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Trade Liberalization and the *Hukou* System of the People's Republic of China: How Migration Frictions Can Amplify the Unequal Gains from Trade

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3.1 Introduction

The emergence of the People's Republic of China as a great economic power has stimulated an epochal shift in patterns of world trade, in contradiction to the conventional wisdom regarding the impact of trade on labor markets in developed countries (Autor, Dorn, and Hanson 2016). The global effects of the People's Republic of China's trade and economic growth has been widely documented (Autor, Dorn, and Hanson 2013; Bugamelli, Fabiani, and Sette 2015; Balsvik, Jensen, and Salvanes 2015; Giovanni, Levchenko, and Zhang 2014; Hsieh and Ossa 2011), reshaping our understanding of the consequences of trade for wages, unemployment, and other labor market outcomes.

On the other hand, equally significant transformations can be identified within the People's Republic of China itself, including the remarkable degree of internal migration occurring within the country. Hundreds of millions of the workers have moved from inland areas to coastal cities, contributing to manufacturing growth and export surges. However, the extent to which they have benefited from the country's trade liberalization remains less clear: migrant workers are usually treated as second-class citizens and are prevented from accessing

various social benefits provided at the local level due to the country's unique household registration system (*hukou*). Does the *hukou* system contribute to the unequal distribution of gains from trade? Does this labor market distortion prevent the People's Republic of China from fully reaping the gains from trade reforms? These are relevant policy questions that require empirical underpinning.

From a theoretical point of view, trade liberalization is often considered an important driver of economic development, as it can raise a country's income through increasing specialization in sectors with a comparative advantage, providing access to cheap foreign inputs, and facilitating the adoption of new technologies. However, prominent trade theories typically focus on long-run equilibria, assuming that the reallocation of resources across economic activities is frictionless. However, in reality, factor adjustments tend to be slow, costly, and heterogeneous across firms, sectors, and space. As long as some production factors are spatially immobile and trade is not frictionless, the extent to which a country can gain from trade is ultimately contingent on labor mobility. This point has long been recognized but has become increasingly emphasized by trade and labor economists, as we find more and more evidence regarding the adverse impact of trade shocks on labor market outcomes.

Nevertheless, demonstrating this empirically is not easy. First, it is very difficult to find a clear measure of migration friction, as most factors or policy shocks affect both goods and people at the same time. Second, according to most studies, internal migration reacts negligibly to trade shocks. Some indirect evidence exists that labor immobility can explain a large proportion of the negative impact of trade,[1] but owing to the aforementioned difficulties, a direct test remains missing. I exploit the People's Republic of China's liberalization episode following its accession to the World Trade Organization (WTO) to test how its internal migration reacts to trade shocks. Using a *hukou* friction measure constructed in Zi (2018), I shed light on the interaction between trade and migration frictions.

Drawing on a rich dataset that I assembled on the People's Republic of China's regional economy, I find that prefectures that experience more positive trade shocks have seen a relative increase in employment, and the effect is strongest in provinces with a lower amount of *hukou* friction. A prefecture at the 75th percentile of effective tariff exposure experiences an employment increase 3.4 percentage points greater (or smaller decrease) than a prefecture at the 25th percentile. In a prefecture

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1 See, for instance, Autor, Dorn, and Hanson (2013); Topalova (2010); Dix-Carneiro and Kovak (2017) for the cases of the United States (US), India, and Brazil, respectively.

with the lowest amount of *hukou* friction, the effect is three times larger than the average effect. On average, over 30% of the regional variation in employment changes can be attributed to trade liberalization. Moreover, the total population and the working-age population of prefectures react to trade shocks and their interaction with the *hukou* measure in a quantitatively similar way to employment, suggesting that the observed regional employment changes are primarily driven by interregional labor adjustments. Direct focus on migration flows yields similar results. Most importantly, I only find that trade shocks result in increases in the population holding local *hukou* in prefectures where *hukou* frictions are low. This result suggests that in spite of labor mobility between prefectures, migrant workers can only obtain a local *hukou* in prefectures with less stringent *hukou* systems. This supports the validity of my *hukou* measure and confirms the existence of *hukou* frictions.

Although the focus of this chapter is on the People's Republic of China, the message and policy implications are not limited to this country. According to World Population Policies 2013 (United Nations 2013), 60% of governments in the world desired a major change in their spatial labor distribution and 80% of these countries had policies in place to influence internal migration. In general, gaining a greater understanding of when and where trade is costly and how various domestic frictions shape the impact of trade on workers, individuals, and/or households of different groups is central to the research agenda of trade economists. Implementing effective policies to eliminate or mitigate these frictions and effectively targeting the most adversely affected individuals should represent a salient issue to policy makers and applied economists.

The content of this chapter is based on the analysis of Zi (2018). I begin by discussing the People's Republic of China's trade reforms since the late 1970s and their acceleration following the country's accession to the WTO. I then provide a detailed description of the country's various *hukou* reforms. In the following section, I identify the trade shocks and migration frictions embedded in the *hukou* system at the local level, present evidence regarding the ways in which trade shocks have stimulated a substantial degree of spatial labor reallocation in the People's Republic of China, as well as how regional *hukou* frictions influence this effect. I subsequently offer a simple conceptual framework that guides our inquiry on measuring and interpreting the welfare impacts of the observed labor reallocation. Finally, I present welfare calculations from Zi (2018), demonstrating how the *hukou* system has prevented optimal spatial adjustments of labor to trade shocks in the country, and how this in turn amplifies the negative distributional consequences of trade.

3.2 The Trade and *Hukou* Reforms of the People's Republic of China

3.2.1 Trade Liberalization in the People's Republic of China: Before and after the WTO

Prior to its economic reform in the early 1980s, the average tariff level in the People's Republic of China was 56%.[2] This tariff schedule was implemented in 1950, with almost no change since, partly due to the relative unimportance of trade policy under the centrally planned economy. Under the planned economy, import and export quantities represented government decisions rather than reflections of market supply and demand (Ianchovichina and Martin 2001). During this period, the People's Republic of China's trade was run by 10 to 16 foreign-trade corporations that were de facto monopolies in their specified product ranges (Lardy 1991).

In 1982, the People's Republic of China commenced its first tariff modification, and gradually reduced its average tariff by 13% in the following 5 years. From 1992 onward, in order to pave the way for the country's accession to the WTO, the government engaged in a series of voluntary tariff cuts on over 5,000 products, driving the simple average tariff down from 43% in 1992 to 24% in 1996 (Li 2013).

However, these episodes of tariff reductions were accompanied by pervasive and complex import and export controls. Import quotas, licenses, designated trading practices, and other nontariff barriers were widely used (Blancher and Rumbaugh 2004). There was also a substantial level of tariff redundancy resulting from various preferential arrangements. To name a few, imports for processing purposes, for military uses, by special economic zones (SEZs), and in certain areas near the People's Republic of China's border were subject to waivers or reductions in import duties. According to Ianchovichina and Martin (2001), only 40% of imports were subject to official tariffs. In addition, the renminbi depreciated by more than 60% in the 1980s, and a further 44% in 1994 to help firms export (Li 2013). As a result, changes in tariff duties do not fully reflect the changes in actual protection faced by firms or the accessibility of imported inputs during these periods.

In 1996, the government implemented substantial reforms that removed most restrictive nontariff barriers to fulfill the preconditions of WTO accession. Trade licenses, special import arrangements,

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[2] This is the 1982 unweighted average tariff documented by Blancher and Rumbaugh (2004).

and discriminatory policies against foreign goods were reduced or eliminated to render tariffs the primary instruments of protection. The share of all imports subject to licensing requirements fell from a peak of 46% in the late 1980s to less than 4% of all commodities by the time the People's Republic of China acceded to the WTO. The state abolished import substitution lists and authorized tens of thousands of companies to engage in foreign trade transactions, undermining the monopoly powers of state trading companies for all but a handful of commodities. The transformation was similarly far-reaching on the export side (Lardy 2005). The duty-free policy on imports for personal use by SEZs was gradually abolished in the 1990s, and preferential duty in some border provinces were abolished in 2001. Moreover, the People's Republic of China also abolished, modified, or added over 1,000 national regulations and policies. At the regional level, more than 3,000 administrative regulations and about 188,000 policy measures implemented by provincial and municipal governments were ceased.

From 2001, phased tariff reductions were implemented following the People's Republic of China's WTO accession, with the goal of reducing both the average tariff levels and the dispersion of tariffs across industries. In 2000, the People's Republic of China's simple average applied tariff was 17%, with a standard deviation across the Harmonized System six-digit level (HS6) products of 12%. By the end of 2005, the average tariff level was reduced to 6%, and the standard deviation had almost halved. The average tariff level stabilized after 2005.[3]

3.2.2 The *Hukou* System

A *hukou* is a household registration record that identifies a person as a resident of a particular area in the People's Republic of China. It officially identifies a person as a resident of an area in the country and determines where he or she is officially allowed to live. The *hukou* system was introduced in the early 1950s to harmonize the old household registration systems across regions. However, under the centrally planned economy, economic resources were mostly devoted to urban areas, as the government hoped to extract the country's agricultural economic surplus to fuel urban industrialization. This uneven allocation of resources led to a massive influx of migrants into the main cities, which in turn resulted in substantial unemployment in urban areas while threatening agricultural production in rural areas (Kinnan, Wang, and

[3] All numbers are calculated using the simple average of most-favored nation applied tariffs at the Harmonized System six-digit level (HS6) from the United Nations Conference on Trade and Development Trade Analysis Information System database.

Wang 2015). As a result, the *hukou* system was soon repurposed to restrict both interregional and rural-to-urban migration. In 1958, the Standing Committee of the National People's Congress adopted the Household Registration Regulations. According to the regulations, citizens could only apply to move after the registration authority had granted them the local *hukou*. From then on, the People's Republic of China entered an era with strict internal migration controls, with the *hukou* being at the center of the migration control system.

By the end of the 1950s, free migration became extremely rare. Migrant workers would require six passes to work in provinces other than their own. Moreover, rural-to-urban migrants would have to adhere to the above restrictions and also first acquire an urban *hukou*, the annual quota of which was 0.15% to 0.2% of the nonagricultural population of each city (Cheng 2007). Under the central planning system, coupons for consumption goods, employment, housing, education, health care, and other social benefits were entirely allocated based on the local *hukou*, and urban dwellers without a local *hukou* would be fined, arrested, and deported. Thus, it was impossible for people to work and live outside their authorized domain (Cheng and Selden 1994).

In the early 1980s, the People's Republic of China latched onto a labor-intensive, export-oriented development strategy that created increasingly large labor demand in cities. Accordingly, migration policy began to relax over time. In 1984, the State Council allowed rural populations to reside in villages with self-sustained staples. In the following year, the Ministry of Public Security allowed people to migrate freely conditional on applying for a temporary residential permit upon arrival. In 1993, the People's Republic of China officially ended the food rationing system, and internal migration was no longer limited by *hukou*-based consumption coupons. Gradually, the distinction between the rural and urban *hukou* also became less important (Bosker et al. 2012). The rural-to-urban migration quotas were officially abolished in 1997; for many cities and towns, the rural/urban distinction of the *hukou* type was also eliminated (Chan 2009).

Nevertheless, the *hukou* system continues to serve as the primary instrument for regulating interregional migration. Certain cities have limited capacity for large quantities of labor due to historical or environmental issues, so they continue to seek to keep migration under tight control. Some regions that are close to national borders or that contain large proportions of ethnic minority groups are also sensitive to migration inflows, largely due to stability concerns. In addition, without fiscal transfers from the central government, prefectures generally have very little incentive to provide public services to migrant workers. Consequently, discrimination against migrant workers on the basis of the

hukou status remains widespread. Individuals who do not have a local *hukou* in the place where they live are not able to access certain jobs, schooling, subsidized housing, health care, and other benefits enjoyed by those who do. As a result, the ease of obtaining a local *hukou* still influences one's migration decisions to a considerable extent.

Importantly, as part of a contemporaneous reform devolving fiscal and administrative powers to lower-level governments, local governments have largely acquired the authority to determine the number of *hukou* to issue in their jurisdictions. Since 1992, some provinces have introduced temporary resident permits for anyone with a legitimate job or business in one of their major cities, and some grant a *hukou* to high-skilled professionals or businesspeople who make large investments in their region (Kinnan, Wang, and Wang 2015). The most significant change is the introduction of two types of residential registration, the so-called temporary residential permit and the blue-stamp *hukou*. Unlike the regular *hukou*, these are not administered by the central government; instead, their design and implementation are determined by local governments. While the temporary resident permit can be issued to anyone who has a legitimate job or business in the city, citizens who want a blue-stamp *hukou* are usually required to pay a one-time entry fee called the urban infrastructural construction fee, which varies between a few thousand yuan in small cities and CNY50,000 in more "attractive" cities. However, the stringency of these policies and general *hukou*-issuing rules differ significantly across regions. For instance, it is notoriously difficult to obtain a *hukou* in Beijing or Shanghai, while Dongguan, a coastal city in Guangdong province, offers relatively generous granting rules to attract low-skilled migrants for its booming manufacturing sectors. It is this heterogeneity in *hukou*-granting practices that provides variation in the *hukou* friction measure.

The aforementioned practices resulted in formal *hukou* reform, launched by the central government in 1997. The major aspects of the reform included officially abolishing the rural-to-urban migration quotas and approving the selective migration policies in cities. Following an experimental period, a national implementation of the reform began in 2001. However, this reform, which is largely an affirmation of local policies that were already in place, has been largely put on hold since mid-2002 due to stability concerns (Wang 2004). According to Chan and Buckingham (2008), it only had a small impact in facilitating internal migration. In spite of the general increase in the number of migrants in the country during the last quarter century, the annual number of *hukou* migrants recorded by the Ministry of Public Security remained stable between 1992 to 2008 (Chan 2013). In 2011, "a *hukou* reform" was

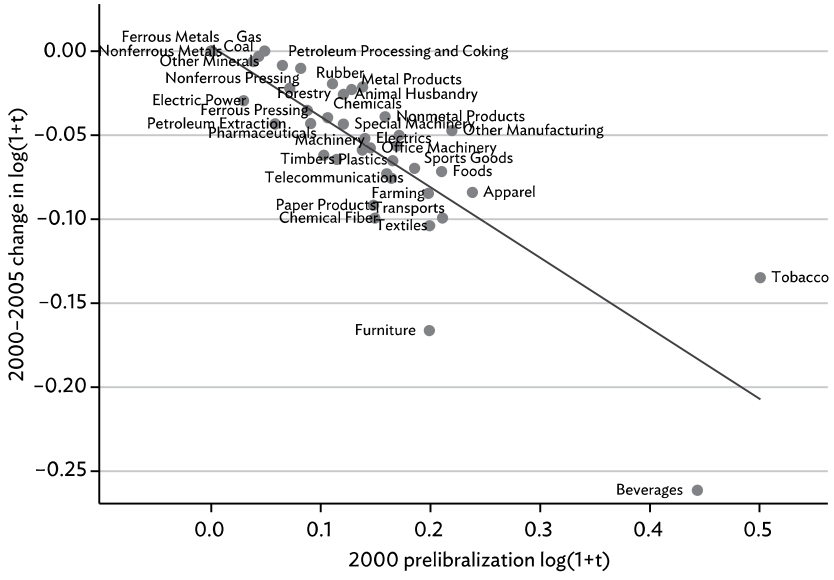
mentioned again in the country's Five-Year Plan, but the exact plan only began to take shape in 2014.

3.2.3 Exogeneity of Trade Liberalization

The validity of the empirical analysis relies on the variation in tariff changes across industries. To draw any causal implications of input trade liberalization, tariff changes must be unrelated to counterfactual industry employment growth. As discussed in Kovak (2013), such a correlation may arise if trade policy makers impose smaller tariff cuts to protect weaker industries, or if larger industries lobby for smaller tariff cuts (Grossman and Helpman 1994).

There are several reasons to believe that these concerns are less important for the People's Republic of China. Viewing WTO membership as a means of locking the country on a path of deepening economic reform and openness, the government has demonstrated a greater desire to open rather than protect its domestic industries (Woo 2001). Additional supporting evidence comes from examining the relationship between tariff cuts and preliberalization employment. If policy makers had permitted "stronger" industries to bear larger tariff

Figure 3.1 Tariff Changes and Preliberalization Tariff Levels



Notes: This figure plots log tariff changes over 2000–2005 against the log 2000 tariff levels. The sectoral tariff is calculated based on the simple average of most-favored nation applied tariff rates at the Harmonized System HS6 product level from the Trade Analysis Information System database. Correlation: −0.84; regression coefficient: −0.43; standard error: 0.044; t: −9.60.

Source: Author's calculation.

cuts, industries with higher employment *growth* between 1990 and 2000 would have experienced greater tariff reductions; if large industries lobbied more or were more likely to be protected due to employment concerns, industries with larger employment (in *levels*) in 2000 would have experienced lower tariff cuts. However, I find only marginal and statistically insignificant correlation between tariff changes and pre-WTO industry employment in both *changes* and *levels*, the simple correlations being 0.13 and 0.16, respectively.

Following the approach of Goldberg and Pavcnik (2005), Figure 3.1 demonstrates that industries with high tariffs in 2000 experienced the largest tariff cuts, with the correlation between the 2000 tariff levels and the change in tariffs being –0.84. The fact that the pre-WTO tariff levels largely determined the tariff changes following the People's Republic of China's WTO accession implies that the primary goal of policy makers was to reduce tariff rates and to smoothen cross-industry variations. This rules out the industry protection and political economy concerns.

Most importantly, even after rounds of voluntary tariff reductions, the country's tariff structure in 2000 remained similar to that of 1992,[4]

Table 3.1 Imports and Tariffs

	Import Values		Varieties		Unit Values	
	All Products	Intermediates	All Products	Intermediates	All Products	Intermediates
	(1)	(2)	(3)	(4)	(5)	(6)
Output tariff	–0.22***	–0.16***	–1.06***	–1.01***	0.02	0.05**
	(0.05)	(0.06)	(0.12)	(0.13)	(0.02)	(0.02)
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
HS6 fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	35,457	26,380	35,457	26,380	33,695	25,193
R-squared	0.08	0.09	0.27	0.29	0.10	0.09
Number of hs2002	5,222	3,904	5,222	3,904	5,124	3,830

HS = Harmonized System.

Notes: Coefficient on tariffs from HS6 product level regression of log import value, HS8 variety numbers, unit value on lagged output tariffs, HS6 product fixed effects, and year fixed effects. An observation is HS6-year. The data cover nonprocessing trade in 2000–2006. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculation.

[4] 1992 is the earliest year that tariff data for the People's Republic of China at the HS6 level are available.

with a correlation of 0.93. On the other hand, the *bound* duties after joining the WTO were largely imposed externally, benchmarking the tariff levels of other WTO members. Unlike in many other developing countries, there is almost no gap between the People's Republic of China's *bound* and *applied* duties, and the binding coverage is 100%. This implies that the preliberalization tariffs in the People's Republic of China were based on a protection structure that was set a decade earlier, while postliberalization tariffs were externally set. Therefore, it is highly unlikely that tariff reductions between 2000 and 2005 are correlated with counterfactual industry employment changes.

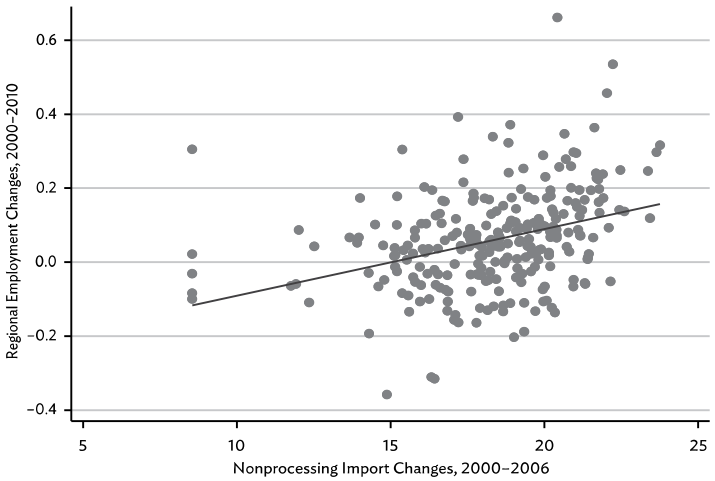
3.2.4 Tariff Reductions, Trade Surge, and Employment Changes

Before analyzing the relationship between input tariff reduction and labor reallocation, I first examine whether the tariff reduction induced by the People's Republic of China's WTO accession was systematically related to its trade expansion. To summarize the findings, I find that (i) lower tariffs led to an overall increase in trade values, (ii) lower tariffs led to an increase in imports in the number of varieties within HS6 categories, and (iii) lower tariffs resulted in lower unit values of existing product lines, with particularly pronounced effects on intermediate products.

These results are summarized in Table 3.1. I begin by examining the responsiveness of import values to tariffs by regressing the log import value of an HS6 product on HS6 log tariff levels, HS6 fixed effects, and year fixed effects. I restrict my analysis to the period 2000–2006, in which I have access to customs data to calculate HS6 product variety numbers. Extending the analysis to the period 2000–2010 yields similar results. For all regressions, I exclude processing trade flows as they are not affected by tariff reductions. Column (1) of Table 3.1 reports the coefficient estimates of tariffs for all sectors, and column (2) for intermediate sectors based on the Broad Economic Categories classification. In both cases, we can note that declines in tariffs are associated with higher import values.

Recent theory also emphasizes the benefits gained by increasing the imported varieties. As we can see from columns (3) and (4), this channel also plays a role in our context. I define varieties as the number of distinct HS8 products within a given HS6 product category. I then regress the number of varieties on the tariff, HS6 fixed effects, and year fixed effects. For all sectors and only intermediate sectors, a decline in tariffs is associated with an increased number of varieties. Lastly, I examine the impact of tariff reduction on the unit price of imports. The estimation results are presented in columns (5) and (6). Tariff declines are associated with decreases in import unit values, but this relationship

Figure 3.2 Regional Employment and Import Changes



Note: See text for details.
Source: Author's calculation.

is only statistically significant for intermediate sectors. That is, the benefits from trade that occur through increasing imports at a lower price are particularly true of intermediate goods, consistent with the beneficial effects of input tariff reduction on regional employment, which I probe formally in later sections.

Next, I examine the relationship between increased imports and employment changes across cities in the People's Republic of China. In Figure 3.2, I plot the difference in log employment between 2000 and 2010 against the change in log nonprocessing imports between 2000 and 2006 at the prefecture city level. As we can see from Figure 3.2, cities with larger import increases are also associated with larger increases in regional employment. Combining the examination of the relationships between tariff reductions and trade surges, we can be confident that the impact of input tariff reductions on spatial labor reallocation is indeed channeled through changes in trade flows.

3.3 Measurements and Specifications

3.3.1 Local Labor Markets

Throughout the empirical analysis, local labor markets are defined as prefectures. A prefecture is an administrative division of the People's Republic of China that ranks below a province and above a county. Given

that most regional policies, including the overall planning of public transportation, are conducted at the prefecture level (Xue and Zhang 2001), I expect counties within the same prefecture to have strong commuting ties and to be economically integrated. In order to account for prefecture boundary changes, I use information concerning the administrative division changes published by the Ministry of Civil Affairs of the People's Republic of China to create time-consistent county groups based on prefecture boundaries in the year 2000. This results in 337 geographic units, which I describe as prefectures or regions, including four direct-controlled municipalities and 333 prefecture-level divisions that cover the entire country. Relative to commuting zones in the United States, the prefectures in the People's Republic of China are about twice as large on average and 1.5 times the size when the 10 largest (but sparsely populated) prefectures in autonomous regions are excluded.

The empirical analysis in this chapter studies 10-year changes in prefecture employment, total and working-age populations, the most recent 5-year migrant inflows from other provinces, and the population holding local *hukou* in each prefecture. I collect these variables at the county level from the Tabulation on Population Census of the People's Republic of China by county for 2000 and 2010, and then aggregate them to prefectures based on the time-consistent county groups. Notably, the employment measure includes informal workers, the lion's share of whom are migrants.[5] Between 2000 and 2010, the People's Republic of China underwent a significant change in its spatial distribution of employment, with some prefectures seeing over a 50% increase in local employment, while others experienced more than a 30% decrease.

3.3.2 Regional Trade Shock Exposures

To construct the exposure of local labor markets to *input tariff reductions*, I combine data on regional industry employment with data on tariffs and industry cost shares. Data on regional employment by industry in 2000 were collected from the Tabulation on the 2000 Population Census published by each province. The original data are by county

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[5] According to Park, Wu, and Du (2012), informal employment in the People's Republic of China is defined either based on (i) whether or not the employer fails to provide all of the three most important types of social insurance that employers are expected to provide in the People's Republic of China (i.e., pensions, health insurance, and unemployment insurance), or (ii) whether workers have a labor contract. Migrant workers contribute to 49.0% of the informal employment in the People's Republic of China under the first definition and 65.7% under the second. The employment data from population census include all informal workers, as long as they engaged in at least 1 hour of paid work the week before the survey date, or were on leave.

and by 92 two-digit 1994 Chinese Standard Industrial Classification (CSIC1994), which I aggregate to prefecture level.[6] I use the simple average of most-favored nation applied tariffs at the HS6 product level from the United Nations Conference on Trade and Development Trade Analysis Information System database to calculate tariff changes. The cost share of each industry is constructed as its share of value in the output industry using the 2002 Chinese national input–output (IO) table.[7] To utilize these various datasets, I also construct a common industry classification, which consists of 71 industries, including five agricultural and 28 nontraded industries.[8]

As is standard in the literature, I measure input tariff cuts (ΔIT) as the input-cost weighted average of tariff reductions:

$$\Delta IT_s = \sum_{k \epsilon \mathrm{K}} \alpha_s(k) d\ln(1 + \mathrm{t}_k), \tag{1}$$

where $\alpha_s(k)$ represents the cost share of industry s due to purchases from industry k, t_k is the tariff rate of industry k, and d represents the long-difference (Autor, Dorn, and Hanson framework) between 2000 and 2005. Following Kovak (2013) and Dix-Carneiro and Kovak (2017), I calculate the regional input tariff cuts (ΔRIT) as follows:

$$\Delta \mathrm{RIT}_i = \sum_{s \epsilon \mathrm{K}} \delta_{is} \Delta \mathrm{IT}_s, \tag{2}$$

where $\delta_{is} = \frac{L_{is}\frac{1}{\phi_s}}{\sum_{s \epsilon K} L_{is}\left(\frac{1}{\phi_s}\right)}$, L_{is} is the initial amount of labor allocated to industry s in region i, and ϕ_s is 1 – the wage bill share of the industry value added. In a specific-factor model with a constant returns production function, $\frac{1}{\phi_s}$ represents the labor demand elasticity (Kovak 2013). The weight δ_{is} captures the intuition behind the construction of ΔRIT: a prefecture will experience a larger increase in employment if its workers are specialized in industries with large input

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6 The 2010 employment by industry has many missing values, so I perform all analyses at the regional rather than the region-industry level.

7 Given that trade liberalization began in 2001, I use the IO table of the closest year. I do so under the assumption that industries' cost structures adjust slowly to trade reforms. I do not use the 1997 IO table for two reasons: first, the 1997 IO table uses an industry classification that is less consistent with employment data; second, it might understate the importance of tradable inputs due to the Asian financial crisis.

8 The common industry classification is created to achieve the maximum disaggregation between different classifications; the 2002 IO table consists of 122 industries and is coded similarly to the 1994/2002 Chinese Standard Industrial Classification (CSIC1994/CSIC2002).

tariff declines, and more so if these industries are elastic in labor demand. Nevertheless, my empirical results are robust to using a weight that is based on employment only.

Disparities in industry weights across regions generate substantial variations in their exposure to input trade liberalization. The three hubs of the People's Republic of China's trade and economic growth—the Bohai Economic Rim, the Yangtze River Delta, and the Pearl River Delta—are among the top beneficiaries of input trade liberalization. Western prefectures that are specialized in animal husbandry or basic food processing and manufacturing benefited greatly from tariff cuts in farming industries, and hence also experienced large reductions in regional input tariffs.

Similarly to calculating the regional *input tariff cuts*, I compute regional *output tariff reductions* as a δ_{is}-weighted average of industry-specific tariff reductions over 2000–2005. In order to calculate external tariff reductions, I first use customs data for the People's Republic of China for 2000 to compute prefecture exports and calculate the export share by destination country for each industry and prefecture. I then take the export-share weighted average of the tariff changes across destination countries to obtain prefecture industry-specific tariff reductions. In the final step, I compute the weighted average tariff changes across industries using δ_{is} for each prefecture.

3.3.3 The *Hukou* Measure

The primary dataset that I use to construct the *hukou* measure is the 0.095% random sampled data of the Population Census in 2000. The complete dataset covers the entire population of the for the People's Republic of China, and the sample was randomly drawn at the household level, with a unique identifier linking individuals in the same household. The dataset contains rich individual-level information including one's *hukou* registration status and migration history in the last 5 years, from which I can infer the stringency of a prefecture's *hukou* system based on the likelihood of an individual obtaining a local *hukou* after settling in that prefecture. In reality, the likelihood of an individual acquiring or being granted a local *hukou* also depends on various individual characteristics. In order to draw out these effects, I calculate the *hukou* measure as follows. I focus on individuals who moved between 1995 and 2000 to a prefecture that is not their birthplace.[9] I regress a dummy equal to 1

[9] In the early 1990s, most internal migration was state planned, guaranteeing local *hukou* to migrants. I therefore focus on the most recent 5 years. The raw dataset contains 1,180,111 observations; given that most people never migrate, the number of observations in my regressions is 62,289.

if the individual had already obtained a local *hukou* before November 2000 (when the census was conducted) on age, age squared, gender, ethnicity (Han versus other), marriage status (ever married), difference in log gross domestic product (GDP) per capita between the migrate-out and migrate-in provinces,[10] migrate-from-rural-areas dummy, migrate-within-province dummy, categorical variables for education and for the years of residence in the current city, and prefecture fixed effects. I then take a simple average of the estimated prefecture fixed effects by province and normalize it from 0 to 1 to obtain the final measure.

The *hukou* measure is an *inverse* indicator of migration frictions associated with the *hukou* system: it equals 0 if a province has the most stringent *hukou*-granting practice. Consistent with common knowledge, my *hukou* measure suggest that Beijing, Shanghai, and Guangdong are among the most difficult provinces to obtain a local *hukou*. In addition, there is no correlation between the GDP per capita of a province and its *hukou* policy. For instance, Qinghai and Xinjiang have very stringent *hukou* policies, which are more likely driven by limited farming land and political stability concerns. *Hukou* stringency is not determined by the initial population density of a region either, with some densely populated provinces such as Henan having a rather liberal *hukou* system, while other densely populated regions such as Beijing have a stringent system.

3.3.4 Empirical Specification

Given the regional input tariff cuts and the *hukou* measure at hand, I estimate the following equations in the next subsection:

$$\Delta Y_i = \beta_1 \Delta \mathrm{RIT_i} + D_p + \mathbf{X_1'}\gamma + \epsilon_i \qquad (3)$$

and

$$\Delta Y_i = \beta_2 \Delta \mathrm{RIT_i} + \beta_3 \Delta \mathrm{RIT_i} * Hukou_p + D_p + \mathbf{X_2'}\gamma + \epsilon_i, \quad (4)$$

where the second specification explores the heterogeneous regional effect of input tariff reductions depending on the *hukou* frictions. Here, ΔY_i is the decadal change of the log value of a regional outcome variable such as employment or total population; β_1 captures the regional effect of input trade liberalization on the variable of interest during the 2000–2010 period, while β_2 and β_3 represent the heterogeneous impact

[10] I obtain GDP per capita data from the 2000 provincial statistical yearbooks. Note that it is important to control for GDP differences, as a migrant from a more developed area might not be willing to switch and acquire a local *hukou*.

of input tariff reductions depending on *hukou* frictions; D_p are province fixed effects; and **X** represents a set of additional controls. In the main specification, **X** includes regional output tariff reductions, external tariff reductions, and the preliberalization level of the outcome variable to control for increased import competition, improved market access,[11] and possible mean convergence. $Hukou_p$ is the *hukou* friction measure; in equation (4), I also control for its interaction with external and output tariff reductions.

3.3.5 Empirical Results

The impacts of input tariff cuts on the People's Republic of China's regional labor adjustments are summarized in Table 3.2. In columns (1) and (2), I first present the results of regressing employment changes on regional input tariff cuts. The standard errors are clustered at the provincial level, accounting for the possible covariance between the error terms across prefectures within the same province. Regressions are weighted by the log of the employment in the initial period. As we can see from column (1), the coefficient of ΔRIT is significant at the 1% level and has the expected positive sign. The estimate of 4.92 implies that a prefecture facing a 1-percentage-point regional input tariff cut experiences an almost 5-percentage-point employment increase. The difference between regional input tariff cuts in regions at the 25th and 75th percentiles is 0.7 percentage points. Evaluated using the estimate in column (1), a region at the 75th percentile experiences a 3.4-percentage-point larger employment increase than a region at the 25th percentile. Consistent with the existing literature, I find that regional output tariff reductions have a negative impact on employment, although at a smaller magnitude compared to the impact of input tariff cuts. The effect of external tariff reductions has the expected positive sign but is statistically insignificant.

In column (2), I add the interaction term between input trade liberalization and the *hukou* measure, probing whether input liberalization-induced employment adjustments are more pronounced in provinces with relatively free *hukou* systems. Given that I normalized my *hukou* measure to the unit interval, coefficients of ΔRIT directly reflect the impact of input tariff cuts in prefectures with the highest *hukou* frictions. The coefficient for the interaction term is positive

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[11] External tariff reductions capture the positive impact of tariff reductions by the People's Republic of China's trading partners following its WTO accession. However, this is less of a concern as most countries had already granted the People's Republic of China most-favored nation status prior to 2001.

and statistically significant. Input tariff reductions have no impact on regional employment in the provinces with the most stringent *hukou* systems. In contrast, in regions with the most relaxed *hukou* systems, a 1-percentage-point increase in input tariff cuts leads to a 16-percentage-point relative increase in employment, which is much larger than the 5-percentage-point average found in column (1). I also find a weak relationship between the effect of output tariff reductions and *hukou* stringency, although the result is only significant when fixed effects are included. This is consistent with the fact that the *hukou* system is primarily designed to control for migration inflows. On the other hand, the interaction terms between external tariff change and *hukou* frictions have the opposite sign. Calculated based on the specification in column (2), the partial R-squared of regional input tariff cuts, regional output tariff cuts and their interactions with the *hukou* measure is 0.35. This suggests that when considering both input and output channels, over 30% of the regional variation in employment changes could be accounted for by trade liberalization.

Table 3.2 Effect of Input Tariff Cuts

	Employment		Working-Age Population	
	(1)	(2)	(3)	(4)
Regional input tariff cuts (ΔRIT)	4.92***	−0.06	4.33***	−1.00
	(1.44)	(1.53)	(1.46)	(1.50)
Regional input tariff cuts x *Hukou*		15.70***		16.43***
		(4.45)		(4.31)
Regional output tariff change	−2.73***	−3.81**	−2.20***	−2.83***
	(0.67)	(0.92)	(0.59)	(0.83)
Regional output tariff change x *Hukou*		4.52**		3.53*
Regional input tariff cuts (ΔRIT)		(2.04)		(1.88)
External tariff change	0.10	0.73	0.16	1.10*
	(0.19)	(0.54)	(0.22)	(0.54)
Controls	Yes	Yes	Yes	Yes
Province fixed effects (31)	Yes	Yes	Yes	Yes
Observations	337	337	337	337
R-squared	0.62	0.65	0.58	0.63

continued on next page

Table 3.2 *continued*

	Migrant Inflows		*Hukou* Population	
	(5)	(6)	(7)	(8)
Regional input tariff cuts (ΔRIT)	13.16**	−5.55**	1.25	−2.51
	(5.56)	(2.05)	(0.77)	(2.59)
Regional input tariff cuts x *Hukou*		61.99***		10.23**
	(15.41)		(4.65)	
Regional output tariff change	−3.73	−2.92	−2.84***	−2.06
	(2.49)	(2.61)	(0.70)	(1.35)
Regional output tariff change x *Hukou*		3.14		−1.26
Regional input tariff cuts (ΔRIT)		(5.39)		(2.66)
External tariff change	0.72	−0.06	0.17	0.68*
	(1.23)	(3.76)	(0.12)	(0.36)
Controls	Yes	Yes	Yes	Yes
Province fixed effects (31)	Yes	Yes	Yes	Yes
Observations	337	337	337	337
R-squared	0.41	0.44	0.70	0.72

Notes: The dependent variable is the difference in log employment, log working-age population (15 to 64 years old), log population that migrated from other provinces between 2005–2010 and 1995–1990, and the 10-year change in log prefecture population holding local *hukou* permit for columns (1) and (2), (3) and (4), (5) and (6), and (7) and (8), respectively. The sample contains 333 prefectures and four direct-controlled municipalities. All regressions include the full vector of control variables; models with interaction terms further include the interaction between the *hukou* measure and other tariff changes as in column (6) of Table 3.1. Prefecture birth and death rates are also controlled in columns (7) and (8). Robust standard errors in parentheses are adjusted for 31 province clusters. Models are weighted by the log of beginning-period prefecture population. *** p<0.01, ** p<0.05, * p<0.1.

Source: Author's calculation.

In combining the results from columns (1) and (2), we know that prefectures facing larger input tariff cuts experience a relative increase in employment, and the effect is stronger in provinces with a lower amount of *hukou* friction. This observed change in regional employment can be caused by both intra- and interregional adjustments. A positively affected region may experience a decline in unemployment and an increase in labor force participation, both of which may result in an increase in local employment. To ensure that it is the spatial reallocation of labor that drives the employment adjustment, I next look at how working-age (15 to 64 years) populations respond to input tariff reductions. If the observed employment changes are mainly due to intraregional adjustments,

trade shocks should have no impact on the local population, whereas if the change is primarily due to interregional adjustments, the local population should react to trade shocks in a quantitatively similar way to that of employment.

Columns (3) and (4) report the results of regressing the regional change of log working-age populations on regional input tariff cuts, with and without interactions. I include the full set of controls and cluster standard errors at the provincial level. The results strongly support interregional labor reallocation: column (3) shows that prefecture-level working-age populations react positively and significantly to input tariff cuts, and the coefficients are quantitatively similar to those of employment. On average, a 1-percentage-point increase in regional input tariff cuts leads to a 4.33-percentage-point increase in the working-age population of a prefecture. In a prefecture with the least *hukou* frictions, a 1-percentage-point increase in regional input tariff cuts leads to a 16.43-percentage-point increase in the working-age population, which reinforces the notion that the observed regional employment adjustment is due to interregional labor reallocation.

Compared to indirectly inferring spatial adjustments in labor from regional population changes, it would be preferable to examine migration directly. However, the ideal measure, i.e., the decadal change in net migration inflows, is not available. Therefore, I instead consider the most similar variable available in the census: the number of migrants from other provinces in the past 5 years. It is important to note that compared to the ideal measure, this variable is likely to provide an insignificant estimate. First, interregional migration occurs much more frequently within provinces than across them. Second, since this variable counts migrant inflows in 5-year periods, I compare the number of migrants between 1995 and 2000 with those between 2005 and 2010. As tariff reductions began in 2001, if their impact levels off quickly, I will not be able to find a significant result.

With the above concerns in mind, I regress the change in the log 5-year inflow of population from other provinces on regional input tariff reductions, with and without interactions. The results are presented in columns (5) and (6) of Table 3.2, respectively. Column (5) reports that a 1-percentage-point increase in regional input tariff reduction leads to a 13.16-percentage-point increase in migrant inflows from other provinces. Column (6) confirms that input tariff cuts result in larger migrant inflows when the *hukou* system is less stringent. Both estimates are significant at the 5% level. Since migration is a flow rather than a stock variable, the magnitude of the estimates is much larger. These results provide additional support to the finding that regional input tariff cuts increase local employment through attracting labor from

other locations, and this effect crucially depends on frictions caused by the *hukou* system.

Interestingly, I find that neither the regional output tariff reductions nor the external tariff changes have a significant effect on migrant inflows, nor does their impact heterogeneously depend on *hukou* frictions. These results further suggest that among various trade shocks associated with the accession to the WTO, input tariff liberalization seems to have played the dominant role in shaping labor reallocation in the country.

Finally, columns (7) and (8) of Table 3.2 show how the number of individuals holding local *hukou* (*hukou* population) in a prefecture responds to input tariff reductions. In these regressions, I further control for prefecture birth and death rates to address two additional concerns. One is that input tariff cuts may generate different life expectancies across regions, affecting *hukou* population changes. The second concern is that it may generate different family planning behavior across regions (i.e., in positively affected areas, families may be willing to have more children). The latter is going to impact the *hukou* population via birth rate changes, as the children of local *hukou* holders are automatically granted a local *hukou*.

If a local *hukou* can be obtained without cost, the *hukou* population should be highly correlated with total population in a given region, and hence react positively to input tariff reductions. The empirical results, however, point to the contrary: column (7) indicates that on average, reductions in regional tariffs do not cause significant changes in the *hukou* population. However, in prefectures with less stringent *hukou* systems, the *hukou* population does increase in positively affected regions. Column (8) indicates that in a prefecture with the freest *hukou* system, a 1-percentage-point increase in regional input tariff cuts leads to a 10.23-percentage-point increase in the *hukou* population. The magnitude, however, is only two-thirds of the input liberalization-induced increase in the working-age population (column (4), Table 3.2). This implies that *hukou* frictions are substantial even in regions with the least stringent system. This represents evidence that even though many migrant workers moved to cities that were positively affected by trade shocks, few were able to obtain a local *hukou*.

3.4 Welfare Quantifications

The empirical results presented in the previous section can be viewed through the lens of a multisector spatial equilibrium model, which allows for IO linkages and migration frictions. Falling trade costs allow firms to access cheaper intermediate inputs and hence produce less expensive final goods. As a result, demand for local production increases.

Regions whose labor is concentrated in industries facing larger input tariff reductions are more positively affected, thus pushing up wages and attracting workers from other places. Immigration increases the price of nontradables and depresses wages until the economy reaches a new equilibrium. When migration frictions are high, employment changes are small due to limited migration, and real wages instead react strongly to trade shocks. In contrast, when migration friction is low, employment reacts more strongly to trade shocks and real wages react less.

In standard economic geography models with no migration frictions, workers will move to arbitrage away the utility difference of living in different cities. When we allow for amenity or productivity difference across locations and heterogeneous workers, real wages can differ across cities. In this case, a city with a high wage in equilibrium either reflects its relative technology superiority, or the fact that it is less livable than the other cities, and so people demand higher wages to compensate for the relatively poor local amenities. In equilibrium, we may observe that some cities offer more employment than others, but from the workers' perspective, they are indifferent about where to live given the equilibrium wage and amenity in each location. Therefore, when the economy is hit by a trade shock, the expected utility change will be the same among all workers.

However, with the presence of the *hukou* system, a larger fraction of the gains accrues to workers with a local *hukou*. This is intuitive: as migrant inflows are limited in positively affected regions when *hukou* friction is high, real wages increase. Workers with a local *hukou* face no constraints on living in the particular region, and hence benefit more significantly from the local wage increase. In other words, the presence of a *hukou* affects the welfare distribution across otherwise identical worker groups.

In Table 3.3, I present the quantification of the welfare change of workers holding a *hukou* of different provinces in the People's Republic of China, and the simulated regional adjustment in other margins following trade liberalization. The five provinces with the largest increases in employment are Beijing, Shanghai, Guangdong, Tianjin, and Fujian, with Beijing experiencing an increase in employment of 0.55% and Shanghai of 0.40%. The five provinces with the lowest employment increase are Hubei, Hunan, Sichuan, Anhui, and Jiangxi, consistent with our observations in the real data. These simulations are based on static models, hence the magnitudes of adjustments are smaller than our observations from real data.[12]

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12 The simulated numbers may change slightly depending on model assumptions; see Zi (2018) for details.

Table 3.3 Regional Adjustments to Trade Liberalization

Province or Autonomous Region	(1) Employment	(2) Real Wage	(3) GDP	(4) Price	(5) Exports	(6) Imports	(7) Welfare
Guangdong	0.19	0.95	1.12	−1.77	5.27	7.05	0.93
Beijing	0.55	1.80	2.27	−2.06	9.62	3.34	1.69
Shanghai	0.40	1.61	1.93	−1.85	6.30	4.02	1.50
Tianjin	0.17	1.43	1.57	−1.96	7.62	4.65	1.38
Fujian	0.08	0.97	1.04	−1.69	6.67	7.14	0.96
Zhejiang	0.06	0.89	0.93	−1.60	5.18	5.69	0.87
Jiangsu	0.05	1.14	1.17	−1.79	9.40	6.85	1.12
Xinjiang Uygur	0.03	0.67	0.67	−1.53	6.42	5.25	0.64
Liaoning	0.02	0.96	0.97	−1.76	8.12	6.50	0.95
Hainan	0.01	0.74	0.76	−1.66	2.76	6.44	0.75
Jilin	0.00	0.73	0.73	−1.74	6.71	5.08	0.73
Yunnan	−0.01	0.49	0.48	−1.49	7.48	5.15	0.49
Shandong	−0.01	0.70	0.68	−1.71	5.92	8.72	0.69
Inner Mongolia	−0.02	0.52	0.50	−1.54	4.76	6.75	0.52
Ningxia Hui	−0.02	0.40	0.38	−1.51	9.17	3.99	0.41
Qinghai	−0.02	0.40	0.38	−1.51	6.72	5.12	0.40
Shanxi	−0.02	0.37	0.35	−1.48	7.23	4.27	0.37
Shaanxi	−0.02	0.46	0.43	−1.60	5.15	5.58	0.46
Heilongjiang	−0.03	0.59	0.56	−1.66	4.06	6.97	0.59
Chongqing	−0.03	0.48	0.45	−1.54	2.67	4.32	0.48
Gansu	−0.03	0.31	0.28	−1.52	5.72	3.82	0.31
Hebei	−0.05	0.41	0.36	−1.62	5.20	7.88	0.42
Henan	−0.05	0.38	0.33	−1.56	5.15	5.23	0.40
Hubei	−0.05	0.48	0.43	−1.59	5.14	5.13	0.50
Guangxi Zhuang	−0.05	0.55	0.50	−1.50	6.59	4.81	0.57
Guizhou	−0.05	0.40	0.35	−1.53	4.76	4.50	0.42
Hunan	−0.07	0.46	0.39	−1.53	7.48	5.12	0.49
Sichuan	−0.08	0.47	0.39	−1.58	4.27	4.81	0.49

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Table 3.3 *continued*

Province or Autonomous Region	(1) Employment	(2) Real Wage	(3) GDP	(4) Price	(5) Exports	(6) Imports	(7) Welfare
Anhui	−0.11	0.52	0.41	−1.53	4.34	5.18	0.55
Jiangxi	−0.12	0.39	0.28	−1.47	3.85	5.36	0.44
Weighted average							0.63
Standard deviation							0.27

GDP = gross domestic product.

Notes: Counterfactual percentage changes in regional employment, real wage, real GDP (total value added divided by local consumption price index), consumption price index, exports, and imports when the tariff structure of the People's Republic of China changed from its 2000 to 2005 level, holding *hukou* frictions constant. The nominal wage of the constructed rest of the world is the numeraire.

Source: Author's calculation.

Column (2) shows that real wages increase in all provinces and that they are positively correlated with changes in employment. When comparing changes in real wages and employment, two patterns stand out. First, regional employment reacts less to trade shocks than do wages (regressing employment changes on wage changes yields coefficient of 0.47), indicating substantial internal migration frictions in the People's Republic of China. Second, a region with a larger real wage increase is not necessarily a region with a greater increase in employment. To see this dynamic, compare Fujian with Guangdong. The latter has a smaller rise in real wage in equilibrium, but its labor inflows rise twice as much. This suggests that migration frictions differ significantly across regions in the People's Republic of China.

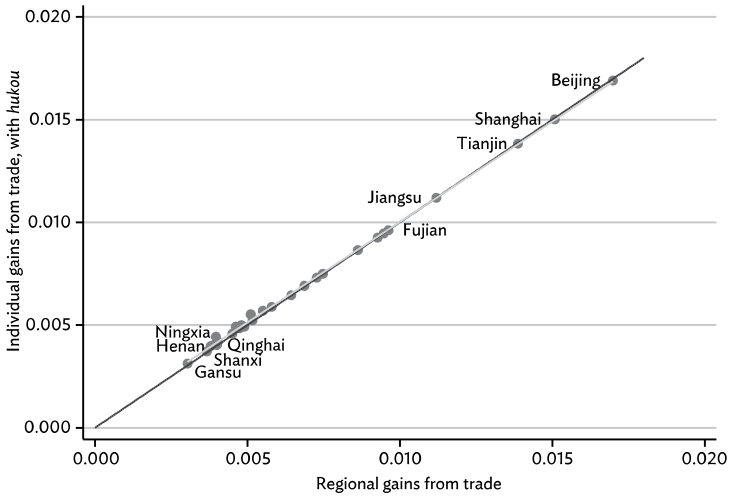
Column (3) presents changes in provincial real GDP, adjusted for the local price index. Every region gains from tariff reductions, but the level differs significantly across regions. The most positively affected provinces are those that were the most developed before the introduction of tariff reductions, implying that trade liberalization has exacerbated regional inequality in the People's Republic of China. Column (4) presents changes in the local consumption price index. Beijing, Tianjin, and Shanghai experienced the largest price decrease, suggesting that they are the top beneficiaries of cheaper foreign goods. Columns (5) and (6) present the total changes in exports and imports, and show that both increased in all provinces, with some provinces experiencing a larger increase in total exports than imports. There are

two main economic forces behind these changes in trade flows. The first is related to industry composition. When sectors with limited regional importance experience substantial tariff cuts, limited import competition is introduced but a broad range of sectors may benefit. This boosts local exports more than imports. The other subtler force works through trade diversion. Cheaper intermediates directly lower production costs in all regions in the People's Republic of China. For a Chinese province, it therefore becomes optimal to source more intermediates locally and from other provinces in the country. This also suppresses growth in imports from the rest of the world.

As suggested by the last column of Table 3.3, all regions (in terms of people's *hukou* status) gain from tariff reductions, but the distribution of the gains is uneven. Individuals with a Beijing and Shanghai *hukou* experience welfare improvements of 1.69% and 1.50%, respectively, while individuals holding a *hukou* from Shanxi and Gansu provinces only gain 0.37% and 0.31%, approximately 80% less. The *hukou* population-weighted average welfare increase is 0.63%, with the standard deviation being 0.27%.

Note that when labor is perfectly mobile, workers may choose to move to different places due to idiosyncratic amenity draws, but the welfare changes should be equal across individuals due to migration. When labor is perfectly immobile, the labor reallocation term equals 0,

Figure 3.3 Individual and Regional Gains from Trade



Notes: This figure plots individual welfare changes in terms of *hukou* provinces (individual gains from trade) against the changes in provincial real income per capita, i.e., regional gains from trade). The lighter line is the linear fit and the darker is the 45-degree line. Correlation: 1.00; regression coefficient: 0.97; t: 178.04; R-squared: 0.999.

Source: Author's calculation.

and hence individual gains from trade equal the real income increase of the individual's *hukou* province. To explore the extent to which internal migration has alleviated the uneven welfare gains, Figure 3.3 plots individual welfare changes in terms of their *hukou* (individual gains from trade) against the changes in provincial real income per capita (regional gains from trade). The relationship is strikingly linear with the data points lying around the 45-degree reference line. This suggests that the redistribution of wealth via migration is limited: although we can see large changes in real income, most of the gains in booming areas accrue to local *hukou* holders due to the high costs of migration.

3.5 Counterfactual *Hukou* Abolishment

The empirical exercise in section 3.3 suggests that the People's Republic of China's internal labor reallocation over 2000–2010 can be explained in large part by its integration into the global economy. Moreover, the labor market distortion caused by the *hukou* system has a significant impact in shaping the effects of trade on migration. A question that naturally follows is, what would happen if the People's Republic of China abolished the *hukou* system? In particular, what is its direct impact on wages, employment, trade, and GDP growth in different regions? What are its distributional consequences? Would the country have reaped more gains from trade reforms if the *hukou* system had been abolished before its accession to the WTO? These are intriguing questions not only of academic interest but also relevant for today's policy debate. For example, reforming this system appears high on the agenda of the government today, but the exact road map is much less clear. Exploring the counterfactual result of *hukou* abolishment could provide valuable guidance regarding the ongoing *hukou* reforms.

3.5.1 Effects of *Hukou* Abolishment

Table 3.4 presents the regional adjustments that would have taken place following the abolishment of the *hukou* system. I report the five provinces that would experience the most significant expansions or contractions. Beijing, Shanghai, and Guangdong are the top migrant-receiving provinces, with an employment increase of more than 10%. Jiangxi, Sichuan, Anhui, Hunan, and Guangxi Zhuang Autonomous Region have the largest migrant outflows. The large migrant outflows in Guangxi and Jiangxi are (among other factors) due to their geographic proximity to Guangdong, while for Anhui these outflows are due to its proximity to Shanghai. In the case of Hunan and Sichuan, locals may face fewer migration frictions for other reasons, such as their

strong historical ties with Guangdong. This is also reflected in the fact that their regional employment reacts strongly to tariff reductions (Table 3.3). In expanding provinces, increased labor supply lowers real wages and boosts local GDP; given the increased economic size, more intermediates can now be sourced locally with a cost advantage, hence the local consumption price decreases.

There are two forces that govern changes in trade flows. A province experiencing expansion requires more intermediate inputs, which implies an increase in both exports and imports; at the same time, increased economic size also means the region gains a cost advantage in producing a wider range of intermediates, suggesting an increase in exports and a decrease in imports. These two forces work in the opposite direction in contracting provinces. Therefore, exports should always rise while the changes in imports are ambiguous in provinces with worker inflows, and the opposite is true in provinces with worker outflows. The calibration exercise shows that imports in all top expanding provinces decrease, suggesting that the latter force prevails. On the other hand, imports increase in some contracting provinces but decrease in others.

In the last column of Table 3.4, I present the individual welfare changes. Although increased regional employment hurts local *hukou* holders by bidding up structure rents and lowering wages, relaxations in the system makes it easier for individuals to move to provinces where they have higher amenity draws, which always improves welfare. Therefore, while individuals holding a *hukou* from provinces with worker outflows benefit from *hukou* reforms unambiguously, those with a *hukou* from migrant-receiving provinces may not necessarily lose. As shown in the last column of Table 3.4, the top expanding provinces' *hukou* holders do

Table 3.4 Regional Effects of *Hukou* Abolishment

Province or Autonomous Region	(1) Employment	(2) Real Wage	(3) GDP	(4) Price	(5) Exports	(6) Imports	(7) Welfare
Beijing	18.99	−5.68	11.75	−1.43	17.47	−2.57	−5.93
Shanghai	18.33	−5.45	11.47	−1.31	13.80	−2.89	−5.52
Guangdong	13.20	−0.37	8.90	−1.23	10.46	−2.55	−3.62
Tianjin	5.26	−1.48	3.62	−0.46	3.54	−1.17	−1.24
Xinjiang Uygur	4.69	−0.73	3.91	−0.57	4.61	−1.25	−0.46
Hainan	4.36	−0.77	3.44	−0.33	3.22	−0.97	−0.27

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Table 3.4 *continued*

Province or Autonomous Region	(1) Employment	(2) Real Wage	(3) GDP	(4) Price	(5) Exports	(6) Imports	(7) Welfare
Zhejiang	3.42	−0.91	2.46	−0.39	1.97	−1.03	0.27
Fujian	2.85	−0.64	2.18	−0.48	1.16	−0.96	0.23
Qinghai	2.09	−0.34	1.77	−0.44	3.00	−1.27	0.21
Yunnan	1.26	0.25	1.47	−0.21	1.10	−0.82	0.46
Inner Mongolia	0.60	0.39	0.94	−0.07	0.26	−0.62	0.98
Liaoning	0.53	0.01	0.54	−0.19	0.52	−0.47	0.31
Shanxi	0.48	0.40	0.83	−0.24	1.04	−1.08	0.66
Jiangsu	0.08	0.04	0.12	−0.20	−0.15	−0.56	0.94
Ningxia Hui	0.02	0.39	0.36	−0.14	−0.03	−0.70	0.88
Shandong	−0.46	0.39	−0.09	−0.11	−1.35	−0.47	0.78
Jilin	−0.59	0.71	0.07	−0.07	−0.49	−0.54	1.32
Hebei	−0.81	0.78	−0.09	−0.03	−2.51	−0.82	1.39
Shaanxi	−1.10	0.67	−0.48	0.02	−0.99	−0.24	1.32
Heilongjiang	−1.26	0.79	−0.48	−0.05	−0.87	−0.38	1.69
Gansu	−1.39	0.84	−0.60	−0.03	−1.36	−0.48	1.49
Chongqing	−1.83	1.37	−0.59	0.06	−2.91	−0.90	2.26
Henan	−2.44	1.03	−1.48	0.08	−3.31	−0.25	2.04
Guizhou	−2.67	1.41	−1.36	0.08	−3.21	−0.51	2.73
Hubei	−3.12	0.99	−2.20	0.26	−4.20	0.05	2.44
Guangxi Zhuang	−3.46	1.66	−1.91	0.10	−4.80	−0.88	3.34
Hunan	−4.73	1.82	−3.10	0.60	−8.54	0.32	3.76
Anhui	−5.06	2.38	−2.90	0.46	−6.17	−0.21	4.40
Sichuan	−5.37	2.02	−3.60	0.82	−8.10	0.72	4.21
Jiangxi	−6.17	2.08	−4.30	0.63	−8.65	0.05	4.66
Weighted average							1.51
Standard deviation							2.22

GDP = gross domestic product.

Notes: Counterfactual percentage changes in regional employment, real wage, real GDP (total value added divided by local consumption price index), consumption price index, exports, imports, and *hukou* population's welfare when *hukou* frictions are reduced to 0 in all provinces, holding tariffs constant. The nominal wage of the constructed rest of the world is the numeraire.

Source: Author's calculation.

experience significant welfare losses. However, of the 17 provinces that experience employment increases, their *hukou* holders' welfare only decreases in six. The average gains across provinces is 1.56%, which is twice as high as the gains from trade reforms.

3.5.2 Effects of Tariff Reductions Given the Elimination of *Hukou* Frictions

I next explore whether the impact of trade liberalization would be different if the *hukou* system had been abolished before the People's Republic of China's accession to the WTO. Starting from the postabolishment equilibrium, I repeat the first quantitative exercise by shocking the system with tariff changes. Table 3.5 presents the regional effects for the five provinces with the biggest and smallest increases in employment. Comparing these results with those in Table 3.3, we observe that regional employment reacts more strongly to trade shocks with the elimination of *hukou* frictions, while real wages react less. For instance, the change in Beijing employment increases by more than 50%, while the change in its real wage declines by 6%. The absolute changes, however, remain small. One plausible explanation regards data aggregation: calibrating the initial labor distribution at the province level overestimates the initial migration frictions, therefore abolishing the *hukou* system seems to have only a marginal effect in shaping the impact of trade as the model suggests very high migration frictions in levels even after abolishing the *hukou*.

Table 3.5 Regional Adjustments to Tariff Reductions, without *Hukou* Frictions

Province or Autonomous Region	(1) Employment	(2) Real Wage	(3) GDP	(4) Price	(5) Exports	(6) Imports	(7) Welfare
Beijing	0.84	1.68	2.44	–2.07	9.97	3.36	1.57
Shanghai	0.58	1.51	2.01	–1.85	6.39	4.00	1.40
Tianjin	0.27	1.39	1.62	–1.96	7.65	4.70	1.33
Guangdong	0.25	0.92	1.15	–1.76	5.12	7.01	0.89
Fujian	0.12	0.95	1.07	–1.68	6.50	7.15	0.94
Zhejiang	0.09	0.87	0.94	–1.59	5.09	5.71	0.86
Jiangsu	0.07	1.13	1.19	–1.79	9.36	6.90	1.11
Liaoning	0.03	0.96	0.98	–1.75	8.11	6.54	0.94

continued on next page

Table 3.5 *continued*

Province or Autonomous Region	(1) Employment	(2) Real Wage	(3) GDP	(4) Price	(5) Exports	(6) Imports	(7) Welfare
Xinjiang Uygur	0.03	0.66	0.67	−1.52	6.39	5.32	0.64
Hainan	0.02	0.73	0.77	−1.65	2.76	6.48	0.75
Jilin	−0.01	0.73	0.72	−1.73	6.55	5.11	0.73
Shandong	−0.02	0.70	0.67	−1.70	5.82	8.79	0.70
Yunnan	−0.02	0.49	0.48	−1.48	7.40	5.20	0.50
Ningxia Hui	−0.03	0.41	0.37	−1.50	9.09	4.04	0.41
Inner Mongolia	−0.03	0.53	0.49	−1.53	4.60	6.83	0.53
Shaanxi	−0.04	0.46	0.42	−1.59	4.99	5.62	0.47
Shanxi	−0.04	0.37	0.33	−1.48	6.99	4.37	0.38
Qinghai	−0.04	0.41	0.36	−1.50	6.69	5.20	0.41
Heilongjiang	−0.04	0.59	0.54	−1.65	3.94	7.04	0.60
Gansu	−0.05	0.31	0.26	−1.52	5.55	3.86	0.32
Chongqing	−0.05	0.49	0.44	−1.53	2.59	4.37	0.50
Guangxi Zhuang	−0.08	0.56	0.49	−1.49	6.44	4.90	0.59
Henan	−0.08	0.40	0.31	−1.55	5.04	5.30	0.42
Hubei	−0.08	0.49	0.41	−1.58	5.05	5.17	0.52
Hebei	−0.08	0.42	0.33	−1.61	4.98	7.98	0.44
Guizhou	−0.09	0.42	0.32	−1.52	4.63	4.56	0.44
Hunan	−0.11	0.48	0.37	−1.52	7.27	5.16	0.52
Sichuan	−0.12	0.49	0.36	−1.57	4.16	4.87	0.53
Anhui	−0.17	0.54	0.36	−1.52	4.14	5.23	0.60
Jiangxi	−0.19	0.42	0.23	−1.45	3.68	5.41	0.49
Weighted average							0.64
Standard deviation							0.25

GDP = gross domestic product.

Notes: This table presents the counterfactual percentage changes in regional employment, real wage, real GDP (total value added divided by local consumption price index), consumption price index, exports, and imports when the tariff structure of the People's Republic of China changed from its 2000 to 2005 level after eliminating *hukou* frictions, holding tariffs constant. The nominal wage of the constructed rest of the world is the numeraire.

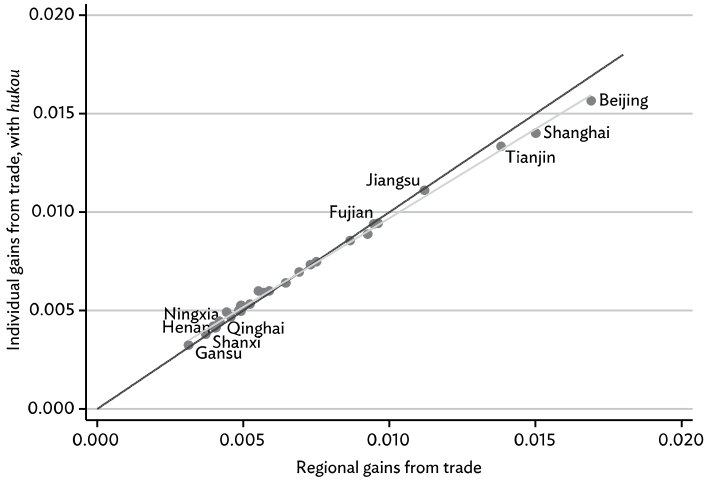
Source: Author's calculation.

The final column of Table 3.5 presents the changes in welfare of *hukou* holders of a given province. Comparing these results to those in Table 3.3, we can see that the top five beneficiaries remain *hukou* holders from Beijing, Shanghai, Tianjin, Jiangsu, and Fujian. However, they gain less due to the larger increase in migrant inflows. On the other hand, provinces with net migration outflows also experience an increase in regional employment response to trade shocks, and this is associated with larger welfare improvements.

The last two rows of column (7) of Table 3.5 report the weighted average and the standard deviation of welfare increases. Average gains from trade increase by about 2%, from 0.71% in the case with *hukou* frictions to 0.72%. Compared with Monte, Redding, and Rossi-Hansberg (2015), who demonstrate that by permitting commuting across counties in the United States, gains improve from a 20% reduction in domestic trade costs by 0.8%, the additional gains from trade due to *hukou* friction elimination are considerable. In addition, calibrating the model at the prefecture city level would likely produce larger estimates. Therefore, we can interpret the 2% gains from trade due to *hukou* abolishment as a lower bound estimate.

The standard deviation of welfare gains across worker types falls from 0.24% to 0.22%. Freer migration leads to greater employment

Figure 3.4 Individual Gains from Trade with and without *Hukou* Frictions



Notes: This figure plots individuals' welfare changes from tariff reductions in terms of *hukou* provinces (individual gains from trade) with *hukou* abolishment against the changes without. The lighter line is the linear fit and the darker line is the 45-degree line. Correlation: 0.999 Regression coefficient: 0.9; t: 101.55; R-squared: 0.997.

Source: Author's calculation.

increases in more positively affected regions, and the opposite in less positively affected regions. This narrows the spatial wage gap, meaning that individuals who stay in contracting regions are less negatively affected. In addition, freer migration makes individuals migrate to booming areas to improve their welfare. Both effects lead to more evenly distributed gains. Figure 3.4 plots individual gains from tariff reductions without *hukou* frictions to those with; the plot is flatter than the 45-degree line, suggesting that the elimination of *hukou* frictions alleviates the distributional effects of trade.

3.5.3 The Role of Internal Geography: General Assessment

I now investigate the importance of accounting for internal geography in computing gains from trade. I compare the results of my model (benchmark) to a multiregion model with no internal migration, as well as to a two-country model treating the People's Republic of China as a unit of analysis. I calibrate each of these models to the year 2000 and compute the welfare response and its decomposition to the tariff reductions from the country's WTO accession. Table 3.6 presents the simulated welfare effects implied by different models. The first row presents the benchmark results, the second row the welfare results for the no-migration model, and the third row the results for the model treating the People's Republic of China as a whole.

Table 3.6 suggests that the welfare effects are smaller for the model without migration compared to the benchmark model. The average gain decreases from 0.63% to 0.61%. It is also distributed more unevenly, with the standard error rising from 0.27% to 0.31%. Allowing interregional migration diminishes both effects.

When treating the People's Republic of China as a unit of analysis, the welfare increases substantially to 0.80%, almost 30% more than the

Table 3.6 Gains from Tariff Reductions: Role of Internal Geography

Model	Average (%)	Standard Deviation (%)
Benchmark	0.63	0.27
No migration	0.61	0.31
People's Republic of China as a whole	0.80	0.00

Notes: Average of counterfactual percentage changes in welfare in terms of individual *hukou* provinces and its standard deviation. In models with many regions in the country, both the average and standard deviation of welfare changes are *hukou* population weighted.

Source: Author's calculation.

benchmark model. The results reflect the importance of accounting for domestic geography. The intuition for this result is related to that of the no-migration model. By treating the People's Republic of China as a unit of analysis, I implicitly assume that both goods and factors are perfectly mobile within the country, and thus I get much larger gains from trade. In short, the results from this subsection illustrate the importance of accounting for economic geography within a country to evaluate the effect of trade policies, especially where the country has significant spatial heterogeneities.

3.6 Conclusion

Trade liberalization can lead to significant spatial labor adjustment within a country, and internal migration frictions are important in shaping the impact of trade. In the context of the People's Republic of China, input-liberalization has stimulated significant labor reallocation across prefectures, as well as the presence of migration frictions caused by the *hukou* system. Quantitatively, tariff reductions improve the People's Republic of China's aggregate welfare by 0.71%, but magnify regional disparities. Abolishing the *hukou* system leads to a sizable improvement in aggregate welfare, but it also has a strong distributional impact. In addition, it increases the gains from trade and alleviates its negative distributional consequences. These results shed light on the benefits of eliminating migration frictions and the importance of taking these frictions into account when evaluating both aggregate and distributional consequences of trade reforms.

While the focus of this chapter has been on the People's Republic of China, the existing literature suggests that migration frictions are pervasive in many other countries. According to the World Population Policies 2013 (United Nations 2013), 60% of governments around the world desired a major change in their spatial labor distribution, and 80% of these had policies to influence internal migration. Therefore, this chapter's exercises may inform migration policy and stimulate further studies in other national contexts.

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