables which contain information on service use by various sectors. We construct a measure of the predicted demand shocks affecting the local service sector as a result of improvements in US market access as

$$ServiceOutputlink_{ct} = \frac{\sum_j Emp_{jc1998} * TariffGap_{j1998} * Outputshare_{sj}}{Emp_{c1998}} * Post_t \qquad (19)$$

where the $Outputshare_{sj}$ variables are defined in an analogous way to the $Outputshare_{ij}$ variables used in the computation of output linkages in the previous section; namely as the share of service sector output sold to manufacturing sector j. Intuitively we expect the local service sector to experience larger demand shocks as a result of WTO accession when nearby manufacturing makes heavy use of services as inputs and experiences substantial improvements in access to US markets. We proceed to relate the evolution of tertiary sector employment across cities to this measure of expected local service sector demand shocks by estimating specifications of the type:

$$\begin{aligned} TertiaryEmp_{ct} = \beta_0 + \beta_1 ServiceOutputlink_{ct} + \rho Z_{ct} + \theta * Post_t * X_{c1998} \qquad (20) \\ + \gamma_c + \delta_t + \epsilon_{ct} \end{aligned}$$

The results of this exercise are presented in Table 11 and provide strong evidence of demand linkages between manufacturing and local service sectors. Our measure of local demand shocks due to WTO accession is a strong predictor of service sector employment growth at both the city and prefecture levels. A one standard deviation increase in the magnitude of the predicted local demand shocks induced by trade liberalization is associated with an increase in tertiary employment of more than 13% at the prefecture level and more than 21% at the level of central cities.

After confirming the presence of substantial linkages between manufacturing and the local service sector, we proceed to analyze in greater detail which activities within the service sector stand to benefit the most from WTO accession. This task is facilitated by the China City Statistical Yearbooks which provide a breakdown of tertiary (service) sector employment into constituent subsectors.[32] We relate changes in employment for each activity within the service sector across cities to improvements in US market access using our preferred city level specifications given by (8). The results of this exercise are outlined in table B3.

Our findings indicate that the effects of WTO accession, mediated by local spillovers, on activities within the service sector are broad-based. Most nontradable activities (Construction;

[32]Due to changes in the breakdown of tertiary sector employment into constituent sectors across different yearbooks, we are forced to perform some aggregation of subsectors. We are left with the following subsectors on which we conduct our analysis: Public Utilities; Construction; Finance; Government; Geological Prospecting, Water Conservation, Scientific Research and Polytechnic Services; Education and Social Services; Sales and Catering; Real Estate, Leasing and Commercial Services

VARIABLES	(1) ln(Pref Tertiary Emp.)	(2) ln(City Tertiary Emp.)
Lib via Service Output Link	0.0833***	0.126***
	(0.0176)	(0.0267)
City Avg. Export Tariff	0.198**	0.208***
	(0.100)	(0.0771)
Observations	438	438
R-squared	0.713	0.548
Number of cities/pref.	219	219
City FE	Yes	Yes
Year FE	Yes	Yes
Controls	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Spillovers to the service sector via local demand linkages

Finance; Government; Education and Social Services; Sales and Catering) display rapid growth at the locations most affected by WTO membership. Public Utilities; Geological Prospecting, Water Conservation, Scientific Research and Polytechnic Services; and Real Estate, Leasing and Commercial Services are the exceptions. The Sales and Catering and Construction sectors are the largest beneficiaries of WTO membership. This is intuitive given that these activities can be considered among the least tradable and thus most likely to completely capture the increase in local demand brought about by WTO accession. Moreover, our findings concerning the construction sector are reassuring in light of our population and investment findings in section 4.

Among the activities for which we find little evidence of gains from WTO membership, the findings concerning the Real Estate, Leasing and Commercial sector are perhaps the most surprising, while the other two sectors (Public Utilities; Geological Prospecting, Water Conservation, Scientific Research and Polytechnic Services) can be considered to be intrinsically less sensitive to local economic conditions. The results concerning the Financial sector are perhaps the most interesting in light of our previous findings, and we proceed to discuss them in greater detail in the next section.

5.3 Local Spillovers and Financial Sector Growth

In the context of our results concerning investment in section 5, our finding of substantial growth in financial sector employment in locations most affected by the US trade policy commitment is significant. Taken together, these two findings raise the prospect of the operation of an investment-financial development channel in the transmission of our trade shock of interest to local economies. In this scenario, improvements in US market access may bring about an increase in local investment demand, as entrepreneurs move to take advantage of the opportunities provided by improved trading conditions with the US (or alternatively incumbents in affected sectors move to enter export markets and expand capacity). In turn, growing investment activity may result in an increase in demand for credit and other financial services. The local financial sector expands to meet this demand.

To shed light on the plausibility of this scenario, we proceed in three steps. First, we build on the work of Rajan and Zingales (1998) and construct an index of financial dependence of the

manufacturing sectors of Chinese local economies. This index is computed as a local weighted average of the financial dependence of the constituent manufacturing sectors, with weights represented by pre-reform (1998) city-level employment in each sector. Formally our measures of local manufacturing financial dependence are defined as:

$$FinDep_{c1998} = \frac{\sum_j Emp_{jc1998} * FinDep_j}{Manuf.Emp_{c1998}} \tag{21}$$

where $FinDep_j$ represents the financial dependence of sector j according to Rajan and Zingales (1998).[33]

Second, we construct two additional variables that can help us track whether developments in the locations most affected by the reform are consistent with investment demand driven financial sector growth: total liabilities of the local manufacturing sector and total debts of the local manufacturing sector. These variables are built for every location by aggregating firm level balance sheets available from the ASIF.

Finally, we augment our preferred empirical specification with an interaction term between city-level exposure to US trade liberalization and our measure of local financial dependence. We use this expanded empirical model to study the evolution of financial sector employment, total liabilities of the local manufacturing sector and total debts of the local manufacturing sector across cities. Formally, we estimate specifications of the type:

$$\begin{aligned} y_{ct} = \alpha + \beta_1 TradeLib_{ct} + \beta_2 TradeLib_{ct} * FinDep_{c1998} + \rho Z_{ct} \\ + \theta * Post_t * X_{c1998} + \gamma_t + \delta_c + \epsilon_{ct} \end{aligned} \tag{22}$$

Intuitively, if WTO accession brings about demand driven financial sector growth, we would expect to observe that improvements in trading conditions with the US are associated with both increases in aggregate borrowing and expansions in financial sector employment at the local level. Moreover, we would expect these effects to be stronger, ceteris paribus, for locations with a large exposure to financially dependent sectors. We present the results of implementing the specifications given by (22) above in Table B4.[34]

Our findings support the hypothesis that improvements in trading relations with the US resulted in an investment demand driven expansion of the financial sector. Locations that benefit more from the elimination of some of the "trade cooling" features of the pre-WTO US trading regime experience larger increases in manufacturing sector borrowing and larger expansions in financial sector employment. Moreover, once we add the interaction term between the extent of US market access improvements and local financial dependence to our analysis, we find that these effects occur only in locations that display relatively elevated levels of financial dependence. This finding adds additional weight to our interpretation of results as reflecting the operation of an investment demand channel through which WTO membership brings about financial sector growth.

6 Migration and Local Labor Supply Elasticities

Our results in section 4 indicate that the adjustment of local economies to US trade liberalization occurred primarily on the quantity margin. Employment and population grew sharply, while

[33] As sectoral financial dependence is available in the 3 digit ISIC revision 2 sectoral classification in Rajan and Zingales (2008), we have to perform a matching and aggregation procedure with our city-sector employment data, which is available at the level of the 4 digit ISIC Revision 3 classification. More details about this procedure are available in the Data and Variable Construction Appendix.

[34] To make sure that our interaction term of interest in specifications of the type given by (22) does not pick up differential trends in the outcome variables for locations with different levels of financial dependence, we control for the potentially time varying effects of initial (1998) city-level financial dependence in these regressions.

effects on the price (i.e. wage) margin were limited. These results stand in contrast with the findings of previous work that investigates the local labor market effects of international trade shocks (Topalova 2007, 2011; Kovak 2013; Autor, Dorn and Hanson 2013 etc.). Typical findings in this literature are that trade shocks have sizable price (i.e., wage) effects on local labor markets but muted quantity (i.e., employment and/or population) effects. In this section we provide a brief discussion of the potential drivers of our different results and their implications.

As previously mentioned, our wage results are difficult to interpret in the presence of large migratory responses of the type we find in our setting. In what follows we focus our discussion on the potential determinants of the large migration flows and the associated high local labor supply elasticities revealed by our analysis. There are at least two particularities of our setting that may help account for this finding. The first is that we are, to the best of our knowledge, the first to study the effect of a trade liberalization shock across local labor markets in China. China displays some unique features during our period of analysis. In particular, the balance of opinion in the literature analyzing China's labor markets is that at least until very recently the Chinese economy has operated in a Lewis (1954)-type regime, in which the abundance of cheap migrant labor from rural areas has limited wage growth and has fueled the growth of the export sector (Yao 2010; Chan 2012).[35] This view is supported by the fact that, in spite of the strictures of the *hukou* (or household registration) system China experienced the largest rural to urban migration in history over the last three decades (Chen, Jie and Yue 2010).

A second potential explanation for the difference between our results and those of most existing work relates to the sign of the shock we analyze. Unlike most prior studies, we study the impact of a positive trade shock on local labor markets. As Glaeser and Gyourko (2005) noted, housing (and implicitly labor) supply elasticities are likely to be much higher in the face of positive shocks than in the face of negative shocks because housing is a durable good. This type of asymmetry in housing supply elasticities to different types of shocks may in turn help account for the high local labor supply elasticities we find.

Our findings may still, however, be considered surprising given the continued importance of the *hukou* system during our period of analysis.[36] To shed additional light on this issue we use data at different levels of spatial aggregation to perform a more detailed investigation of migration patterns. We first check if a substantial fraction of the migration effects we identify at the city level reflect within-prefecture migration. To do this, we re-run the analysis of our main local outcomes of interest but use prefectures as our geographic unit of analysis. Intuitively, if a significant share of the migration response to US trade liberalization occurs within prefectures, we would expect to see the effects of improvements in foreign market access on population growth to be smaller at the prefecture level. Results are presented in table C1. We find that the relationship between improved foreign market access and local population growth is much weaker at the prefecture level, which is consistent with most of the migration we detect in our city level analysis being within prefecture. This finding is reassuring, given that the restrictions imposed by the hukou system are less severe for within prefecture migration (see Baum-Snow, Brandt, Henderson, Turner and Zhang 2015).

We also proceed to analyze patters of cross-prefecture migration in response to China's WTO accession. For each prefecture in our sample we construct a measure of the US market access improvements experienced by neighboring locations after WTO accession. We compute this measure as the average of prefecture-level exposures to US trade liberalization for all prefectures

[35] In fact, the debate about whether or not China has reached the "Lewis Turning Point"continue even today.

[36] However, it is important to note that a significant reform of the *hukou* system took place between 1997 and 2002. This reform brought a substantial relaxation of the constraints imposed by the system, which may help account for our findings. For more details see Wang (2004).

located in the same province as the prefecture under analysis:

$$NeighborTradeLib_{ct} = \frac{\sum_{t \in Prov; t \neq c} TariffGap_{c1998}}{\sum_{t \in Prov; t \neq c} 1} * Post_t \tag{23}$$

We then proceed to estimate specifications of the type:

$$\begin{aligned} y_{ct} = \alpha + \beta_1 TradeLib_{ct} + \beta_2 NeighbourTradeLib_{ct} + \rho Z_{ct} \\ + \theta * Post_t * X_{c1998} + \gamma_t + \delta_c + \epsilon_{ct} \end{aligned} \tag{24}$$

for our main outcome variables of interest at the local level. These specifications add our measure of neighbors' improved US market access as an additional variable to our preferred empirical set-up. If improvements in US market access bring about substantial inter-prefecture migration, we would expect to find a negative coefficient on the $NeighborTradeLib_{ct}$ variable in the population regressions; as prefectures suffer from population diversion effects towards nearby locations that experience large positive shocks as a result of WTO accession. The results of this exercise are presented in table C2. We find limited evidence of cross-prefecture migration related to US trade liberalization. The relevant coefficient in the population regressions is statistically insignificant.

The results of tables C1 and C2 also help us assess whether our findings at the city level reflect growth effects caused by improved foreign market access or spatial reallocation of economic activity in response to trade liberalization. The implications of our results are mixed. Our findings on population and employment in table C1 point towards an important role for within-prefecture reallocation of economic activity in response to US trade liberalization. However, our findings of employment growth and increased investment activity (see table C3) in prefectures most exposed to trade liberalization indicate that not all our city-level results can be accounted for by within prefecture reallocation. In turn, results in table C2 suggest a limited role for cross-prefecture reallocation of economic activity as a result of WTO accession. Overall, while the analysis of the aggregate effects of WTO membership is difficult in the absence of a quantitative general equilibrium model, the balance of our results indicates that WTO accession had a positive aggregate effect on the Chinese economy.

All in all, our local labor market findings deliver an optimistic message but also a cautionary note. While import competition studied by previous work generates geographically concentrated losses and sluggish spatial reallocation of factors in developed country settings, at least in the case of China improvements in access to foreign markets seem to bring about widely shared benefits and rapid reallocation of factors in response to the new economic environment. Moreover, our results indicate that congestion effects are small, and thus have only a minor impact on the overall welfare implications of trade liberalization. However, the fact that much of the migration effects of the reform seem to occur within prefectures raises the concern that the *hukou* system does indeed generate significant spatial mobility frictions. In the case of the event we study, within-prefecture migration seems to have been sufficient for adequate adjustment to the US trade policy shock to take place. Should other large macroeconomic shocks occur in the future, however, the constraints generated by the *hukou* system could become binding and generate substantial welfare losses.

7 Heterogeneous Effects

In this section we explore whether improvements in access to US markets had heterogeneous effects across cities with different initial characteristics. In particular, we aim to assess whether proximity to a port, the significance of SOEs in the local economy and the presence of a SEZ

within city boundaries were important in determining the extent to which cities could benefit from improvements in trading conditions with the US.

We begin by exploring the role played by proximity to a trading gate represented by a port.[37] Intuitively, we expect that cities closer to such trading posts should benefit more from WTO membership as they have easier access to the now more accessible US market. In order to test this hypothesis we augment our preferred specification with an interaction term between our city-level measures of US trade liberalization and a measure of distance to the nearest port. Thus, we estimate models of the type:

$$y_{ct} = \alpha + \beta_1 TradeLib_{ct} + \beta_2 TradeLib_{ct} * Dist\_Port + \rho Z_{ct} + \theta * Post_t * X_{c1998} + \gamma_t + \delta_c + \epsilon_{ct} \quad (25)$$

Tables D1 and D2 present the results of this exercise. The evidence supports the hypothesis that WTO accession brought larger benefits, ceteribus paribus, to cities located closer to international trading gates. We find strong evidence that cities located further away from ports exhibit slower growth in output than otherwise comparable cities subject to similar exposure to US trade liberalization but located closer to ports. We also find suggestive evidence that these locations exhibit slower population, employment and investment growth (at the prefecture level, the finding of smaller benefits in terms of employment growth for locations further away from trading gates is statistically significant at conventional levels).

We proceed to analyze the role played by the local presence of SOEs in determining the response of cities' economies to easing constraints imposed by the post-WTO accession US trading regime. Evidence from existing work (Brandt, Van Biesenbroeck, Wang and Zhang 2012; Feng, Li and Swenson 2014) indicates that SOEs in China tend to benefit less from trade liberalization (and associated reforms) than non-SOEs. Translated into our setting, this may lead us to expect smaller benefits from improved access to US markets for locations where SOEs have a stronger presence. It is even possible that locations with heavy exposure to SOEs may lose from WTO accession, as trade liberalization may encourage entry into the most positively affected sectors by more efficient private firms. In turn, these entrants might crowd out the SOEs that dominate production in cities with large SOE presence and lead to a decline in the economic fortunes of these locations. To shed some light on these issues we proceed to estimate specifications of the type

$$y_{ct} = \alpha + \beta_1 TradeLib_{ct} + \beta_2 TradeLib_{ct} * SOE\_share_{c1998} * Post_t + \rho Z_{ct} + \theta * Post_t * X_{c1998} + \gamma_t + \delta_c + \epsilon_{ct} \quad (26)$$

where our preferred empirical model has been augmented with an interaction term between our city-level trade liberalization measure and cities' initial (1998) share of employment accounted by SOEs.

Results are presented in Tables D3 and D4. Our findings support the idea that locations with large SOE presence benefit less from improvements in trading conditions with the US. We find evidence that, ceteribus paribus, locations with a higher share of their employment in SOEs display lower growth in investment and output as a result of WTO accession than comparable cities with reduced SOE exposure. We also find suggestive evidence that these locations exhibit slower population and employment growth. The magnitude of the coefficients on the interaction term is often large, and thus consistent with the idea that some local economies with particularly large SOE presence may have been hurt by improved access to US markets.

[37] For a more detailed analysis of the role of trading gates in driving patterns of specialization and the spatial configuration of economic activity in a Chinese context see Cosar and Fajgelbaum (2014).

Finally, we complete this section with an analysis of the role of cities' SEZ status in shaping the local economic impact of WTO accession. A priori, the effects of SEZ status are ambiguous, as it is straightforward to describe potential mechanisms that may cause SEZ status to be act as a complement or substitute for the liberalization of the US trading regime. Thus, it is conceivable that cities that contained SEZs and benefited from the corresponding regulatory (and tax) advantages did not experience a binding constraint from the features of the pre-WTO US trade regime, and as a result stood to benefit (relatively) less from trade liberalization. However, it is equally possible that WTO accession brought about an increased level of internationalization of the Chinese economy, with cities that contained SEZs being particularly well placed to benefit from this development. In a similar vein to the analyzes above, we aim to shed light on this issue by estimating an empirical model of the type:

$$\begin{aligned} y_{ct} = \alpha + \beta_1 TradeLib_{ct} + \beta_2 TradeLib_{ct} * SEZ_{c1998} + \rho Z_{ct} \\ + \theta * Post_t * X_{c1998} + \gamma_t + \delta_c + \epsilon_{ct} \end{aligned} \tag{27}$$

where SEZ_{c1998} is a dummy variable indicating whether city c contained a SEZ at the start of our period of analysis (1998). The results of this exercise are outlined in Tables D5 and D6. Overall, our results offer only limited evidence in support of cities' SEZ status playing a role in the response of local economies to improvements in US market access. Moreover, our findings are mixed. Cities that contain a SEZ within their boundaries benefit less from WTO membership than comparable non-SEZ locations in terms of employment growth, but exhibit larger gains from trade liberalization in terms of output and investment.

8 Robustness and Alternative Specifications

In this section we revisit our city-level analysis and implement a number of robustness checks and alternative specifications that aim to address a number of concerns regarding omitted variable bias, measurement as well as issues pertaining to data quality. We organize our discussion in 3 parts: Section 8.1 reports robustness checks aimed at mitigating concerns related to omitted variable bias and potential outliers. Section 8.2 proposes an alternative measure of city-level exposure to US trade liberalization that arguably better captures China's patterns of comparative advantage and the importance of US markets for China's industrial sectors. Finally, section 8.3 aims to address some data quality concerns and implements a number of cross-checks employing census data.

8.1 Robustness Checks

8.1.1 Dropping Provincial Level Cities

In our baseline analysis in section 4 we study a sample of 226 cities over the period 1998 to 2007. Among these we include the 4 provincial level cities of Beijing, Tianjin, Shanghai and Chongquing. However, a sizable literature in urban economics (Ades and Glaeser 1995, Davis and Henderson 2003) has found that biases towards politically favored cities may be important drivers of local economic development; and recent work by Chen, Henderson and Cai (2015) has identified markers of sizable political biases towards provincial-level cities in China. To address the concern that our results may be driven by provincial level cities, in Table E1 we report results obtained from implementing our baseline empirical specification on a sample that excludes these cities. All our main results go through unaffected.

8.1.2 Controlling for the initial share of employment in SOEs

From the mid 1990s, Chinese authorities began to cut the formerly close ties that bound government and state owned enterprises (Naughton 2007). As a result, SOEs faced increased product market competition and pressure, on the one hand, and reduced access to funding from government banks, on the other. SOEs adjusted to these shifts in policy by downsizing and restructuring. This process of restructuring was encouraged by the government as part of a shift of the overall policy regime towards greater emphasis on deepening economic reforms. Indeed, according to observers of China, this period marks a shift from commitment to a policy of "reforms without losers"to the willingness of Chinese authorities to accept "reform with losers".

In turn, the process of SOE restructuring had important implications for urban economies across China. Due to the scale of the downsizing and the important role played by SOEs in urban labor markets at the time, for a few years official statistics show that aggregate formal urban employment may have actually declined. Given the proximity of this reform to our period of analysis, we check the robustness of our population and employment findings to controlling for the time-varying effects of each city's initial exposure to SOEs, proxied by each city's initial (1998) share of employment in SOEs.

Results are presented in Table E2. We find that controlling for the initial SOE share of employment reduces our coefficient of interest in the city population regression by about a third, but it remains highly statistically significant. For the case of the broad employment regressions, the coefficient of interest actually increases in magnitude by about a fifth and remains highly significant. Surprisingly, the introduction of the SOE controls significantly alters the results in our regression on narrow employment, with our coefficient of interest declining sharply in magnitude and becoming statistically insignificant. All in all, our results remain consistent with improvements in US market access having sizable effects on economic development across Chinese localities.

8.1.3 Further Controls for Initial Sectoral Composition

One concern raised by the shift-share (or Bartik 1991) methodology employed in this paper is that results may be driven by underlying trends in the outcome variables of interest that are associated with differences in pre-reform employment composition used in the computation of our measures of US market access improvement. One approach used in the literature to mitigate this concern (see McCaig 2011) is to control for the potentially time varying effects of differences in initial sectoral composition measured at a higher level of sectoral aggregation than that used in the computation of city-level shocks. We perform this exercise by adding controls for the initial shares of 2-digit ISIC manufacturing sectors interacted with a time dummy to our baseline specifications.

Results are presented in Table E3. Again, all of our findings go through virtually unchanged, with the magnitude of the coefficients preserved. The only substantial change in the coefficients of interest occurs in the population regressions, where it declines by about a third, but remains highly significant.

8.1.4 IV strategy to account for variation in the size of the non-tradable sector

Another potential concern regarding our empirical strategy relates to the construction of our city-level measures of US trade liberalization. These metrics have the nature of scaled indices that vary both with the relative size of the local manufacturing sector and with its composition. Formally, our baseline measure of city-level exposure to US trade liberalization brought by China's WTO

accession is given by

$$TradeLib_{ct} = \frac{\sum_i Employment_{i,c,1998} * TariffGap_{i1998}}{TotalEmployment_{c,1998}} * Post_t$$

where crucially in the computation of the index the final normalization is performed by dividing by *total* city employment. As a result of normalizing by total city employment our measure of improvements in foreign market access is negatively correlated with the size of the local nontradable sector. To the extent that the size of the local nontradable sector is in turn correlated with our dependent variables of interest, the coefficients on our variable of interest may be biased.

To mitigate this concern, we follow the strategy suggested by Topalova (2007) and separate out the variation in our variable of interest that is due to cities' sectoral composition *within* manufacturing, from the variation emerging from the overall size of the manufacturing sector relative to non-manufacturing. To do this, we implement IV specifications where we employ an unscaled measure of exposure to US trade liberalization given by

$$Tr\_TradeLib_{ct} = \frac{\sum_i Employment_{i,c,1998} * TariffGap_{i1998}}{ManufacturingEmployment_{c,1998}} * Post_t \quad (28)$$

as an instrument for our baseline scaled measure. Note that in the computation of the unscaled measures of city-level exposure to potential US tariff hikes, manufacturing employment at the city level replaces overall employment in the denominator. Results from the estimation of these alternative specifications are reported in Table E4. Our main results concerning population, employment and investment go through virtually unchanged (if anything the employment results are strengthened). The only exception is represented by the city-level output regressions, where the magnitude of the coefficient on our variable of interest declines by about half and is no longer statistically significant at conventional levels.

8.1.5 Controlling for changes in Non Tariff Barriers - The Multi-Fiber Agreement (MFA)

While China's accession to the WTO did not bring substantial changes to the *applied* tariff policy of its major trading partners, it did bring about changes in the non-tariff barriers faced by Chinese exporters. In particular, upon accession to the WTO China became eligible to the provisions of the Multi-Fiber Agreement which had been agreed by WTO members and stipulated gradual phasing out of quotas for a range of products (mostly textiles).[38] To the extent that exposure to the phasing out of quotas is correlated with exposure to US trade liberalization related to China's WTO accession, this may pose a threat to our identification. To alleviate this concern we recompute our measures of city-level US trade liberalization and exclude sectors affected by the phasing out of quotas from the computation. This alternative measure of improvements in US market access (which we denote $TradeLib\_Non - MFA_{ct}$) should therefore be uncorrelated with declines in exposure to export quotas at the level of local economies. We then proceed to re-run our preferred city level analysis with $TradeLib\_Non - MFA_{ct}$ as our main explanatory variable of interest. We present our results in Table E5. All of our main results are robust to this check, with the magnitudes of the coefficients of interest increasing in all regressions.

8.2 Alternative Measure of Local Exposure to the Reform

A potential limitation of our baseline analysis is that our main measure of improvements in access to US markets fails to take into account China's patterns of comparative advantage, as well

[38] For more details on the Multi-Fiber Agreement see Brambilla et al. (2009)

as any considerations related to the importance of US markets for various Chinese sectors. For each industry, the removal of uncertainty surrounding access to US markets can be considered equivalent the elimination of a constraint. However, for some sectors the initial constraint may not have been binding, as China may have not been a competitive exporter in those sectors even in the absence of the trade dampening features of the US pre-WTO trading regime. Furthermore, even for sectors in which China did have comparative advantage, we expect the effect of improvements in US market access to be more significant for sectors that are heavily dependent on exports to the US.

To address this concern, we propose an alternative measure of city-level improvements in US market access. We alter our baseline measure by weighting the contribution of each sector to the index by the sector's initial exposure to the US market.[39] This modified measure of US trade liberalization is given by:

$$Exposure\_TradeLib_{ct} = \frac{\sum_i Employment_{i,c,1998} * TariffGap_{i1998} * Exposure_{i,1998}}{TotalEmployment_{c,1998}} * Post_t \tag{29}$$

The sectoral level additional weights employed above, $Exposure_{i,1998}$ are described by the expression:

$$Exposure_{i,1998} = \frac{Exports_{US,i,1998}}{Output_{i,1998}} \tag{30}$$

where $Exports_{US,i,1998}$ denotes the value of China's exports to the US in sector i at the beginning of our period of analysis (1998), while $Output_{i,1998}$ denotes sector i's initial period total output.

We proceed to re-run the main stages of our analysis using the alternative measure of local exposure to US trade liberalization defined above. The results of this exercise are reported in tables E6 to E9.

Our findings from this exercise largely match our baseline results. Cities more exposed to US market access improvements experience faster population, employment and output growth as well as increased investment activity. The local tradable (secondary) sector and the tertiary (nontradable) sector benefit from the reform in equal measure. We find no evidence that the primary sector benefits from WTO membership, with point estimates for agriculture being negative. The detailed analysis of non-tradable sector employment again reveals that reductions in US market access uncertainty contribute to broad based growth across tertiary sector activities.

Perhaps the most striking difference relative to our baseline analysis is that we now identify a substantially stronger negative relationship between exposure to US market access improvements and local average wage growth. However, this finding is not robust to the introduction of further controls, as the results of table E7 show. This table reports the results of a specification that controls for the initial composition of employment at the level of 2-digit ISIC sectors (i.e. this specification is comparable with that undertaken in Robustness Check 3 - see table E3). All in all, we conclude that our main findings are robust to specifications that employ the proposed alternative measure of US market access improvements.

8.3 Cross-Checks Using Census Data

In this section we aim to address some issues related to the quality of the data used in our baseline analysis. Of particular concern is the fact that the city and prefecture population counts

[39] A similar approach to measuring the exposure of local labor markets to trade policy reforms is employed in Kovak (2013) who weighs changes in import tariffs during Brazil's trade liberalization by the sectoral import penetration when building his regional level tariff measures for Brazil. He finds that this modified measure is a much better predictor of price changes across sectors in Brazil than a baseline measure that does not take into account the "intensity of the treatment"at the sectoral level.

reported in the City Statistical Yearbooks often capture only cities' *de jure* populations, i.e. the number of people with local *hukou* registration. Given that the last two decades have seen substantial non-*hukou* migration within China, discrepancies between the *de jure* and the *de facto* populations of Chinese cities can be substantial, with potentially important implications for our results. Moreover, the presence of this issue also raises concerns about the reliability of the employment measures provided in the China City Statistical Yearbooks.

To address these concerns we turn to census data, which should capture the de facto population of China's administrative units.[40] We study the evolution of population and employment, as measured in the censuses, across prefectures and focus on the period covered by the last two "long censuses", namely 2000 to 2010[41]. Moreover, the use of census data also allows us to extend our analysis to two other variables that are of interest in light of our previous results: migration and unemployment.

Unfortunately, the study of migration permitted by census data is limited, as we are only able to observe the local stock of long-distance migrants, namely the number of individuals within a prefecture who report coming from a different *province*. We compute (long distance) migrant shares at the level of Chinese prefectures by dividing the stock of out-of-province migrants by the total population of the prefecture. We also compute local unemployment rates for Chinese prefectures. The study of local unemployment is of interest in its own right but also aids the interpretation of some of our previous results, particularly those related to employment and wages.

The results of our census based cross-checks for population and employment, as well as our new results on migration and unemployment are outlined in Table E10.[42] When interpreting these findings it is important to note that they come out of regressions that are run on prefecture-level outcomes. As a result they are only comparable to the results reported in Table C1.

Our findings confirm that improvements in access to US markets were associated with faster population and employment growth. While our estimates from the population regressions are similar in magnitude to the ones found in the analysis using data from the City Statistical Yearbooks (but are now statistically significant), the magnitude of our coefficient on interest in the employment regressions declines sharply. However, it remains highly statistically significant and economically meaningful. This casts some doubt on the reliability of employment numbers in the China City Statistical Yearbooks but otherwise provides additional support for our main findings.

We also find that prefectures that experience larger improvements in their trading conditions with the US exhibit increases in the share of local populations represented by (long distance) migrants. Coupled with our populations findings, our census based analysis provides support for the view that the US trade policy reform brings about long-distance migratory flows towards prefectures that benefit from the largest market access improvements. Moreover, these results add to the evidence that improved US market access spurs economic development and leads to local population increases primarily via the migration channel.

Interestingly, we fail to identify any relationship between exposure to the US trade liberalization and local unemployment rates (the point estimate is negative but small and statistically

[40] We only have reasons to expect that census data will be superior to CSY data for the population numbers. However, given the concerns about China's employment numbers (see Banister 2005) we find it useful to also run Census cross-checks for employment.

[41] As our census data is available in county tabulations format only and given that matching counties to central cities may be associated with additional measurement error, the results reported in this section are at the prefecture level only. Preliminary results at the level of multiple definitions of central cities are available from the authors upon request and are similar to the findings reported for prefectures.

[42] The results in Table E10 come from estimating specifications similar to our preferred set-up with controls (see equation (8)). However, since we do not have access to pre-reform census data, we are unable to control for pre-trends in outcome variables in these specifications.

insignificant). In light of our other findings, we are led to conclude that trade liberalization associated with WTO membership is reflected in more affected Chinese local economies by increases in local labor demand that are largely accommodated via in-migration. As a result of this strong migration response, liberalization induced increases in labor demand are not reflected in tighter local labor market conditions. This latter fact is supported by our inability to detect any effects of improvements in access to US markets on either local wage growth or unemployment rates.

9 Concluding Remarks

In this study we have sought to shed light on the role played by improvements in foreign market access in sustaining growth and modernization in a developing country. To do so, we have exploited plausibly exogenous variation across Chinese local economies in the magnitude of market access improvements brought about by China's WTO accession.

Our findings deliver several important lessons. The first is that the study of the effects of international economic integration is incomplete without a balanced analysis of both the winners and the losers from deepening globalization. While much of the existing work focuses on the adverse effects of increased import competition resulting from liberalization, we reveal the existence of substantial economic benefits from increased trade integration in the context of a large surplus economy. Moreover, our optimistic message about the opportunities provided by trade liberalization is strengthened by two additional considerations. The first is that the magnitude of the overall effects of improved market access can be large, as agglomeration effects augment the impact of liberalization on the tradable sector and there are substantial spillovers from the tradable to the nontradable sector. The second is that, at least in the case of China, the spatial reallocation of factors required for the benefits of trade integration to be fully realized and widely shared seems to have occurred rapidly and without substantial congestion costs.

A second message delivered by our findings is the importance of accounting for trade policy uncertainty when assessing the overall restrictiveness of a trade policy regime and its potential effects on the economic prospects of trade partners. This insight is particularly timely as it may contribute to an improved understanding of the changing nature of modern trade agreements, such as the Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP). These increasingly tend to emphasize reducing regulatory and policy uncertainty and focus on issues such as investment and intellectual property protection, predictability of the policy environment and harmonization of regulatory standards. Moreover, a deeper understanding of trade policy uncertainty may also aid in the study of episodes of potential break-up of trade agreements, such as the proposed exit of the United Kingdom from the EU single market.

A final lesson from our results is that large episodes of trade integration can have a substantial impact on the internal economic geography of countries. Our findings indicate that WTO accession had a role in generating differential growth across different regions of China, as well as spatial reallocation of economic activity. This should be of interest to policymakers, particularly where environmental or other considerations require territorial planning.

Our study also leaves several important issues unaddressed. The first concerns explaining why the effects of large macroeconomic shocks such as China's entry into the WTO "stay local" and can be identified by analyses of local economies like the one undertaken in this paper. Our findings indicate a relatively elevated level of factor mobility, so it is not immediately clear why new jobs created in growing sectors should remain in those sectors' historic clusters. The answer to this question is likely to involve a prominent role for the agglomeration and spillover effects that we found to be important in the transmission of the effects of WTO accession to local economies. More research is required to determine how these forces operate and how they inter-

act with different types of economic shocks under various conditions. A deeper understanding of these forces could contribute towards methodological improvements involving the shift-share (or Bartik) instruments frequently used to analyze local labor markets.

A second open question in light of our findings is how spatial economic considerations may influence our assessment of the gains from opening up to international trade. Our results suggest that agglomeration forces and frictions to spatial mobility may have a material impact on the relevant welfare calculations. Significant departures from standard welfare analysis of trade liberalization may be required in environments in which agglomeration economies/ local spillovers are important. In these situations, adjustments to trade shocks are likely to involve "people following jobs" rather than "jobs following people". The importance of such considerations is compounded if there are large mobility frictions, as in these circumstances the welfare costs associated with the large movements of people required by adjustments to trade liberalization may be first order.

The considerations above naturally lead to questions about the settings in which adjustments to trade shocks are likely to occur most easily. Here our results suggest that frictions to spatial and sectoral mobility may interact to produce complex patterns of adjustment to trade shocks. In many developing countries geographic mobility of labor may be low as poor residents are more dependent on local support networks for their livelihoods. On the other hand, spatial and sectoral mobility are co-determined, and this leads to concerns about adaptability to trade shocks for developed countries. As these countries occupy the higher rungs of global value chains, more of their workforces are likely to exhibit highly specific skills, making inter-sectoral and spatial mobility more difficult. By contrast, in developing countries, workers often lack sector-specific skills, which lowers the costs of sectoral and spatial reallocation. Moreover, land use restrictions also play a role in shaping geographic mobility in response to major economic shocks, and these tend to be both more restrictive and better enforced in developed countries.

Last but not least, our analysis leaves unanswered an important, if technical, question about the exact mechanism driving the effects of improvements in access to US markets in our setting. As we briefly discussed in the introduction, WTO accession brought about the removal of the upper tail of the distribution of potential US tariffs faced by Chinese exporters. This in turn led to both a decline in expected tariffs (termed an "expected mean effect" by Handley and Limao 2014) and a compression of the tariff distribution (termed a "pure risk effect" by Handley and Limao 2014). It would be interesting to perform a decomposition of the economic impact of the reform studied in this paper among these two effects, which are conflated in our current analysis.

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Appendix A - Balacedness Analysis

VARIABLES	(1) ln(Pop.)	(2) ln(Emp.)	(3) Econ. Zone	(4) Coastal	(5) Rail. Dens.	(6) Highway Dens.	(7) Dist. to Port	(8) ln(GDP)	(9) ln (GDP/capita)	(10) ln(Fix. Asset)	(11) ln(Avgwage)
City Trade Lib.	0.0140	-0.0165	0.0256***	0.0117*	-0.254	0.189	-0.126**	0.0517***	0.0358***	0.0489***	0.0151***
	(0.0110)	(0.0157)	(0.00216)	(0.00665)	(0.151)	(0.166)	(0.0510)	(0.00895)	(0.00706)	(0.00849)	(0.00238)
Constant	14.86***	13.26***	0.0988**	0.0932	21.52***	13.05***	5.344***	23.35***	8.507***	22.63***	8.659***
	(0.133)	(0.266)	(0.0420)	(0.0734)	(2.260)	(2.213)	(1.056)	(0.163)	(0.104)	(0.157)	(0.0305)
Observations	226	226	226	226	226	226	226	219	219	226	226
R-squared	0.019	0.018	0.154	0.044	0.012	0.007	0.043	0.179	0.184	0.153	0.184

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

Table A1: Correlations between Initial Characteristics and City-Level Trade Liberalization

Appendix B - Local Spillovers

Detailed Specifications - Spillovers Within Manufacturing

VARIABLES	(1) Ln(Emp)	(2) Ln(Output)	(3) Ln(No firms)	(4) Ln(No Exp)	(5) Ln(Fix Asset)	(6) Ln(Exp.)
Ind Trade Lib	0.00405	0.000546	0.00321	0.00162	-0.00106	-0.0116
	(0.00400)	(0.00892)	(0.00251)	(0.00156)	(0.00387)	(0.00879)
Lib via Output Link	0.160	-0.329	0.346***	-0.0220	0.334*	-0.305
	(0.152)	(0.284)	(0.108)	(0.0979)	(0.180)	(0.373)
Lib via Labor Link	0.0527***	0.0352***	0.0284***	0.0523***	0.0295***	0.136***
	(0.0108)	(0.0132)	(0.00866)	(0.00715)	(0.0100)	(0.0215)
Lib via Tech Link	-0.00817	-0.354	0.103	0.113	0.134	0.700**
	(0.171)	(0.282)	(0.0952)	(0.0954)	(0.149)	(0.310)
Lib via Search Link	-0.0864***	0.0370	-0.00698	-0.0165	-0.0863***	-0.147**
	(0.0316)	(0.0413)	(0.0185)	(0.0140)	(0.0305)	(0.0620)
Ind Export Tariff	0.0144	-0.0713	0.0166	0.0215**	-0.0138	-0.0559
	(0.0402)	(0.0525)	(0.0223)	(0.0104)	(0.0399)	(0.0556)
Ind Input Tariff	0.00624	0.00920	0.0139***	0.00732***	0.0147**	0.0409***
	(0.00643)	(0.00948)	(0.00364)	(0.00272)	(0.00605)	(0.0155)
Ind Import Tariff	0.000973	-0.00208	-0.000512	-0.00243	-0.000521	-0.0178
	(0.00593)	(0.00838)	(0.00369)	(0.00193)	(0.00613)	(0.0119)
Observations	24,108	24,114	24,114	24,114	24,036	24,114
R-squared	0.032	0.560	0.256	0.120	0.184	0.072
Number of pref-ind.	12,054	12,057	12,057	12,057	12,018	12,057
Pref-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Note: All outcomes at the prefecture-industry level.
Standard errors double clustered at the industry and prefecture level
*** p<0.01, ** p<0.05, * p<0.1

Table B1: Detailed spillover specifications, prefecture - industry regressions, controls

VARIABLES	(1) Ln(Emp)	(2) Ln(Output)	(3) Ln(No firms)	(4) Ln(No Exp)	(5) Ln(Fix Asset)	(6) Ln(Exp.)
Ind Trade Lib	0.000792	-0.00706	0.00219	0.00278*	-0.00994**	0.0108
	(0.00405)	(0.00820)	(0.00251)	(0.00165)	(0.00433)	(0.00952)
Lib via Output Link	0.239	-0.0684	0.419***	0.0465	0.615***	0.476
	(0.170)	(0.255)	(0.125)	(0.103)	(0.200)	(0.438)
Lib via Labor Link	0.0590***	0.0630***	0.0337***	0.0592***	0.0404***	0.257***
	(0.0107)	(0.0129)	(0.00867)	(0.00778)	(0.0103)	(0.0286)
Lib via Tech Link	0.592***	0.491*	0.206*	0.203*	0.989***	2.226***
	(0.207)	(0.293)	(0.107)	(0.121)	(0.231)	(0.458)
Lib via Search Link	0.0134	0.118***	0.0122	-0.00427	0.00648	-0.0927
	(0.0289)	(0.0392)	(0.0195)	(0.0156)	(0.0326)	(0.0769)
Ind Export Tariff	0.0127	-0.0660	0.0202	0.0273**	-0.0246	0.0339
	(0.0342)	(0.0480)	(0.0243)	(0.0123)	(0.0329)	(0.0762)
Ind Input Tariff	0.00705	0.00852	0.0133***	0.00651**	0.0135**	0.0405**
	(0.00536)	(0.00892)	(0.00364)	(0.00269)	(0.00543)	(0.0176)
Ind Import Tariff	-0.000333	-0.00570	-0.000841	-0.00219	-0.00310	-0.0114
	(0.00433)	(0.00717)	(0.00349)	(0.00200)	(0.00431)	(0.0139)
Observations	24,108	24,114	24,114	24,114	24,036	24,114
R-squared	0.143	0.626	0.272	0.140	0.299	0.191
Number of pref-ind.	12,054	12,057	12,057	12,057	12,018	12,057
Pref-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean Reversion	Yes	Yes	Yes	Yes	Yes	Yes

Note: All outcomes at the prefecture-industry level
Standard errors double clustered at the industry and prefecture level
*** p<0.01, ** p<0.05, * p<0.1

Table B2: Detailed spillover specifications, prefecture - industry regressions, controls, mean reversion terms

Local Spillovers to the Service Sector

VARIABLES	(1) ln(Pub Ut E.)	(2) ln(Const E.)	(3) ln(Fin E.)	(4) ln(Gov E.)	(5) ln(Geosci E.)	(6) ln(Trans Com E.)	(7) ln(Educ Soc E.)	(8) ln(Sale Cat E.)	(9) ln(R Est E.)
City Trade Lib.	-0.00175	0.0206**	0.0125***	0.0147***	0.00354	0.0143**	0.0176***	0.0287***	0.00707
	(0.00507)	(0.00964)	(0.00272)	(0.00244)	(0.00589)	(0.00630)	(0.00300)	(0.00484)	(0.00732)
City Avg. Export Tariff	-0.0716	-0.00669	-0.0754	0.0483	0.0674	-0.0311	0.0870	0.0338	0.143
	(0.0712)	(0.198)	(0.0550)	(0.0383)	(0.0734)	(0.112)	(0.0560)	(0.129)	(0.126)
Observations	442	446	446	446	443	446	446	446	438
R-squared	0.286	0.371	0.474	0.620	0.764	0.401	0.531	0.736	0.748
Number of cities	224	226	226	226	225	226	226	226	224
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table B3: Detailed Analysis of the Service Sector

VARIABLES	(1) ln(City Liab.)	(2) ln (City Debt)	(3) ln(City Fin. Emp)	(4) ln(City Liab.)	(5) ln (City Debt)	(6) ln(City Fin. Emp)
City Trade Lib	0.0135	0.0252**	0.0124***	-0.0170	-0.0314	-0.00566
	(0.0107)	(0.0118)	(0.00386)	(0.0212)	(0.0268)	(0.00916)
City Avg. Export Tariff	-0.232**	-0.606**	-0.0734	-0.230**	-0.613**	-0.0893
	(0.100)	(0.241)	(0.0760)	(0.104)	(0.276)	(0.0852)
City Trade Lib * City Fin Dep.				0.0659**	0.103**	0.0218
				(0.0295)	(0.0411)	(0.0161)
Observations	452	402	446	452	402	446
R-squared	0.744	0.280	0.474	0.757	0.310	0.490
Number of pref_con	226	219	226	226	219	226
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table B4: Borrowing and Financial Sector Growth

Appendix C - Migration Specifications

Checks for Within-Prefecture Migration

VARIABLES	(1) Ln(Pref Pop)	(2) Ln(Pref GDP)	(3) Ln(Pref Emp.)	(4) Ln(Pref Staff)	(5) Ln(Avg. Pref Wage)
City Trade Lib	0.00229	0.00334	0.0199***	0.0149***	-0.00374*
	(0.00179)	(0.00481)	(0.00486)	(0.00453)	(0.00200)
City Avg. Export Tariff	0.149*	-0.00767	0.0891	0.0732	-0.112**
	(0.0835)	(0.0689)	(0.1000)	(0.0663)	(0.0504)
Observations	440	426	440	440	440
R-squared	0.418	0.946	0.492	0.474	0.985
Number of prefectures	220	213	220	220	220
Pref FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table C1: Checks for within prefecture migration & reallocation, prefecture-level regressions, controls

Checks for Migration Across Prefectures

VARIABLES	(1) Ln(Pref Pop)	(2) Ln(Pref GDP)	(3) Ln(Pref Emp.)	(4) Ln(Pref Staff)	(5) Ln(Avg. Pref Wage)	(6) Ln(Fix Assets Pref)
City Trade Lib	0.00357*	0.00523	0.0210***	0.0153***	-0.00404**	0.00841*
	(0.00197)	(0.00484)	(0.00472)	(0.00379)	(0.00191)	(0.00508)
Neighbor City Trade Lib	-0.00245	-0.00474	-0.00356	-0.00147	0.000897	0.00814
	(0.00185)	(0.00795)	(0.00891)	(0.00723)	(0.00374)	(0.0132)
City Avg. Export Tariff	0.142*	-0.00925	0.0893	0.0728	-0.111**	-0.136
	(0.0836)	(0.0703)	(0.0997)	(0.0643)	(0.0500)	(0.0890)
Observations	436	422	436	436	436	436
R-squared	0.415	0.945	0.767	0.472	0.986	0.867
Number of prefectures	218	211	218	218	218	218
Pref FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table C2: Migration and Reallocation Regressions,Cross-Prefecture Specifications, Controls

Reallocation Check: Investment

VARIABLES	(1) Ln(Fix Assets Pref)	(2) Ln(Fix Assets Pref)
City Trade Lib	0.00411	0.0113*
	(0.00771)	(0.00615)
City Avg. Export Tariff		-0.143
		(0.0900)
Observations	452	440
R-squared	0.834	0.861
Number of prefectures	226	220
Pref FE	Yes	Yes
Year FE	Yes	Yes
Controls	No	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table C3: Investment regressions, prefecture level

Appendix D - Heterogeneous Effects

VARIABLES	(1) Ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(Avg. Wage City)	(6) Ln(Fix Assets City)
City Trade Lib	0.0157***	0.0186***	0.0329***	0.0178***	-0.00422	0.0197***
	(0.00387)	(0.00609)	(0.00510)	(0.00405)	(0.00399)	(0.00624)
City Trade Lib * Dist Port	-3.62e-05	-0.00326**	-0.00210	-0.000701	-9.60e-05	-0.00153
	(0.000772)	(0.00132)	(0.00131)	(0.00104)	(0.000933)	(0.00239)
City Avg. Export Tariff	0.0136	-0.114	0.117*	0.0578	-0.144**	-0.282**
	(0.0763)	(0.0980)	(0.0709)	(0.0666)	(0.0709)	(0.127)
Observations	440	428	440	440	440	440
R-squared	0.550	0.933	0.631	0.444	0.957	0.806
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table D1: Heterogeneous Effects - Distance to Nearest Port, City Level, Controls

VARIABLES	(1) Ln(Pref Pop)	(2) Ln(Pref GDP)	(3) Ln(Pref Emp.)	(4) Ln(Pref Staff)	(5) Ln(Avg. Pref Wage)	(6) Ln(Fix Assets Pref)
City Trade Lib	0.00242	0.00419	0.0198***	0.0148***	-0.00327*	0.0117*
	(0.00177)	(0.00432)	(0.00564)	(0.00445)	(0.00191)	(0.00623)
City Trade Lib * Dist Port	-0.000301	-0.00299**	-0.00523***	0.000281	-0.000917	-0.00148
	(0.000426)	(0.00130)	(0.00185)	(0.00108)	(0.000771)	(0.00209)
City Avg. Export Tariff	0.147*	-0.0301	0.0676	0.0752	-0.119**	-0.159
	(0.0834)	(0.0782)	(0.0981)	(0.0655)	(0.0535)	(0.102)
Observations	440	426	440	440	440	440
R-squared	0.419	0.948	0.779	0.475	0.987	0.864
Number of pref.	220	213	220	220	220	220
Pref FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table D2: Heterogeneous Effects - Distance to Nearest Port, Prefecture Level, Controls

VARIABLES	(1) Ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(Avg. Wage City)	(6) Ln(Fix Assets City)
City Trade Lib	0.0178***	0.0227***	0.0324***	0.0270***	-0.00589	0.0275***
	(0.00527)	(0.00667)	(0.00588)	(0.00473)	(0.00537)	(0.00592)
City Trade Lib * SOE share	-0.0123	-0.0353***	-0.00279	-0.0553***	0.00861	-0.0539***
	(0.0148)	(0.0134)	(0.0186)	(0.0142)	(0.0146)	(0.0186)
City Avg. Export Tariff	0.00766	-0.119	0.126*	0.0282	-0.136**	-0.319**
	(0.0751)	(0.0941)	(0.0689)	(0.0550)	(0.0639)	(0.138)
Observations	440	428	440	440	440	440
R-squared	0.552	0.933	0.627	0.500	0.957	0.813
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table D3: Heterogeneous Effects - Initial SOE share of Employment, City Level, Controls

VARIABLES	(1) Ln(Pref Pop)	(2) Ln(Pref GDP)	(3) Ln(Pref Emp.)	(4) Ln(Pref Staff)	(5) Ln(Avg. Pref Wage)	(6) Ln(Fix Assets Pref)
City Trade Lib	0.00226	0.00590	0.0200***	0.0195***	-0.00387**	0.0173**
	(0.00174)	(0.00420)	(0.00511)	(0.00520)	(0.00195)	(0.00679)
City Trade Lib * SOE share	0.000210	-0.0200	-0.00258	-0.0366**	0.000953	-0.0513***
	(0.00663)	(0.0128)	(0.0241)	(0.0161)	(0.00707)	(0.0164)
City Avg. Export Tariff	0.149*	-0.0299	0.0862	0.0486	-0.111**	-0.203**
	(0.0859)	(0.0754)	(0.0982)	(0.0647)	(0.0494)	(0.103)
Observations	440	426	440	440	440	440
R-squared	0.418	0.946	0.766	0.509	0.986	0.870
Number of pref.	220	213	220	220	220	220
Pref FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table D4: Heterogeneous Effects - Initial SOE share of Employment, Prefecture Level, Controls

VARIABLES	(1) Ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(Avg. Wage City)	(6) Ln(Fix Assets City)
City Trade Lib	0.0259***	0.00953	0.0536***	0.0191	-0.00499	0.00977
	(0.00763)	(0.0112)	(0.00754)	(0.0129)	(0.00730)	(0.0182)
City Trade Lib * SEZ	-0.0128	0.00857	-0.0253***	-0.00204	0.000858	0.0110
	(0.00899)	(0.0116)	(0.00870)	(0.0136)	(0.00813)	(0.0161)
City Avg. Export Tariff	0.00184	-0.0863	0.111	0.0616	-0.143*	-0.263**
	(0.0772)	(0.0957)	(0.0723)	(0.0689)	(0.0735)	(0.118)
Observations	440	428	440	440	440	440
R-squared	0.556	0.931	0.639	0.443	0.957	0.806
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table D5: Heterogeneous Effects - Initial SEZ Status, City Level, Controls

VARIABLES	(1) Ln(Pref Pop)	(2) Ln(Pref GDP)	(3) Ln(Pref Emp.)	(4) Ln(Pref Staff)	(5) Ln(Avg. Pref Wage)	(6) Ln(Fix Assets Pref)
City Trade Lib	0.00349	-0.00771	0.0285***	0.0186**	-0.00641	0.00253
	(0.00394)	(0.00972)	(0.00887)	(0.00926)	(0.00431)	(0.0145)
City Trade Lib * SEZ	0.00349	-0.00771	0.0285***	0.0186**	-0.00641	0.00253
	-0.00139	0.0123	-0.00916	-0.00427	0.00305	0.00988
	(0.00406)	(0.00772)	(0.00857)	(0.00737)	(0.00373)	(0.0130)
City Avg. Export Tariff	0.148*	-0.00277	0.0854	0.0708	-0.111**	-0.143
	(0.0832)	(0.0727)	(0.0983)	(0.0652)	(0.0515)	(0.0934)
Observations	440	426	440	440	440	440
R-squared	0.419	0.946	0.767	0.476	0.986	0.864
Number of pref.	220	213	220	220	220	220
Pref FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table D6: Heterogeneous Effects - Initial SEZ Status, Prefecture Level, Controls

Appendix E - Robustness Checks and Alternative Specifications

Robustness Checks

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(City Fix Asset)	(6) ln(City Avg Wage)
City Trade Lib	0.0163***	0.0168**	0.0316***	0.0181***	0.0197***	-0.00450
	(0.00355)	(0.00663)	(0.00459)	(0.00393)	(0.00659)	(0.00378)
City Avg. Export Tariff	0.0382	-0.0933	0.128*	0.0878	-0.254**	-0.155**
	(0.0725)	(0.0939)	(0.0726)	(0.0670)	(0.121)	(0.0745)
Observations	432	420	432	432	432	432
R-squared	0.562	0.931	0.653	0.462	0.804	0.957
Number of cities	216	210	216	216	216	216
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E1: Robustness 1: City-Level Main Regressions, No Provincial Cities, Controls

VARIABLES	(1) Ln(City Pop)	(2) ln(City Emp)	(3) ln(City Staff)
City Trade Lib	0.0105***	0.0320***	0.00405
	(0.00403)	(0.00456)	(0.00299)
City Avg. Export Tariff	0.00216	0.127*	0.0404
	(0.0780)	(0.0685)	(0.0593)
Observations	440	440	440
R-squared	0.559	0.627	0.531
Number of cities	226	226	226
City FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes
SOE Control	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E2: Robustness check 2 - Controlling for the Initial Share of Employment in SOEs

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(City Fix Asset)	(6) ln(City Avg Wage)
City Trade Lib	0.0110***	0.0169**	0.0322***	0.0123***	0.0193***	-0.000280
	(0.00290)	(0.00675)	(0.00513)	(0.00429)	(0.00551)	(0.00317)
City Avg. Export Tariff	-0.106	-0.189**	0.0826	-0.0485	-0.371***	0.000146
	(0.0920)	(0.0921)	(0.0968)	(0.0672)	(0.107)	(0.0430)
Observations	440	428	440	440	440	440
R-squared	0.613	0.939	0.699	0.575	0.843	0.966
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Composition Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E3: Robustness check 3 - Further Controls for Initial Sectoral Composition

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(City Fix Asset)	(6) ln(City Avg Wage)
City Trade Lib	0.0129***	0.00799	0.0327***	0.0161***	0.0150**	-0.00177
	(0.00313)	(0.00740)	(0.00596)	(0.00503)	(0.00728)	(0.00447)
City Avg. Export Tariff	0.0113	-0.0773	0.110*	0.00618	-0.185	-0.146**
	(0.0665)	(0.0966)	(0.0608)	(0.0513)	(0.182)	(0.0642)
Observations	440	428	440	440	440	440
R-squared	0.549	0.929	0.627	0.442	0.804	0.957
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E4: Robustness check 4 - IV strategy to account for variation in the size of the non-tradable sector

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(City Fix Asset)	(6) ln(City Avg Wage)
Non-MFA City Trade Lib	0.0230***	0.0272***	0.0453***	0.0233***	0.0235**	-0.00819**
	(0.00470)	(0.00849)	(0.00741)	(0.00655)	(0.00939)	(0.00379)
City Avg. Export Tariff	-0.0157	-0.108	0.0604	0.0191	-0.321***	-0.147**
	(0.0795)	(0.0982)	(0.0712)	(0.0643)	(0.110)	(0.0738)
Observations	440	428	440	440	440	440
R-squared	0.552	0.932	0.626	0.436	0.803	0.957
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E5: Robustness check 5 - MFA Robustness

Alternative Specifications

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(City Fix Asset)	(6) ln(City Avg Wage)
City Exposure Trade Lib	0.184***	0.238***	0.275***	0.229***	0.195***	-0.0990***
	(0.0595)	(0.0424)	(0.0699)	(0.0684)	(0.0732)	(0.0366)
City Avg. Export Tariff	-0.0663	-0.168	-0.0663	-0.0151	-0.373***	-0.137**
	(0.0848)	(0.111)	(0.0801)	(0.0558)	(0.109)	(0.0676)
Observations	440	428	440	440	440	440
R-squared	0.562	0.933	0.617	0.479	0.806	0.958
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E6: Alternative Specification: City-Level Main Regressions, Controls

VARIABLES	(1) ln(City Pop)	(2) ln(City GDP)	(3) ln(City Emp)	(4) ln(City Staff)	(5) ln(City Fix Asset)	(6) ln(City Avg Wage)
City Exposure Trade Lib	0.113***	0.263***	0.241***	0.127***	0.272***	-0.0114
	(0.0373)	(0.0560)	(0.0645)	(0.0396)	(0.0884)	(0.0328)
City Avg. Export Tariff	-0.148	-0.222**	-0.0686	-0.0940	-0.408***	-0.00282
	(0.0995)	(0.103)	(0.102)	(0.0701)	(0.110)	(0.0463)
Observations	440	428	440	440	440	440
R-squared	0.610	0.940	0.669	0.569	0.845	0.966
Number of cities	220	214	220	220	220	220
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sectoral Controls	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E7: Alternative Specification: City-Level Main Regressions, Standard Controls and Sectoral Controls

VARIABLES	(1) Ln(City Prim. Emp)	(2) Ln(City Sec. Emp)	(3) Ln(City Ter. Emp)	(4) Ln(City Manu. Emp)
City Exposure Trade Lib	-0.0693	0.248**	0.210***	0.214*
	(0.158)	(0.108)	(0.0405)	(0.120)
City Avg. Export Tariff	0.409	-0.139	0.0464	-0.177*
	(0.391)	(0.105)	(0.0713)	(0.103)
Observations	412	440	440	440
R-squared	0.695	0.506	0.528	0.540
Number of cities	206	220	220	220
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E8: Alternative Specification: City-Level Structure of Employment Regressions, Controls

VARIABLES	(1) ln(Pub Ut E.)	(2) ln(Const E.)	(3) ln(Fin E.)	(4) ln(Gov E.)	(5) ln(Geosci E.)	(6) ln(Trans Com E.)	(7) ln(Educ Soc E.)	(8) ln(Sale Cat E.)	(9) ln(R Est E.)
City Exposure Trade Lib	0.0720	0.122	0.114***	0.171***	0.0655	0.129**	0.211***	0.192*	0.102*
	(0.0636)	(0.121)	(0.0367)	(0.0170)	(0.0590)	(0.0523)	(0.0492)	(0.0945)	(0.0526)
City Avg. Export Tariff	-0.00660	-0.200	-0.176*	-0.0473	0.0582	-0.141	-0.0228	-0.224	0.108
	(0.0973)	(0.277)	(0.0862)	(0.0561)	(0.0745)	(0.153)	(0.0843)	(0.189)	(0.166)
Observations	442	446	446	446	443	446	446	446	438
R-squared	0.292	0.364	0.470	0.631	0.765	0.399	0.545	0.728	0.749
Number of cities	224	226	226	226	225	226	226	226	224
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E9: Alternative Specification: Detailed Analysis of the Service Sector, Controls

Census Cross-Checks

	(1)	(2)	(3)	(4)
VARIABLES	Ln(Pop. Census)	Ln(Emp. Census)	Migration Rate	Unemp. Rate
City Trade Lib	0.00257*	0.00481***	0.204*	-0.000715
	(0.00135)	(0.00137)	(0.107)	(0.00727)
City Avg. Export Tariff	0.0187	0.0327	-1.592*	0.106
	(0.0219)	(0.0352)	(0.842)	(0.202)
Observations	448	448	448	448
R-squared	0.501	0.458	0.468	0.832
Number of cities	224	224	224	224
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

Standard errors clustered at the province level
*** p<0.01, ** p<0.05, * p<0.1

Table E10: Census Cross Checks, Prefecture Level

Appendix F - A Simple Model

Our empirical setting and results can be rationalized via a simple Jones (1975) style specific factors model (Kovak 2013, has more recently employed a specific factors model to analyze the impact of Brazil's trade liberalization in the 1980s).

Imagine a country with C cities indexed by $c \in \{1, 2, \ldots, C\}$. Production takes place many sectors indexed by $i \in \{1, 2, \ldots, I\}$. Aside from cities, there is also a countryside (hinterland) where a traditional good is produced. The traditional good is designated as the numeraire, and is produced in the countryside with productivity ω.

Output in each sector is produced using labor and an industry specific factor of production denoted by T_i. Labor is costlessly mobile across sectors and locations, and the labor force of the country is considered to be sufficiently large such that the countryside is never empty. The production technologies of each sector are described by production functions of the type:

$$y_i = AL_i^{\alpha_i} T_i^{1-\alpha_i} \tag{31}$$

Sectoral-specific capital is considered to be completely immobile across space. Each location c is characterized by a vector $\langle \overline{T_{1c}}, \ldots, \overline{T_{Ic}} \rangle$ of endowments of sectoral specific capital.

The prices of all commodities are determined on the international market and are given by the vector $\{P_1, P_2, \ldots P_I\}$. In order to access the international market, domestic producers are faced with sectoral specific tariffs. The product specific tariffs faced by each product take the iceberg form, are stochastic and given by:

$$\tau_i = \begin{cases} \tau_{iH} \text{ with probability } \gamma \\ \tau_{iL} \text{ with probability } 1-\gamma \end{cases} \tag{32}$$

where $\tau_{iH} > \tau_{iL} > 1$. We can write $\tau_i = 1 + t_i$ where t_i represents the ad valorem tariff.

With the set-up above, solving for the endogenous variables of interest (employment at the city-industry level, total employment/ population and the rental rates of the specific factors yields):

$$L_{ic} = \left\{ \frac{\alpha_i A \left[\tau_{iL} + \tau_{iH} - E(\tau_i)\right] P_i}{\omega \tau_{iH} \tau_{iL}} \right\}^{\frac{1}{1-\alpha_i}} \overline{T}_{ic} \tag{33}$$

$$L_c = \sum_{i=1}^{I} \left\{ \frac{\alpha_i A \left[\tau_{iL} + \tau_{iH} - E(\tau_i)\right] P_i}{\omega \tau_{iH} \tau_{iL}} \right\}^{\frac{1}{1-\alpha_i}} \overline{T}_{ic} \tag{34}$$

$$r_{ic} = (1-\alpha_i) \left(\frac{\alpha_i}{\omega}\right)^{\frac{\alpha_i}{1-\alpha_i}} \left\{ \frac{\alpha_i A \left[\tau_{iL} + \tau_{iH} - E(\tau_i)\right] P_i}{\omega \tau_{iH} \tau_{iL}} \right\}^{\frac{1}{1-\alpha_i}} \tag{35}$$

The US policy change induced by China's WTO accession we study in this paper can be modeled as a decline in the probability of high tariffs γ. Studying the evolution of prefecture-industry employment and city-level outcomes as a result of China's WTO accession yields:

$$\hat{L_c} = \frac{L_{1c}}{L_c} \hat{L_{1c}} + \frac{L_{2c}}{L_c} \hat{L_{2c}} + \cdots + \frac{L_{Ic}}{L_c} \hat{L_{Ic}} \tag{36}$$

$$\hat{L_{ic}} \approx -\frac{\Delta\gamma}{1-\alpha_i} g(\Delta t_i) \tag{37}$$

where $g(.)$ in an increasing function and $\Delta\gamma = \gamma_L - \gamma_H$ with $\gamma_H > \gamma_L$, γ_H the initial high probability and γ_L the new reduced probability of high tariffs. Moreover if we set $\alpha_i = \alpha \forall i$ we

obtain:

$$\hat{L_c} = -\frac{\Delta\gamma}{1-\alpha}\left[\frac{L_{1c}}{L_c}g(\Delta t_1) + \ldots + \frac{L_{Ic}}{L_c}g(\Delta t_I)\right] \tag{38}$$

Which gives us the prediction that cities specialized in sectors subject to bigger tariff gaps before 2001 can be expected to grow faster in population and employment after China's WTO accession. Note that in the absence of an estimate of $\Delta\gamma$ the simple model above only makes "sign"predictions, while being silent on the magnitude of the coefficients in our regression models in the previous section.

Appendix G - Data and Variable Construction

China Outcomes and Controls

City-level data are taken mainly from the 1999 and 2008 China City Statistical Yearbooks (CSY). The CSY reports various socio-economic outcomes, including local GDP, population, employment by sector, average number and average wage of staff, average net fixed asset during the year and number of new FDI contracts, for more than 200 prefecture-level cities in China in the preceding year. Data are available at 2 levels of spatial disaggregation: the prefecture-level city and the urban ward of prefecture city (Shixiaqu). The number of prefecture-level cities included in CSY increases over time as existing counties or prefectures were upgraded into cities. Yet only 228 and 266 cities do not report report missing values of our key variables in the 1999 and 2008 CSY respectively. Our final sample includes a balanced panel of 226 cities after dropping missing values.

Sectoral-level and sectoral-city-level variables are computed from the 1998 and 2007 Annual Surveys of Industrial Firms (ASIF). The ASIF include all state-owned enterprises and non-state owned enterprises with sales over 5 million RMB. Firms report their zip codes, 4-digit CIC codes, ownership, export status and more than 60 financial variables from their balance sheets and profit statements. The 4-digit CIC codes are based on the 1996 and 2002 Chinese Industrial Classification (410 industries) and matched across years using the industry concordance provided by Brandt, Biesebroeck and Zhang (2012). The CIC codes are then matched with 4-digit ISIC Rev.3 codes with the use of the correspondence table developed by Dean and Lovely (2009). The firm-level data is aggregated to create a balanced panel of city-industries at 4-digit ISIC-level for 2 spatial levels. All variables are deflated to real values before aggregation. Output and input deflators are provided by Brandt, Biesebroeck and Zhang (2012). Additional city-level variables, including total manufacturing employment, employment share of state-owned enterprises, number of exporters, total export value, total equity by regional sources, total liabilities and total debt, are also computed from the 1998 and 2007 ASIF by simple aggregation.

As a robustness check, we use the 2000 and 2010 Tabulations on Population Census by County to re-calculate total population and total employment at 2 levels of spatial disaggregation. The data also allow us to calculate the migration rate and unemployment rate for each prefecture-level city and its urban ward. Migration rate is defined as the share of population who reported to have migrated from another province. The unemployment rate is the number of individuals searching for jobs divided by the size of population aged between 15 and 64 excluding students, home makers, retired people, disabled and reported not working for other reasons.

City's distance to port is obtained from China's GIS Map with county boundaries for the year 1999. We measure the length of the straight line from the center of a county to its nearest port, and define a city's distance to port as the median distance among all counties located in that city.

Trade Variables

Tariff Gaps

We obtained US column 1 and column 2 tariffs at 8-digit HS for the year 1998 from Feenstra et al. (2002). We assume that column 2 tariffs are the tariff rates that would have been imposed on Chinese exports if China's MFN status is revoked while column 1 tariffs are the applied tariff rates faced by Chinese exporters. Our product-level tariff gap is the average difference between US column 1 and column 2 tariffs at 6-digit HS. Sectoral-level tariff gaps are defined as the simple average of 6-digit tariff gaps at 4-digit ISIC. The concordance between 6-digit HS and 4-digit ISIC Rev. 3 is provided by the UN Statistics. Sectoral-city employment used to compute city-level tariff gaps (equation 6) and all our measures of city-level US trade liberalization is from the 1998 ASIF while total city employment in 1998 is from the 1999 CSY.
To control for the removal of quotas due to the provisions of the Multi Fiber Agreement (MFA) in 2004, we recompute city-level tariff gaps assuming that the sectoral-level tariff gap and employment of ISIC industries 1711, 1721, 1722, 1723, 1729, 1730, 1810 and 2430 are zero.

Tariffs

Our control variables include city-level tariff shocks arising from changes in tariffs on China's imports and exports. China's import values and export values are obtained from UN Comtrade at 6-digit HS product levels for each import origin and export destination. Data on tariffs are available at the World Integrated Trade Solution (WITS) at 8-digit HS. Product concordances for HS1996, HS2002 and HS2007 are provided by UN Statistics Division. Our calculations for city-level tariff shocks involve two steps. First, we aggregate China's 8-digit product tariffs to 4-digit ISIC. Applied tariffs on Chinese exports (export tariffs) from 149 trading partners are aggregated to 4-digit ISIC by first taking simple average to 6-digit HS and then weighted by countries' import shares in 1998. Tariffs on Chinese imports are divided into two types: tariffs on imported final goods (output tariffs) and tariffs on imported intermediate inputs (input tariffs). Output tariffs are average 6-digit HS tariffs weighted by the product import shares in 1998. Input tariffs are weighted averages of final goods tariffs, where weights are 4-digit industry cost shares. The breakdown of industry input cost shares is from the 2002 Chinese Input-Output Table. Second, city-level tariffs are computed in a similar way as city-level tariff gaps (equation 6), except that sectoral tariff gaps are replaced by sectoral tariffs. Sectoral-city employment used to compute city-level tariffs is taken from 1998 ASIF while total city employment is obtained from the 1999 CSY.

Local Spillovers

Output Share

Industry output shares used to compute output and search linkages are taken from the 2002 Chinese Input-Output Table. We aggregate the output shares of 112 CIC industries to 69 3 to 4 digit ISIC using the correspondence table developed by Dean and Lovely (2009).

Labor Correlation

Following Ellison, Glaeser and Kerr's (2010) methodology, we compute a measure of similarity in occupational labor requirements for pairwise industries using the 2012 Industry-Occupation Matrix (IOM) published by the US Bureau of Labor Statistics. The IOM reports employment in

277 occupations at 4-digit NAICS. We first map the 4-digit NAICS manufacturing industries to 4-digit ISIC using the concordance table provided by the UN Statistics Division. Then we compute the occupational shares for each industry and calculate the pairwise correlation of occupational shares between every two 4-digit ISIC industries.

Technology Flow

Our measure of technology outflow uses the technology flow matrix developed by Scherer (1984). The matrix estimates the inter-industry R&D benefits arising from supplier-customer relationships or potential utilization of patented inventions for 38 US manufacturing industries during the 1970s. Following Ellison, Glaeser and Kerr's approach, we convert the R&D flows between 38 industries to 4-digit ISIC using total industry sales obtained from the 1998 ASIF. To be more specific, if R^*_{mn} is the dollar amount of R&D that industry m benefits from industry n , and i (resp., j) is a 4-digit ISIC industry that is part of industry group m (resp., n) and accounts for a fraction w_i (resp., w_j) of the total industry sales in that industry group, then $R_{ij} = w_i w_j R^*_{mn}$.

Financial Dependence

Rajan and Zingales (1998) calculate the median level of external financing for 36 ISIC industries in the US during the 1980s. External dependence is defined as the fraction of capital expenditures not financed with cash flow from operations. We use their measure of sectoral external dependence for all companies to compute our index of financial dependence for manufacturing sectors.

List of Variables

This section explains the definitions of outcome and control variables taken from the 1999 and 2008 City Statistical Yearbooks (CSY), and 2000 and 2010 Tabulations on Population Census by County (TPC). All CSY variables are available for the entire prefecture-level city and the urban ward of the city, unless stated otherwise. The TPC variables are computed at the city-level.

City Statistical Yeabooks

Variable Name	Definition
Pop	Total registered population
GDP	Local GDP in 10,000 RMB
Emp	Total employed persons. Employed persons refer to individuals who are engaged in social working and receive remuneration payment or earn business income, including total staff and workers, re-employed retirees, employers of private enterprises, self-employed workers, employees in private enterprises and individual economy, employees in township enterprises, employed persons in the rural areas, and other employed persons (including teachers in the schools run by the local people, people engaged in religious profession and the servicemen, etc.). Please refer to variable of 'Staff' for the definition of 'staff and workers'.
Prim Emp	Total employed persons in primary sector
Sec Emp	Total employed persons in secondary sector, which includes mining, construction and manufacturing industries
Ter Emp	Total employed persons in tertiary sector
Manu Emp	Total employed persons in manufacturing sector
Manu Share	Manufacturing share of employed persons
Staff	Average number of staff and workers. Staff and workers refer to individuals who work in (and receive payment therefrom) enterprises and institutions of state ownership, collective ownership, joint ownership, share holding, foreign ownership, and ownership by entrepreneurs from Hong Kong, Macao, and Taiwan, and other types of ownership and their affiliated units, excluding the retired persons invited to work in the units again, teachers in the schools run by the local people and foreigners, and persons coming from Hong Kong, Macao and Taiwan and working in the state-owned economic units.
Avg Wage	Average wage of staff
Fix Asset	Average net fixed asset during the year in 10,000 RMB
New FDI Contr	Number of new FDI contracts

Variable Name	Definition
Emp Elecc	Total employed persons in public utilities (urban ward only)
Emp Consc	Total employed persons in construction (urban ward only)
Emp Finc	Total employed persons in finance and insurance (urban ward only)
Emp Govc	Total employed persons in government or party agencies, social organizations (urban ward only)
Emp Geoscic	Total employed persons in geological prospecting, water conservatory management, scientific research, polytechnic services (urban ward only)
Emp Trancomc	Total employed persons in transport, storage, post, telecommunications, computer and software (urban ward only)
Emp Educsocc	Total employed persons in education, social services, health care and social welfare (urban ward only)
Emp Salecatc	Total employed persons in wholesale, retail, accommodation and catering (urban ward only)
Emp Estatec	Total employed persons in real estate, leasing and commercial services (urban ward only)

Annual Surveys of Industrial Firms

Variable Name	Definition
Emp	Total employment
Output	Real industrial output value. Firm-level industry outputs are deflated with Brandt, Biesebroeck and Zhang's (2012) 4-digit CIC output deflators, then aggregated to 4-digit ISIC for each city.
Sales	Real industry sales. Firm-level industry sales are deflated with Brandt, Biesebroeck and Zhang's (2012) 4-digit CIC output deflators, then aggregated to 4-digit ISIC for each city.
No of Firms	Number of manufacturing firms
No of Exp	Number of exporting firms
Fix Asset	Net fixed assets
Exp Value	Total export value

Tabulations on Population Census by County

Variable Name	Definition
Pop	Total population
Emp	Total employed persons
Migration Rate	Number of individuals who reported to have migrated from another province divided by total population
Unemp Rate	Number of individuals searching for jobs divided by the size of population aged between 15 and 64 excluding students, home makers, retired people, disabled and reported not working for other reasons