Labour Market Reform, Firm-level Employment Adjustment and Trade Liberalisation

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Abstract

This paper empirically investigates whether the nature of firm-level employment adjustment is affected by the flexibility of the labour market and by an exposure to trade liberalisation. Specifically, we take advantage of differences in local labour market conditions created by the non-uniform implementation of hukou reform in China. Variations in the implementation across cities and time allow us to identify the employment effects of the reform by comparing firms in regions with hukou reform to those in regions without hukou reform. Combining firm-level data and city-level hukou reform data from 1998 to 2007, we adopt a difference-in-differences approach to address this question. The empirical results show that firms exposed to the hukou reform have higher employment adjustment rate on average than similar firms without reform, indicating that labour market reform allowed more employment adjustment. Consistent with our expectations, firms respond to trade shocks by adjusting employment relatively more in the presence of hukou reform. These findings offer important policy implications to the current labour market reform in China and to other developing countries with inflexible labour markets.

Key Words: Labour Market Reform, Hukou, Employment Adjustment, Trade Liberalisation
JEL Classification: F14, F16, F66, J21, J42

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1 Introduction

In a well-functioning economy, firms are able to adjust factors of production freely in response to shocks to achieve more efficient resource allocation. Recent empirical evidence suggests that misallocation exits broadly, especially in developing countries, which generates considerable productivity losses (Hsieh and Klenow, 2009; Brandt et al., 2013).[1] One critical source of such misallocation relates to factor market distortions, as modelled in Hsieh and Klenow (2009). While existing papers mainly focus on measuring the magnitude of misallocation and the resulting productivity losses, limited evidence is available on the way in which distortions affect adjustment. It is documented in the literature that labour market adjustment in response to trade shocks is often sluggish; possibly due to labour market regulations that impede labour movement across firms, industries or regions (e.g. Hasan, 2001 and Mouelhi, 2007). Micro-level evidence on how firms adjust employment in response to trade shocks and how labour market flexibility shapes such an adjustment is, however, relatively scare.

A recent strand of literature examines the impact of China's rise on firms and local labour market outcomes in both developing and developed countries.[2] However, relatively little is known about labour market adjustment in Chinese firms in response to China's trade liberalisation and accession to the WTO in 2001. With a reduction in import tariffs and an expansion of the export markets, firms experienced substantial adjustments. The aim of this paper is to examine employment adjustment at the firm level following trade liberalisation and in particular how such an adjustment was affected by labour market conditions.

The Chinese labour market has traditionally been highly rigid, featuring a household registration system (or hukou system) that segregates the labour market into rural and

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[1]Restuccia and Rogerson (2013) offer a comprehensive review on recent literature that study misallocation and productivity.

[2]Autor et al. (2013) and Dauth et al. (2014) explore the effects of import competition from China on the local labour market in the U.S. and in Germany separately. Mion and Zhu (2013) and Bloom et al. (2016) examine firm-level adjustment in employment, skill upgrading, innovation and productivity with rising Chinese import competition in Belgium and European countries. Utar and Ruiz (2013), however, focus on the third-country competition effects and investigate the impact of intensified competition from China on Mexican maquiladoras in the U.S. market.

urban sectors. A typical resident is registered as a certain hukou type in a region, which makes the movement across agriculture and non-agriculture sectors and across regions difficult since social welfare, like medical care, children's education, is based on hukou. Such rural-urban migration barriers have resulted in substantial labour misallocation (Meng, 2012; Brandt et al., 2013); labour surplus in the rural sector and labour shortage in the urban sector coexisting and yielding a wage gap between rural versus urban areas. This has meant that firms in urban areas have been less able to reach the desired level of employment due to restricted labour supply and relatively high labour costs.

To address the segregation of local labour market, the hukou reform was launched from 2001 in selected cities. The aim was to abolish the distinction between rural and urban hukou types and to encourage labour movement from rural to urban areas. To achieve it, local governments in some cities have taken specific actions to lower barriers to mobility and to attract rural workers. The implementation of the reforms in some cities offers a basis for a quasi-natural experiment that enables us to evaluate the extent to which differences in labour market conditions between reform and non-reform cities affect firms' employment adjustment in response to trade shocks, provided that we can account for selection by cities for reform in our empirical strategy. Relying on a rich firm-level dataset, the current study provides the first micro-level empirical evidence on firms employment adjustment conditional on differential labour market conditions, which has so far only been investigated theoretically in the existing literature (e.g. Coşar, 2013; Itskhoki and Helpman, 2015; Coşar et al., 2016).

In this paper, we first evaluate the impact of the hukou reform on firms employment adjustment and then examine the conditional effects of trade liberalisation on employment adjustment with the presence of the hukou reform. One challenge in establishing a causal relationship between employment adjustment and hukou reform is the potential endogeneity of the reforms. Specifically, reform cities may well not have been randomly selected and those selected reform cities might be systematically different from non-reform ones. If the determinants of the hukou reform are correlated with firms employment adjustment, our empirical results would be misleading. To address the endogeneity issue, we consider a difference-in-differences (DiD) approach

and control for the initial differences between reform and non-reform cities that potentially determined the selection of reform cities in our main specification.

Our main results show a positive effect of the hukou reform on net employment adjustment at the firm level. This suggests that a more flexible labour market allows firms to adjust their labour use in response to shocks more efficiently, as predicted by recent theories (Itskhoki and Helpman, 2015; Coşar et al., 2016). This finding is also consistent with recent studies on resource misallocation due to factor market distortions such as Hsieh and Klenow (2009) and Brandt et al. (2013), and implies that firms would have achieved higher productivity and output levels without the hukou system. Regarding trade liberalisation, we consider barriers to both imports and exports. We further distinguish between tariffs on imports of intermediate inputs and final goods following the literature that emphasises the role of intermediate imports (e.g. Amiti and Konings, 2007; Amiti and Cameron, 2012). Our results show that firms in general tended to adjust employment more in reform than non-reform cities. Our findings underline the role of labour market flexibility in affecting firms adjustment following trade shocks.

The contribution of this paper to the existing literature is twofold. Firstly, while existing studies have examined the effects of labour market frictions on firm-level outcomes, the labour market institutions under consideration, such as dismissal protection (Autor et al., 2007; Hasan et al., 2007), trade union (Montagna and Nocco, 2013), rise in minimum wages (Poncet et al., 2014), and stringency of labour regulation enforcement (Almeida and Poole, 2017), mainly aimed at protecting workers rights also increased adjustment costs for firms. However, the hukou reform exploited in this paper relaxed restrictions on worker movement and tended to benefit both workers and firms.

Second, effects of reducing costs on labour movement are often modelled in theoretical settings and lack empirical evidence (e.g. Artuç et al., 2010; Dix-Carneiro, 2014). The firm-level dataset used in this paper captures a period during which both trade reforms and the hukou reform occurred. This allows us to empirically evaluate firms differential responses to trade shocks conditional on labour market flexibility. Several papers have

analysed Chinas hukou system and its potential consequences (e.g. Gilbert and Wahl, 2003; Whalley and Zhang, 2007; Xu, 2014), based on theoretical modelling and numerical simulations. This paper is among the first to provide empirical evidence on how the hukou reform has affected firms.

The rest of the paper proceeds as follows. In the next section, we provide more background information on China's hukou system, reform and trade liberalisation. Section 3 presents relevant theories and empirical evidence. Details of the data and the sample frame used in this paper are described in Section 4. Section 5 discusses the empirical methodology and possible identification issues, followed by the empirical results that are reported in Section 6. Finally Section 7 concludes.

2 Policy Background

2.1 Hukou reform and internal migration

In the early stages of China's planned economic system, labour mobility was highly controlled by the government through a household registration (or hukou) system. This system divided residents into agricultural and non-agricultural population based on occupation, and into rural and urban population according to birthplace. Movements between rural and urban areas, and between agriculture and non-agricultural sectors were prohibited or subject to control. This segmentation resulted in average wages being much higher in urban than rural areas. To pursue higher wages, many rural residents wanted to move into cities, but such movement was costly (Zhao, 1999). Labelled as rural residents by their hukou status, migrant workers were allowed to work only in specific urban industries and were prevented from working in state-owned enterprises (SOEs) to limit competition with urban workers (Dmurger et al., 2009). Migrant workers were also unable to obtain necessary housing, medical care, and educational resources, which made it impossible to move into cities with the whole family. This imposed additional social costs. The high migration costs distorted matching efficiency between firms and workers, which potentially restricted firms decisions on choosing the optimal level of employment and slowed down their adjustment in the face of shocks.

These regulations were not changed until the late 1980s, when it became possible to purchase an urban hukou, though the total number of purchasable urban hukous in each province was constrained by a quota. A pilot reform in 1997 allowed rural residents to move into selected towns and small cities. However, this reform had limited effects as these towns and small cities were less attractive to rural residents. To promote labour movements from rural to urban areas, the distinction between agricultural and non-agricultural hukou types was abolished in late 2001 and was replaced with planned quotas for granting urban hukou with entry conditions in selected prefectural cities.[3] This round of hukou reform has increased the probability of obtaining a hukou in a city and has attracted surplus rural workers, which directly increased labour supply in the urban labour market. Figure 1 shows the estimated difference in non-agriculture population in urban areas between reform and non-reform cities across years relative to the difference in 1998. It is evident that the difference is not significantly different from 0 until 2001 when the earliest hukou reform started, whereas afterwards the non-agriculture population is significantly higher in reform cities compared to non-reform cities, with the difference increasing over the years. This is indicative that the hukou reform was effective in attracting rural workers to move to urban areas.

The increased labour supply would result, other things constant, in a lower average wage and a higher level of employment in the urban labour market. However, over the time period we examine, China experienced dramatic economic growth (Brandt et al., 2012) due to a series of internal reforms and trade openness (Autor et al., 2013). This would be accompanied by an increasing demand for labour, which further implies that the equilibrium employment in the labour market could be even higher. With access to a larger pool of labour at lower costs, firms may adjust their employment along various dimensions. Firms may directly increase labour use or substitute current workers with the cheaper newcomers. This is true particularly for some labour-intensive manufacturing firms that do not have strong skill requirements. Employment adjustment could also happen along the extensive margin. For example, one may find

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[3]Strictly, there were two main types of the hukou reform. "Entry barriers" reform involved an entry condition scheme, whereby rural residents were eligible to apply for a local hukou and to benefit from local social welfare. "Unified hukou" reform allowed new residents to be registered as unified resident hukou holders, thereby eliminating the distinction between agricultural (urban) and non-agricultural (rural) hukou types. While some cities only enacted one of the above two types of reform, more cities conducted both at the same time.
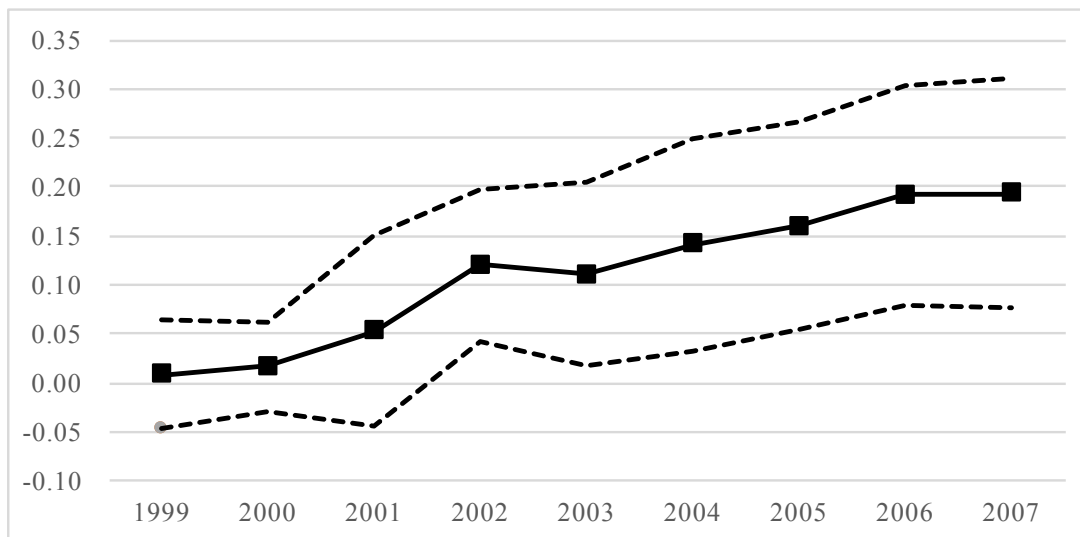
Figure 1: Difference in Non-agriculture Population in Urban Areas between Reform and Non-reform Cities: 1999-2007

Notes: Estimated coefficients (β) and 95 percent confidence interval from the regression: $\ln pop_{ct} = \alpha + \beta_t Reform_c \times \theta_t + \phi_c + \theta_t + \varepsilon_{ct}$, where pop_{ct} is the log of non-agriculture population in urban areas in city c in year t, $Reform_c$ is a dummy variable indicating whether city c is a reform city, θ_t denotes year fixed effects, ϕ_c are city fixed effects and ε_{ct} is the error term. β_t measures the difference in non-agriculture population in urban areas between reform and non-reform regions relative to the difference in 1998.

it easier to start a business due to reduced labour costs or the least productive firms that would have exited the market may have a higher probability to survive.

We identify 75 cities that implemented the hukou reform before 2007 and restrict our empirical analysis to those cities that launched the hukou reform before the end of 2005 so as to allow at least two years for the policy to take effect.

2.2 Trade liberalisation in China

China started its application for the membership of the General Agreement on Tariffs and Trade (GATT) in 1986 and relaunched it in 1995 when the WTO was founded. After a 15-year negotiation, China joined the WTO in 2001, though it had reduced its tariff rates significantly before its accession. China committed to further reduce its tariffs up to 2010, with the majority of tariff reductions to be implemented by 2005. As shown in Figure B.2 in the appendix, the average tariff rates on both imported intermediate (input) and final (output) goods were reduced by around 7% points between 1998 and 2005.[4] The tariff reductions were non-uniform across industries, with more protected

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[4]Details of the calculation of intermediate and final goods tariff rates are shown in section 4.3 below.

industries reducing tariff rates more substantially. Figure B.3 shows the initial tariff rates in 1998 and the average change until 2007 across industries. It is clear that industries with the largest tariff reductions are ones with higher initial tariffs. Variations across time along with variations across industries in tariff reductions allow us to explore whether firms that were exposed differently to trade shocks adjusted their labour use differentially.

Chinas WTO membership also involved the gaining of most-favoured-nation (MFN) status for its exports. As a result, the tariff rates on Chinas exports were reduced. The average tariff rate on its exports fell by only 1% point between 1998 and 2007, as shown in Figure B.2. Nevertheless, exports grew rapidly in response to the fall in barriers against its exports and its own import liberalisation. Figure B.2 shows that China exported around 18% of its output in 1998, and this almost doubled by 2007. During the same time period, the import share also doubled.

3 Relevant Theories and Empirical Evidence

An efficient allocation of resources maximises overall outputs in a competitive environment by determining which establishments produce and how resources are allocated across those establishments (Restuccia and Rogerson, 2013). However, institutional factors that violate the procedure of either of those two decisions will induce resource misallocation and productivity losses. Productivity losses due to resource misallocation are found to be substantial, for instance, 30 to 50 percent in China and 40 to 60 percent in India (Hsieh and Klenow, 2009).

There is also considerable evidence that the extent of labour market regulations is negatively associated with employment. Kaplan (2009), for example, studies labour regulation reforms in 14 Latin American Countries using firm-level data and finds that a more flexible labour market is associated with higher aggregated employment. Amin (2009) shows that labour market regulations in India potentially decrease employment by 22% on average for retail stores. Other evidence includes Almeida and Carneiro (2009) for the case of Brazil, Autor et al. (2007) for the case of the U.S, and Eslava et al.

(2010) for the case of Colombia, etc.

In addition to distorting the optimal level of labour use for firms, labour market regulations impede the speed of firm's adjustment following trade shocks. As documented in Melitz (2003), allowing for the heterogeneity in productivity across firms, a reduction in trade costs enables the relatively more productive firms to expand due to access to a larger foreign market. It follows that the less productive firms shrink and the least productive ones exit the market. This process is accompanied by an adjustment of employment for each firm. It is shown in the literature that the adjustment process is fairly sluggish and usually takes a long time (Hasan, 2001; Mouelhi, 2007; Coşar, 2013). A lack of labour market flexibility is one source of the sluggish adjustment. As Kambourov (2009) points out, significant labour reallocation across sectors after trade liberalisation is observed in countries with relatively flexible labour markets, whereas those with relatively rigid or distorted labour markets show no significant sectoral labour reallocation. In a dynamic general equilibrium setting, Kambourov (2009) explores the role of firing costs as main form of labour market distortion affecting labour reallocation and productivity, and finds that high firing costs account for a substantial part of the sluggish reallocation of labour.

A number of recent papers try to model the role of labour market frictions on firms adjustment following external shocks. Our paper builds on the spirit of the model by Itskhoki and Helpman (2015) who incorporate search and matching frictions into a Melitz (2003) model to study the dynamic of a firms employment adjustment. As in Melitz (2003), low-productivity firms contract or even exit the market while high-productivity firms expand with a reduction in trade costs, leading to employment reshuffling across firms. However, labour market frictions slow down such reallocation, with the low-productivity incumbents reluctant to exit the market due to sunk hiring costs. In other words, declines in labour market frictions reduce adjustment costs and encourage productive firms to be more responsive to trade liberalisation, leading to larger adjustments in employment and higher job turnover rates. In the spirit of Itskhoki and Helpman (2015), the migration barriers set by the hukou system translate into greater search and matching frictions, which hamper efficient matching between

firms and workers. The relaxation of migration barriers is expected to result in higher employment adjustments for both low- and high-productivity firms by providing an easier access to a larger pool of cheaper labour in the urban labour market.

Our paper is related to several studies that document the empirical impact of labour market regulations on firms adjustment following trade shocks. Based on a sample of 48 developing countries, Hasan (2001) finds trade liberalisation is more likely to increase employment in countries with more flexible labour markets. Similar findings are observed in Middle East and North African (MENA) countries(Selwaness and Zaki, 2015). By specifically focusing on hiring and firing costs of labour in India, Hasan et al. (2007) find that the effects of trade liberalisation on the labour demand elasticity is much larger in magnitude in states with more flexible labour markets. Almeida and Carneiro (2009) study the enforcement of labour market regulations and firm performance in Brazil, and find negative employment effects of the enforcement of labour market regulations. With a similar setup, Almeida and Poole (2017) consider trade liberalisation in Brazil and investigate the interactive effects of the enforcement of labour market regulations and trade liberation on employment. They find that trade openness is associated with higher job creation and lower job destruction, whereas such effect is weakened by the enforcement of labour market laws. Small, labour-intensive and non-exporting firms are found to be the most vulnerable to institutional constraints.

This paper is also related to a number of studies that specifically examine labour market reforms in China. Whalley and Zhang (2007) find that the hukou reform in China played a significant role in preventing labour movements and in generating large regional income disparities. Labour market imperfections, especially the barriers to regional labour mobility are found to be associated with lower gains from Chinas WTO accession, as in Hertel and Zhai (2006). Following Whalley and Zhang (2007), Xu (2014) introduces the hukou reform into a multi-country Ricardian trade model. Counterfactual exercises show that an elimination of the hukou reform could increase real GDP per capital for both China and Chinas neighbouring trade partners. These papers, however, are limited to analyse the effects of the hukou reform in theoretical settings or using numerical simulation. In this paper, we evaluate the impact of the hukou reform empirically.

4 Data and Sample Frame

4.1 Firm-level data and measuring employment adjustment

The main data source for this study is the Annual Survey of Industrial Enterprises (ASIE) dataset which is a rich firm-level panel dataset spanning 1998-2007. The data is collected by Chinas National Bureau of Statistics (NBS) in an annual survey of all industrial state-owned enterprises (SOEs) and non-state owned enterprises (non-SOEs) with annual sales over RMB 5 million (around $780,000). The number of firms included in this dataset increases steadily from around 150 thousand in 1998 to more than double that in 2007. All firms are required to report complete information on balance sheet, profit and loss account, and cash flow statement. This dataset is the most comprehensive firm-level survey data for China. It accounts for around 95% of total industrial output, over 70% of industrial employment, and more than 97% industrial exports (Ma et al., 2015). Since manufacturing firms are ones that are more directly affected by trade liberalisation, we constrain our sample to manufacturing firms in this paper.

The raw data cannot be used directly as some observations are misleading, largely due to misreporting by some firms.[5] First we drop firms without an identification number and those reporting negative values of the key variables. Then we drop observations if any of the following criteria is true, following Jefferson et al. (2008) and Yu (2015). (1) Liquid assets are greater than total assets; (2) total fixed assets are greater than total assets; and (3) the net value of fixed assets is greater than total assets. To minimise the effects of misreporting, particularly from small firms, we drop firms with fewer than eight workers.

Table 1 reports the number of firms across years after cleaning. As shown in column (1), the number of firms in the full sample increases from 53,263 in 1998 and almost doubled in 2005 and then decreases slightly to 93,010 in 2007, generating a sample with 908,288 observations in total. Columns (2) and (3) are number of observations for reform and non-reform cities separately. Consistent with the full sample, the number of observations in both regions peaks in 2005, having doubled in size as compared to

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[5]One typical group of these firms are family-owned firms that have no formal accounting system.

Table 1: Number of Observations by Year (1998-2007)

	Full sample	Reform locations	Non-reform locations
	(1)	(2)	(3)
1998	53,263	15,764	37,499
1999	64,375	19,000	45,375
2000	71,005	22,136	48,869
2001	92,631	28,135	64,496
2002	104,046	30,032	74,014
2003	116,168	31,022	85,146
2004	107,661	30,706	76,955
2005	105,949	30,808	75,141
2006	100,180	29,908	70,272
2007	93,010	28,137	64,873
Total	908,288	265,648	642,640

Notes: This table reports the number of firms by year. Reform locations are cities where the hukou reform under concern was implemented by the end of 2005. Non-reform locations are cities where no hukou reform was implemented during the whole sample period (1998-2007). We exclude cities that implemented the hukou reform in 2006 and 2007 to allow at least two years for firms to adjust to the policy change.

the level of 1998, and then decreases slightly in the latter two years.[6] Due to the limited number of reform cities, the size of the reform sample is around half the size of the non-reform sample across years.

Our main outcome variable of interest is firm-level employment adjustment. To measure employment adjustment, we calculate the absolute year-to-year employment change divided by the average employment level over the two periods. As such, this variable treats both positive and negative employment adjustments in a symmetric manner. The measure is as follows:

$$|EAR_{it}| = \frac{|E_{it} - E_{it-1}|}{(E_{it} + E_{it-1})/2}. \tag{1}$$

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[6]The decrease in the number of observations in 2006 and 2007 is attributed to the exclusion of cities where hukou reform was enforced in these two years.

where E_{it} is employment of firm i in year t. In contrast to the conventional employment growth rate, defined as the change in employment between period $t-1$ and t divided by the employment in period $t-1$, this adjustment measure is bounded between $[0, 2]$, where 2 corresponds to the employment adjustment rate for newly established firms, therefore minimising the effects of possible outliers. This is crucial for the Chinese data as it has a large amount of mis-records and may potentially have a strong outlier effect.

To calculate employment adjustments using this dataset, two concerns are worth noting. The first is that newly appearing firms cannot be identified necessarily as start-ups. Non-starting-up firms may enter the sample for the first time for several reasons: First, some non-SOEs may not have reached the threshold of RMB 5 million annual sales until year t when they were recorded for the first time. Second, some firms may have changed their identification number such that the newly appearing firms are not necessarily newly established ones. Finally, a small fraction of firms may not be recorded in all years because of misreporting. To identify new firms, we rely on a firms opening year following Dong and Xu (2009). Specifically, firms that entered for the first time and that are less than two years old are defined as start-ups. The corresponding employment adjustment rate is 2. All other newly entering firms are identified as continuing firms. For those firms, we set employment adjustment as missing since employment for the previous year is not available.

The second problem is that some firms re-entered the sample after disappearing for one or more years. We refer to them as discontinuous firms. During the gap years, they were not included in the survey either because of the lower-than-threshold annual sales or due to misreporting. Similar to the newly entering continuing firms, we set employment adjustments as missing. Therefore, our sample only includes continuing firms (with observations available in both t and $t-1$) and the real new firms.

4.2 City-level hukou reform

To identify reform cities, we reviewed the reform documents and media reports and successfully identify 75 cities that implemented the hukou reform by 2007. Considering that we are interested in firms employment adjustment as a result of the hukou reform,

we constrain our sample to firms that implemented the reform before the end of 2005 to have at least two observations both before and after the reform year. To leave at least two years for firms to adjust to the policy change, we only consider cities that started the reform before the end of 2005. This reduces the number of reform cities to 66.[7] In 2001, only two cities launched the reform while the number of reform cities rises considerably to 10 in 2002, 23 in 2003, 21 in 2004 and 10 in 2005. A map of reform cities is present in Figure B.1 in the appendix.

4.3 Measuring the extent of trade liberalisation

To measure trade liberalisation, we rely on applied tariff data at the 8-digit level of the Harmonised System (HS) product classification obtained from the World Integrated Trade Solution (WITS) database. Specifically, we first map Chinas import tariff rates into Chinas Industrial Classification (CIC) at the 4-digit level using the concordance table provided by Brandt et al. (2017) to produce an industry weighted average output tariff. Given that imports of intermediate inputs subject to reduced tariff rates may affect firms employment adjustment differently from final goods imports, we also calculate input tariff rates. Following the literature (e.g. Amiti and Konings, 2007 and Amiti and Cameron, 2012), input tariff rates are calculated as the weighted average of final goods or output tariffs using industry input shares as weights:

$$input tariff_{kt} = \sum_j \frac{input_{kj}^{2002}}{\sum_j input_{kj}^{2002}} \times output tariff_{jt} \tag{2}$$

where $\frac{input_{kj}^{2002}}{\sum_j input_{kj}^{2002}}$ is the input share of industry j in the production of a good in industry k based on the China Input-Output (IO) table 2002. Due to the relatively more aggregated industry classification in the IO table, input tariff rates are at 3-digit CIC level.

Export tariff is measured as the weighted average tariff rates applied on Chinas exports using the export share to each destination market as weights. Specifically, it is constructed as follows:

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[7]Zhengzhou implemented the reform in 2003 but canceled it one year later. We therefore eliminate this city from the sample.

$$exporttariff_{jt} = \sum_m \frac{export_{mj}^{96-98}}{\sum_m export_{mj}^{96-98}} \times tariff_{mt} \tag{3}$$

where $\frac{export_{mj}^{96-98}}{\sum_m export_{mj}^{96-98}}$ is the average export share to destination m in total exports of industry j between 1996 and 1998. The use of the pre-sample export share is to avoid potential effects from factors that may affect the choice of export markets and firm's employment adjustment simultaneously.[8] Similar to the output tariff rates, export tariff rates are obtained from the WITS databased at HS 8-digit level and then mapped to 4-digit CIC level. Figure 2(a) in the appendix shows the average tariff rates by type across years. Table C.1 shows the descriptive statistics of the above variables and the other variables used in the econometric modelling.

5 Empirical Strategy

5.1 Econometric specification

We initially explore the causal effects of labour market flexibility resulting from the hukou reform on firms employment adjustment. We would like to compare the observed employment adjustment of a firm subject to the change in policy conditions with what would have happened to that same firm in the absence of the hukou reform. However, this counterfactual is not observable. The non-uniform nature of the hukou reform under investigation provides us a possibility, however, of adopting a difference-in-differences (DiD) approach. Specifically, we categorise firms located in reform cities as the treatment group and those located in non-reform cities as the control group. Given that the timing of the hukou reform varies across reform cities, we constrain control firms to those located in areas that were never exposed to the hukou reform during the entire sample period.

Our multiple-group multiple-period DiD framework is therefore as follows:

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[8]The use of the pre-sample export share as weights is based on the assumption that within-industry export structure across countries is relatively stable over the years. Considering that the export share to each country changed a lot during our sample period, particularly after China's WTO accession, we also use the time-varying export share as weights to check whether our results are sensitive to the choice of weights and the results are fairly robust.

$$EAR_{ijct} = \alpha + \beta policy_{ct} + \mathbf{X}_{ijct}\gamma + \mathbf{Z}_{ct}\delta + \theta_i + \theta_j + \theta_t + \epsilon_{ijct} \tag{4}$$

where i denotes firm, j denotes industry, c is city and t is year. EAR_{ijct} is the firm-level employment adjustment rate as defined earlier in year t. $policy_{ct}$ indicates whether the hukou reform policy is in force in city c in year t. It is equivalent to an interaction term between a reform location dummy that indicates reform cities and a reform year dummy that indicates post-reform years. $\mathbf{X}_{ijct}$ and $\mathbf{Z}_{ct}$ represent a set of firm-level and city-level control variables. θ_i denotes firm fixed effects that control for unobserved time-invariant firm characteristics that may affect firm's employment adjustment. The hukou reform may also have heterogeneous effects across industries. For instance, firms in labour-intensive industries might react to the hukou reform more strongly compared to those in capital-intensive industries. We account for such industry-specific effects by including industry fixed effects, θ_j. θ_t is a year dummy controlling for the common shocks to all firms in a given each year, e.g. changes in the macroeconomic environment. Finally, ϵ_{ijct} is the error term. To correct for possible correlations of firms within cities, we cluster our standard errors at the city level in all specifications. The main coefficient of interest is β_2, which measures the mean shift in employment adjustment in reform regions following the implementation of the hukou reform relative to the adjustment in non-reform regions.

The coefficient of the policy variable in equation (4) captures the average effects of the hukou reform on firms employment adjustment in response to all potential shocks. Against the background of rapid trade liberalisation in China during our sample period, we are further interested in whether firms with differential labour market flexibility adjust their labour use differently in response to reduced trade barriers. To address this second research question, we augment our baseline specification as follows:

$$\begin{aligned}
E_{ijct} &= \alpha + \beta_1 policy_{ct} + \beta_2 tariff_{j,t-1} + \beta_3 tariff_{j,t-1} \times policy_{ct} \\
&\quad + \mathbf{X}_{ijct}\gamma + \mathbf{Z}_{ct}\delta + \theta_i + \theta_j + \theta_t + \epsilon_{ijct}
\end{aligned} \tag{5}$$

where $tariff_{jt-1}$ denotes the various types of tariff rates as defined earlier. The main purpose of lagging tariff rates by one year is to avoid potential reverse causality. All

other variables are defined in the same way as above. Our main variable of interest is the coefficient of the interaction term, β_3, which measures the additional employment effects owing to the hukou reform following trade liberalisation.

5.2 Endogeneity of the hukou reform and identification strategy

One crucial threat to identifying the causal relationship between hukou reform and employment adjustment is the potential non-randomness of the selection of reform cities. If the determinants of the hukou reform are correlated with firms' employment changes, then the reform is endogenous and the empirical estimates are spurious. It is likely that the hukou reform was implemented in cities with a greater need for the reform, for instance, due to more rapid economic growth that requires more workers. Indeed, several provincial capital cities that are often the most developed in their own province were among the first to implement the reform. In this case, firms may be adjusting their labour use not because of hukou reform but rather due to higher economic growth.

To address the endogeneity problem, we first include firm fixed effects in our regressions. Notice that since firms did not change their city location across years which means that firm fixed effects also control for all time-invariant determinants of the hukou reform at the city level, as city fixed effects do.[9] City officials decided whether to implement the reform based on pre-reform characteristics. If those initial differences across cities are time-invariant, one does not need to worry about the endogeneity problem once city fixed effects are included.

However, since cities implemented the hukou reform in different years, the initial city characteristics that affect the decision to reform may be year-specific. In this case, the determinants of the hukou reform are not only city-specific but also time-specific. While city fixed effects could control for the former, the latter is still a problem. An alternative problem is that the effects of the pre-reform characteristics on firms employment adjustment may vary across years. This could be the case, for example, if cities with a higher initial economic growth rate attract more migrant workers, which in

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[9]There are a small number of firms (0.57%) that changed their city location in our sample period. To reduce potential noise that violates the identification of a causal relationship due to city changes, we exclude those firms from our sample.

turn promotes economic development and attracts more workers and therefore affects firms employment change. To account for these two possibilities, we further include a set of pre-reform city-level characteristics which we interact with year dummies. In fact, the decision to adopt the reform involves complicated discussions and there is no consensus in the literature on a clear set of determinants. We therefore consider several potential city-level factors, including the log of GDP per capita, the share of agriculture population in total population, the log of fiscal expenditure per capita, the share of industrial employment in total employment and the share of non-SOE employment. More details about the choice of determinants can be found in appendix A.

An alternative approach to deal with the potential non-random selection of reform cities is to use propensity score matching (PSM). The basic idea of matching is to select non-reform cities that are most similar to reform cities in terms of observable pre-reform characteristics. In practice, we use the same set of pre-reform city-level characteristics as stated above and run probit regressions, based on which we select non-reform cities that have the most similar probability to be treated as a reform one. By doing so, we construct a more comparable control group and therefore largely alleviate the selection problem. Details of the PSM are given in appendix A. The combination of PSM and DID can improve the quality of non-experimental evaluation studies (Blundell and Dias, 2000) and is effective when dealing with an endogenous programme placement (Todd, 2008).

Technically, the PSM approach addresses the same endogeneity problem as the specification using the full sample as well as controls for initial city-level conditions interacted with year dummies. However, because we have a much smaller number of reform cities than non-reform cities, PSM reduces the sample size substantially. Considering that PSM may be sensitive to the choice of a specific matching approach and to various parameter settings, we rely on the first specification as main results and use matching as a robustness check.

We use two additional ways to construct a more comparable control group and to test the robustness of our main identification strategy. First, since our preferred specification

relies on the full sample, one may worry that firms in the least developed far western non-reform cities are considerably different from those in reform regions. The inclusion of such firms may violate our identification. To alleviate this concern, we exclude firms in provinces where no reform was implemented in any city within the sample period. As such, treatment and control firms are all from reform provinces and are therefore more comparable. Second, we construct an alternative control group by exploiting the sequential implementation of the reform across reform cities. Specifically, we treat the early reform cities (i.e. those implementing the reform in 2001, 2002 and 2003) as treatment group and use the later reform cities (i.e. those implementing the reform in 2005, 2006 and 2007) as control group. Given that these control cities have also implemented the reform, the treatment and control groups are considerably similar and only differ in the timing of the reform.

We are less worried about the possible endogeneity of our measures of trade liberalisation. Regarding import tariff rates, the endogeneity problem arises when there are factors that affect both tariff rate reductions and firms employment changes simultaneously. This could be the case if politically powerful industries successfully lobby the government for more protections (Goldberg and Pavcnik, 2005; Amiti and Cameron, 2012). However, in the context of comprehensive tariff reforms as part of membership negotiations with the WTO there were constraints on the effectiveness of such lobbying (Brandt et al., 2017). We also consider export tariffs to be exogenous since tariff rates on Chinas exports are determined in the foreign markets.

6 Empirical Results

6.1 Effects of the hukou reform on firms' employment adjustment

6.1.1 Baseline results

We start by estimating equation (4) based on the full sample and the results are summarised in Table 2 (Panel A). In column (1), we use a simple specification that only controls for firm fixed effects and year fixed effects. Notice that firm-level fixed effects account for all time-invariant observable characteristics such as location of the

firm, exporter status, as well as time-invariant unobservable factors that may affect firms employment adjustment. As discussed earlier, the inclusion of firm fixed effects also accounts for initial differences in city-level characteristics and therefore addresses the endogeneity of the hukou reform.

In column (2), we add firm-level characteristics. The log of sales is included to control for time-varying heterogeneity of firms such as changes in size or productivity growth. Following Nucci and Pozzolo (2010) and Dai and Xu (2017), we additionally control for firm-level mark-up. The mark-up is calculated as the ratio of sales over the difference between sales and profits. To account for variations in ownership and industry affiliation, we additionally include a full set of ownership and industry dummies in the regression. If a firm did not change ownership or industry affiliation, the firm-level fixed effects can capture such time invariant factors. However, we find that a considerable number of firms did experience changes in ownership and industry, in line with Brandt et al. (2014). In column (3), we include the Herfindahl index as an additional city-level control variable. It captures the effects of competition across firms in the local market. We also include a set of initial city conditions interacted with year dummies. As discussed earlier, this controls for cross-city variations in pre-reform characteristics that potentially influence the selection of reform cities. The interaction with year dummies allows such effects to vary across time.

The results in Table 2 show that the coefficients of the policy variable in all specifications are positive and highly significant, indicating that the hukou reform broadly raised average employment adjustment rates. This also reflects that firms were constrained in adjusting employment in the non-reform locations, and by implication that firms in reform locations would have faced constraints on employment adjustment in the face of shocks in the absence of reform. Since we do not identify a specific source of shock that pushes firms to adjust, the DiD estimator is measuring the average effect of hukou reform on firms net employment adjustment arising from all types of shocks.

With increased labour supply at lower costs resulting from the hukou reform, it is likely that urban firms substitute the currently relatively expensive workers with cheaper

Table 2: Hukou reform and firm-level employment adjustment: Baseline results

	Panel A: Full sample			Panel B: PSM matched sample		
	Baseline	+Firm controls	+City controls	Baseline	+Firm controls	+City controls
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.037***	0.046***	0.052***	0.049***	0.049***	0.048***
	(3.182)	(4.078)	(4.277)	(3.260)	(3.267)	(3.225)
ln(sale)		-0.080***	-0.078***		-0.071***	-0.071***
		(22.717)	(22.761)		(16.471)	(16.455)
Markup		0.004	0.006		-0.010	-0.010
		(0.525)	(0.814)		(0.887)	(0.858)
Herfindahl index			0.029			0.095
			(0.686)			(1.513)
Constant	0.219***	0.953***	0.857***	0.215***	0.864***	0.860***
	(35.261)	(20.068)	(3.884)	(23.786)	(13.378)	(13.366)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Ownership FE	No	Yes	Yes	No	Yes	Yes
Initial cond. × year	No	No	Yes	No	No	No
Observations	903,279	835,021	833,004	438,428	415,984	415,984
R^2	0.034	0.049	0.051	0.031	0.045	0.045

Notes: This table reports the DID estimation results based on the full sample (Panel A) and the PSM matched sample (Panel B), respectively. All specifications control for firm and year fixed effects. Column (2) and (5) control for firm-level characteristics, including logarithm of sale, markup, industry dummy, and ownership dummy. Column (3) and (6) further control for city-level characteristics, including Herfindahl index, and initial city conditions interacted with the year dummies. The initial city conditions include logarithm of local GDP per capita, share of agriculture population, employment share of non-SOEs, share of industrial employment and logarithm of local fiscal expenditures per capita. Robust standard errors are clustered at the city level in all specifications.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Absolute t values in parentheses.

ones, which implies that job destruction and job creation occur simultaneously, or job turnover rates increase as in Coşar et al. (2016). However, given that the nature of our data does not allow us to investigate job destruction and creation, our estimates can be interpreted as a lower bound of the employment adjustments.

Regarding the control variables, our results show that sales are negatively associated with the employment adjustment rates. This implies that larger firms have a higher capability to absorb economic shocks and their production is more stable such that labour adjustment is slower or on a smaller scale. We do not find significant effects of

firm-level mark-up and city-level Herfindahl index on firms employment adjustment.

Panel B shows regression results based on the PSM matched sample. It should be noted that different from column (3), we do not include initial city conditions interacted with year dummies in columns (4)-(6) as cities are matched based on pre-reform characteristics. By and large, the coefficient estimates of the policy variable are significantly positive in all specifications with a similar size as the estimates based on the full sample. This indicates that our preferred specification in column (3) successfully accounts for the selection problem of reform cities. Given that the sample size falls by over a half in the case of the matching methodology, we concentrate on the full sample results in the following discussions.

Our dependent variable measures the average employment adjustment within firms, including both positive and negative employment changes. To examine the source of the positive employment adjustment, we use employment growth rate as alternative dependent variable and replicate all regressions of Table 2. The results are set out in appendix Table C.2. We find that the coefficient of the policy variable is significantly positive in all specifications, indicating that hukou reform encouraged employment growth in general, with less negative than positive adjustment overall.

6.1.2 Further identification checks

A key identification assumption underlying our DiD approach is that the average trends in employment adjustments are parallel between reform and non-reform cities before the implementation of the hukou reform. If the timing of the hukou reform is correlated with pre-treatment differences in employment adjustments, the estimates obtained before would be biased. To test the plausibility of the common trend assumption, we augment equation (4) by including a set of leads and lags:

$$
EAR_{ijct} = \alpha + \sum_{m=1}^{4} \beta_m^+ D_{t+m} + \beta_0 D_{ct} + \sum_{n=1}^{4} \beta_n^- D_{c,t-n}
$$
$$
+ \mathbf{X}_{ict}\gamma + \mathbf{Z}_{ct}\delta + \theta_i + \theta_j + \theta_t + \epsilon_{ijct}
$$

(6)

where D_{ct} is a dummy variable for the year of the hukou reform implementation for city c; $D_{c,t+m}$ is a dummy variable for m years before the reform and $D_{c,t-n}$ is a dummy variable for n years after the reform. In particular, $D_{c,t-4}$ denotes 4 years or more after the reform. The coefficient of the leads β_m^+ measures the pre-reform time trend of the difference in employment adjustment; and the coefficient of the lags β_n^- measures the lagged effects of the hukou reform. We run the regression by controlling for a full set of firm-level characteristics, year fixed effects and the initial city conditions interacting with the time trend. The estimated coefficients $\hat{\beta}$ are displayed in Figure 2 with 95 percent confidence bands.
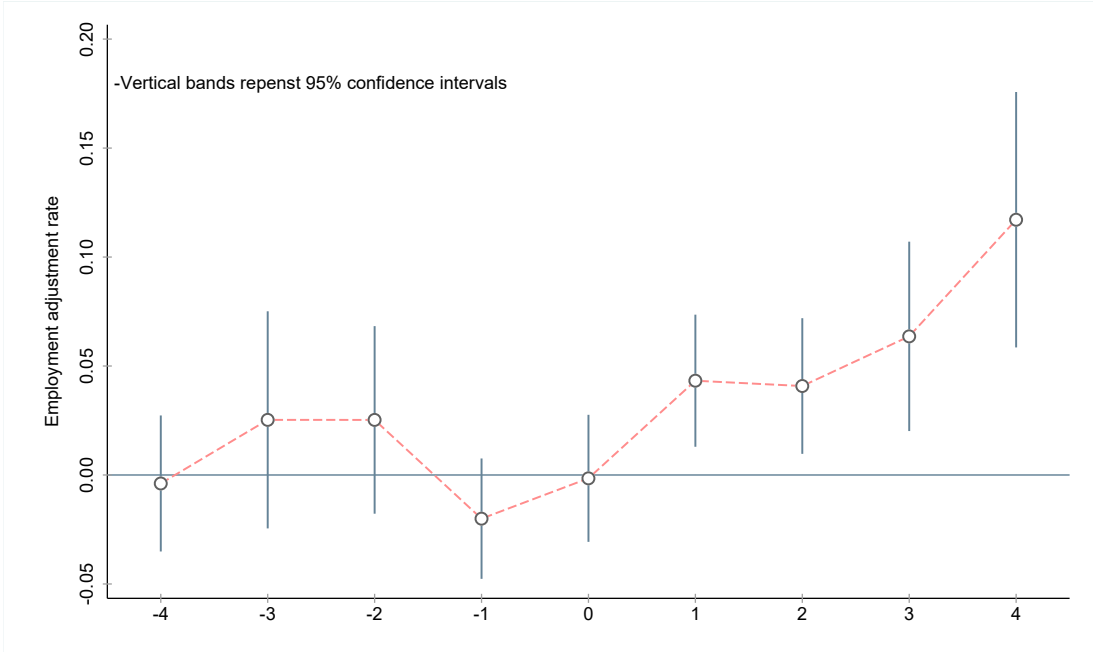
Figure 2: Time trend of employment adjustment around year of the hukou reform

Notes: This figure shows the estimated coefficients and 95 percent confidence interval from a regression of the employment adjustment rate on a set of reform time dummies controlling for firm fixed effects, year fixed effects, firm characteristics and city characteristics.

Figure 2 shows that none of the coefficients of the pre-reform years and of the reform year are significantly different from zero. The positive effects of the hukou reform on employment adjustment are realised one year after the launch of the reform. The persistently rising coefficients indicate that the hukou reform had strong lagged effects which increased across years. The results show that firms in reform and non-reform regions did not differ much in employment adjustment prior to the hukou reform, which further confirms the validity of our identification strategy.

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An alternative approach to address the common trend assumption is to include city-specific time trends (Angrist and Pischke, 2015). This allows the average employment adjustment rates to follow nonparallel linear time trends between reform and non-reform cities prior to the reform. The causal identification in this case comes from a sharp deviation from otherwise smooth trends. The city-specific time trend variable equals to zero in the year of the reform implementation, 1 in the year right after the reform and -1 in the year before the reform, and so on. It is set to zero for all non-reform cities.

We estimate equation (4) by additionally controlling for city-specific time trends. Table 4 shows the results. It is evident that after adjusting for the trend in employment adjustment, our main coefficient of interest, the policy variable, remains positive and statistically significant. This result supports the validity of our DiD approach.

Table 3: Hukou reform and firm-level employment adjustment: Controlling for city time trend

	(1)	(2)	(3)
Policy	0.043***	0.040***	0.038***
	(4.387)	(4.133)	(3.650)
City time trend	-0.001	0.002	0.004
	(0.620)	(0.677)	(1.478)
ln(sale)		-0.080***	-0.078***
		(22.721)	(22.716)
Markup		0.003	0.006
		(0.517)	(0.797)
Herfindahl index			0.023
			(0.540)
Constant	0.216***	0.957***	0.872***
	(31.084)	(20.048)	(3.998)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	No	Yes	Yes
Ownership FE	No	Yes	Yes
Initial cond. $\times$ year	No	No	Yes
Observations	903,279	835,021	833,004
R^2	0.034	0.049	0.051

Notes: This table reports the regression results that check the common trends assumption of the DiD approach by including city-specific time trends in all regressions. Control variables of each specification are the same as in Table 2. Robust standard errors are clustered at the city level in all specifications. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Absolute t values in parentheses.

Finally, we perform a falsification test. We generate a random reform year between 1998 and 2007 (the first and last year of our sample period) that is different from the actual

reform year for each reform city, and we construct a placebo policy variable based on this random reform year. We then run equation (4) using the false policy variable and store the estimates. We repeat the exercise 500 times and the density of the simulated coefficients is shown in Figure 3. As expected, the simulated coefficients are centred around zero and the estimated coefficient of our true policy variable (column (3) in table 3) lies on the very end of the distribution with one out of the 500 false estimates being on the right. This exercise suggests that our main results are unlikely to be biased.
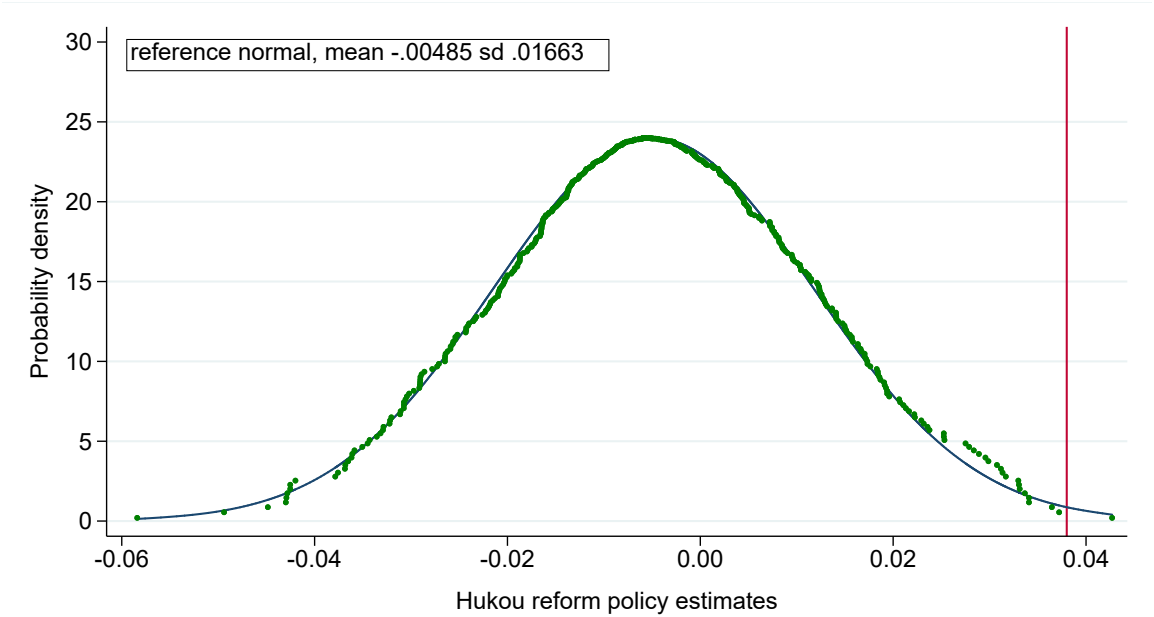

Figure 3: Density of the estimated coefficients with random reform years

Notes: This figure shows the density function of the 500 estimated coefficients from regressions of the employment adjustment rate on a placebo policy variable controlling for firm fixed effects, year fixed effects, firm characteristics, city characteristics and city time trend.

6.1.3 Additional robustness checks

In this section, we perform various robustness checks of our main findings on the effects of the hukou reform on firms employment adjustment. The first set of exercises deals with concerns about the comparability of treatment and control groups. In column (1) of Table 5, we drop provinces where no hukou reform was implemented in any city during our sample period. As such, we exclude non-reform cities that are considerably different from the reform ones, like those in the far west Xinjiang Uygur Autonomous Region and Tibet Autonomous Region. Another factor that may affect our results is that pilot hukou reforms were implemented before 2001 in selected towns and small cities. In fact, the pilot reform had limited effectiveness in encouraging rural-to-urban

migration as towns and small cities had limited attraction for rural workers. However, if the pilot reform had lagged effects on migration, our estimated policy effects may be affected by the pilot reforms. We therefore exclude cities where the pilot reform was enacted before 2001 and the result is reported in column (2). The regression results based on these two refined samples show that the coefficient of the policy variable remains positive and highly significant, revealing that our main findings are robust to these different specifications.

Another issue about our identification strategy is that other reforms that happened during our sample period might also affect firms employment. China implemented several reforms during the early 2000s, such as an SOE reform, a minimum wage reform, an exchange rate regime reform, etc. The policy variable in our empirical specification could hence capture a composite effect of all reforms rather than solely the hukou reform. Indeed, this is a problem only if other reforms were implemented in the same manner as the hukou reform, that is, with the same regional variation across reform and non-reform cities and time variations over pre- and post-reform years. The inclusion of city-level employment shares of SOEs in our main specification can capture the potential effects of the SOE reform. Here we further account for the minimum wage reform and the exchange rate regime reform.

The minimum wage regulations in China were non-binding before 2004, as the adjustment of the minimum wage level was infrequent and its coverage was limited (Huang et al., 2014; Poncet et al., 2014). A new Minimum Wage Rule was issued in 2004 that formalised the minimum wage system by increasing the minimum wage level, by extending the coverage, by setting regular adjustment intervals, and by increasing non-compliance penalties. In theory, a firms response to an increase in the minimum wage rate might be to deter hiring of new workers and may even lead to increase dismissals of of current workers. Incidentally, this might (in contrast to the effects of hukou reform) be expected to reduce employment adjustment and growth.

To remove the potential impact of this reform, we include city-level log of minimum wages in our regression. The regression result is reported in column (3). The significant

positive coefficient indicates that firms in cities with a higher minimum wage level tend to experience higher employment adjustment. One potential explanation is that higher minimum wages indicate that economic conditions are better in those cities, where firms often have higher employment growth. Controlling for minimum wages, the coefficient of the policy variable is hardly affected.

Another reform that was implemented nationwide during our sample period was the exchange rate regime reform in 2005. Instead of pegging the RMB solely to the U.S. dollar pegging to a basket of currencies was introduced, with the nominal exchange rate of the RMB depreciating by more than 20% against the U.S. dollar. Theoretically, such a change stimulates imports and dampens exports, and potentially has a negative effect on employment. Although the exchange rate reform was introduced at the national level, firms in different industries could be affected differently (Almeida and Poole, 2017). While this reform should have limited direct effects on the identification of our policy variable, variations in the composition of industries across cities and years might introduce an omitted variable bias problem. To address this concern, however, we include the exchange rate variable into the regression as an additional regressor.[10] As shown in column (4), the exchange rate regime reform has insignificant effects on employment adjustment. More importantly, the DiD estimate remains robust.

To address this concern, we first construct trade-weighted industry-specific real exchange rates based on the bilateral exchange rates against the U.S. dollar, the Japanese Yen and the Hong Kong dollar taken from various issues of the China Statistical Yearbooks and industry-level bilateral trade from the UN Comtrade Database. Then we calculate city-level exposure to the exchange rates changes using the employment share of each industry within cities as the weights. We include the exchange rate variable into the regression as an additional regressor. As shown in column (5), the exchange rate regime reform has insignificant effects on employment adjustment. More importantly, the DiD estimator remains robust.

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[10]To construct city-level exchange rates, we first construct trade-weighted, industry-specific real exchange rates based on the bilateral exchange rates against the U.S. dollar, the Japanese Yen and the Hong Kong dollar taken from various issues of the China Statistical Yearbooks and industry-level bilateral trade from the UN Comtrade Database. Then we calculate city-level exposure to the exchange rate changes using the employment share of each industry within cities as weights.

Table 4: Hukou reform and firm-level employment adjustment: Robustness checks

	Excl. NR provinces	Excl. pilot ref. cities	Min. wages	+Exch. rates	Excl. villages	Excl. towns	2-way cluster
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Policy	0.043***	0.028***	0.036***	0.036***	0.037***	0.032***	0.036***
	(3.870)	(3.032)	(3.567)	(3.573)	(3.611)	(2.945)	(3.559)
City time trend	0.002	0.005	0.003	0.003	0.003	0.001	0.003
	(0.798)	(1.457)	(1.290)	(1.266)	(1.231)	(0.318)	(1.288)
ln(sale)	-0.075***	-0.078***	-0.079***	-0.079***	-0.079***	-0.087***	-0.078***
	(18.080)	(20.036)	(22.724)	(22.798)	(22.812)	(21.814)	(19.302)
Markup	0.007	-0.008	0.005	0.005	0.005	0.023**	0.006
	(0.758)	(1.075)	(0.771)	(0.756)	(0.732)	(2.195)	(0.796)
Herfindahl index	0.037	0.038	0.027	0.027	0.029	-0.009	0.026
	(0.633)	(0.822)	(0.657)	(0.655)	(0.696)	(0.233)	(0.622)
Minimum wages			0.063***	0.064***	0.063***	0.048**	0.063***
			(3.306)	(3.377)	(3.322)	(2.284)	(3.197)
Exchange Rates				0.021	0.021	0.011	0.021
				(1.307)	(1.300)	(0.706)	(1.316)
Constant	0.887***	1.004**	0.796***	0.722***	0.721***	1.020***	
	(15.830)	(2.368)	(3.593)	(3.019)	(3.003)	(6.710)	
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	634,668	562,624	832,640	832,640	821,725	240,319	837,125
R^2	0.054	0.048	0.052	0.052	0.052	0.052	0.426

Notes: This table reports the results of various robustness checks. Column (1): firms in the non-reform provinces where no hukou reform was implemented in any city during the sample period are excluded. Column (2): firms in non-reform cities that implemented the pilot hukou reform before 2001 in towns are excluded from the control group. Column (3): city-level minimum wages (deflated to the 1998 level) are included in the regression. Column (4): city-level exposure to exchange rates is included as an additional control variable. City exchange rates are calculated as the weighted average industry-level exchange rates using the initial employment share across industries within cities as weight. Industry-level exchange rates are calculated as the weight average level using trade share with each trade partner within industries as weight. Column (5) and (6): firms in the rural areas are excluded from the sample. Rural areas are identified following two criteria: a wide one (column 5) and a arrow one (column 6). Column (7): robust standard errors are clustered at the city level and the industry level. Robust standard errors are clustered at the city level in columns (1)-(6).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Absolute t values in parentheses.

In columns (5) and (6), we constrain our sample to the urban market as the hukou reform encouraged migration from rural to urban areas, which mainly affects urban firms. However, the data available does not allow us to precisely identify whether a firm is located in a rural or urban area. We rely on a firms name and the name of their administrative location. In column (6) we consider a narrow identification, that is, firms that have the Chinese characteristic "cun" or village in its name or in the location name are treated as rural firms. However, due to variations in Chinese ways of naming rural areas and the incomplete names of a large number of firms, this approach may well exclude some rural firms. In column (6) we consider a broader identification. That is, we additionally treat a town or "zhen" as a rural area. This approach, on the other hand, may incorrectly rule out some urban firms as some urban areas are named "zhen" in China. In fact, this approach reduces the sample size substantially. The regression results in columns (5) and (5), though not precisely defined, show that our main findings are robust.

Lastly, we cluster the standard errors at both city level and industry level in column (7) and the results hardly change.

6.1.4 Heterogeneity issues

The above findings provide evidence that the hukou reform enables firms to adjust employment more significantly than similar firms located in non-reform regions. In this section, we consider the heterogeneity of these results based on ownership, region and exporter status.

We start by splitting the full sample into three sub-samples based on a firms ownership, i.e. SOEs, private firms and foreign invested firms.[11] This exercise is motivated by the fact that there are often strong barriers for rural migrants to find a job in SOEs whereas private and foreign firms are the main receivers of rural workers. The regression results are set out in columns (1)-(3) in Table 5. The results show that all types of firms have

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[11]If a firm changed its ownership during the sample period, we identify its ownership based on the total length of each type. We also run regressions based on firms without ownership change during the sample period and the results are fairly similar.

positive employment adjustment following the hukou reform. However, private firms and foreign firms respond more strongly than SOEs, which confirms our expectation that the impact of the hukou reform on SOEs is limited.

Considering the large geographical area of China, firms in different regions may react differently to the hukou reform. Our sample of reform cities spans widely across China from the most developed coastal region to the less developed western region. This allows us to explore possible regional differences in the effects of the hukou reform. To this end, we split the full sample into eastern, central and western regions, with economic and social development levels decreasing from east to west. We repeat our regressions for these three subsamples separately and the results are reported in columns (4)-(6). The coefficient of the policy variable is only found to be significant in the eastern and the western regions while the impact of the hukou reform is insignificant in the central region. This implies that firms in the eastern and the western regions were more constrained by the hukou system before the reform. However, the reason for this may be different.[12] In the 2000s, there was a large scale of migration from the west to the east. Despite the large inflow of migrant workers, firms may still face labour shortages due to rapid growth. The hukou reform that encouraged migration from rural to urban areas within cities further enabled firms to adjust their labour use. However, labour shortage of western firms was not due to high growth, rather it was because of the outflow of workers.

The last two columns of Table 5 consider the difference between exporting and non-exporting firms. Following Almeida and Poole (2017), we define exporters as firms with positive exports in any of the sample years, and non-exporters as firms that never exported. The regression results show that the hukou reform has a positive impact on both exporters and non-exporters. However, non-exporters respond more strongly than exporters. It is well documented in the literature that exporters are usually more productive than non-exporters (Pavcnik, 2002; Melitz, 2003; Bernard et al., 2003). To achieve higher productivity, exporters tend to use more capital-intensive inputs and high-skilled workers, and on average, shed employment (Menezes-Filho and Muendler,

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[12]Another potential explanation to the insignificant coefficient for the central region is the relatively smaller number of reform cities. Only 11 out of 74 reform cities are from the central region.

Table 5: Hukou reform and firm-level employment adjustment: Heterogenous results

	Ownership			Region			Exporter status	
	SOE (1)	Private (2)	Foreign (3)	East (4)	Central (5)	West (6)	Exporter (7)	Non-exporter (8)
Policy	0.018*	0.036***	0.032***	0.029***	0.047	0.059***	0.027***	0.046***
	(1.801)	(3.203)	(2.910)	(2.636)	(1.510)	(2.972)	(2.661)	(3.997)
City time trend	-0.001	0.006**	0.002	0.006*	-0.009	-0.000	0.004	0.002
	(0.670)	(1.978)	(0.559)	(1.836)	(1.617)	(0.091)	(1.251)	(0.957)
ln(sale)	-0.048***	-0.079***	-0.092***	-0.071***	-0.096***	-0.101***	-0.079***	-0.079***
	(11.978)	(17.096)	(14.467)	(16.287)	(15.744)	(15.497)	(17.372)	(21.362)
Markup	0.012	0.012	-0.039***	-0.011	0.044**	0.038***	-0.008	0.015*
	(1.316)	(1.270)	(3.100)	(1.354)	(2.294)	(2.726)	(0.808)	(1.800)
Herfindahl index	-0.083**	0.054	-0.072	0.055	0.058	-0.055	0.097	-0.011
	(2.135)	(1.158)	(0.724)	(0.651)	(1.057)	(1.249)	(1.296)	(0.287)
Minimum wages	-0.029	0.110***	-0.032	0.100**	0.078***	-0.030	0.058**	0.076***
	(1.487)	(4.944)	(0.743)	(2.516)	(2.856)	(0.882)	(2.367)	(3.614)
Exchange Rates	0.029***	0.005	0.047	0.025	0.019	0.007	0.034	0.013
	(2.683)	(0.298)	(1.293)	(0.609)	(1.098)	(0.496)	(1.144)	(1.060)
Constant	0.310	1.427***	0.852*	0.478	0.977***	1.228***	0.692	0.692***
	(1.223)	(4.252)	(1.889)	(1.217)	(2.710)	(3.307)	(1.214)	(8.470)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership FE	No	No	No	Yes	Yes	Yes	Yes	Yes
Initial cond. × year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	86,081	551,309	195,250	605,281	145,817	81,542	406,548	426,092
R^2	0.056	0.058	0.061	0.051	0.064	0.073	0.053	0.053

Notes: This table reports various exercises that examine the heterogeneity of the results. Eastern, central and western regions are divided based on firms' geographical locations. Eastern region includes Liaoning, Beijing, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, and Hainan. Central region includes Heilongjiang, Jilin, Shanxi, He'nan, Anhui, Hubei, Hu'nan, and Jiangxi, and western region includes Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang. A firm is defined as an exporter if it exported in any year of the sample period, and non-exporters are those that never exported. All specifications include firm fixed effects, year fixed effects and a full set of firm-level and city-level control variables. Robust standard errors are clustered at the city level in all specifications.
* $p <$0.1, ** $p <$0.05, *** $p <$0.01. Absolute t values in parentheses.

2011). In which case, exporters were less sensitive to the hukou reform since this reform mainly induced the movement of relatively low-skilled rural workers into urban areas.

6.2 Effects of trade liberalisation in the presence of the hukou reform

Our empirical results so far indicate that the hukou reform had a positive effect on firms employment adjustment. In this section, we evaluate the role of the hukou reform in shaping firms employment adjustment in response to trade shocks.

In theory, trade openness may affect firms through various channels. Import competition induced by lower import tariff rates may push firms to increase investment in more efficient technology or to lower costs through using cheaper inputs (Muendler, 2004). Reductions in the input tariff rates, in particular, may induce competition effects for similar local intermediate inputs producers. However, lower input tariff also enables firms to have access to more varieties of inputs of better quality or at lower prices, which improves firms production efficiency and triggers production expansion. Following Melitz (2003), with declines in trade costs and access to larger foreign markets, the most productive exporters expand, the less productive non-exporting firms shrink, while the least productive ones exit the market. Such adjustments result in a market share reallocation towards more productive firms.

It follows that the employment effect of trade liberalisation is ambiguous since the different channels may offset each other. Imported competition has a negative effect on employment if firms shrink production or lower costs by reducing employment in response to competition. However, if firms respond to competition by changing production strategy, e.g. investing more in technology upgrading, this may increase employment if production expands as a result of higher efficiency. The employment effects of intermediate input imports depend on the skill intensity of the imports and the substitutability between imported inputs and workers. Skill-intensive inputs may increase the demand for skilled workers and low-skill-intensive inputs may rise the demand for unskilled workers if inputs and workers with similar skill levels are complementary with each other in production. However, if imported inputs substitute with labour, the employment effect of lower input tariff rates will be negative. Amiti

and Cameron (2012) find that in Indonesia, imported intermediate inputs increased the demand for unskilled labour since domestic intermediate input production was relatively skill-intensive and lower tariff rates allowed firms to change from skill-intensive production of inputs to imports.

Following Melitz (2003), access to larger export markets is often related to production expansion for the most productive exporters and hence a higher level of employment. However, for those less productive firms that shrink or even exit the market, we would expect a reduction in employment. In addition, to compete with local producers and exporters from other countries, firms also have greater pressure to lower production costs (Milner and Tandrayen, 2007). It follows that firms may reduce employment and invest more in technology.

To examine the employment effects of trade liberalisation and the role of labour market flexibility, we run regressions according to Equation (5). To avoid possible reverse causality, we lag tariff rates by one year, though this is not a big concern since a single firm can hardly affect tariff rates at the industry level. All specifications include a full set of control variables. The regression results are shown in Table 6.

We start from examining the impact of import tariff reductions. Column (1) considers the effects of the tariff rates on employment adjustment and column (2) adds the hukou reform by including the policy variable and its interactions with tariff rates. The coefficients of both output tariff and input tariff are positive, but with only the coefficient of the input tariff being statistically significant at the 5% level. The positive coefficient on the output tariff does not indicate increased import competition, rather firms in more protected sectors were subject to higher employment adjustment, or alternatively output tariff reduction is associated with lower employment adjustment. The reliance on tariffs to measure protection for final goods producers may be an issue here, since lower tariffs may result in pressures for higher non-tariff measures (NTMs). Imported intermediate goods are less likely to be subject to NTMs, however, and the taxing effect of import barriers is better captured therefore by our input tariffs measure. The significantly positive coefficient of input tariff rates shows therefore that input liberalisation in itself did not increase employment adjustment.

Table 6: Trade liberalisation and firm-level employment adjustment with the presence of the hukou reform

	A: Import tariffs		B: Export tariffs			C: Both	
	Tariff	Tariff +hukou	Tariff	Tariff +hukou	Exporters	Tariff +hukou	+Trade intensity
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Policy		0.070***		0.043***	0.039***	0.070***	0.069***
		(4.147)		(3.998)	(3.450)	(4.115)	(4.032)
Output tariff	0.000	0.000				-0.000	0.000
	(0.299)	(0.174)				(0.041)	(0.037)
Input tariff	0.002**	0.002*				0.002*	0.002*
	(2.478)	(1.841)				(1.885)	(1.846)
Export tariff			0.002***	0.002***	0.002*	0.002**	0.002**
			(2.992)	(2.926)	(1.912)	(2.360)	(2.365)
Output tariff_Policy		-0.001***				-0.001***	-0.001***
		(2.801)				(2.703)	(2.707)
Input tariff_Policy		-0.002				-0.002	-0.002
		(1.511)				(1.424)	(1.386)
Export tariff_Policy				-0.002**	-0.003***	-0.000	-0.000
				(2.354)	(2.652)	(0.132)	(0.103)
Import share							0.001
							(1.428)
Export share							0.001
							(1.602)
Observations	756,574	756,574	798,443	798,443	392,974	755,628	752,666
R^2	0.052	0.052	0.051	0.052	0.053	0.052	0.052

Notes: This table shows the regression results of the effects of both import tariff rates and export tariff rates on firm's employment adjustment conditional on the hukou reform. All tariff rates are lagged by one year. All specifications include firm fixed effects, year fixed effects, city-time trend and a full set of firm-level and city-level control variables. Firm-level control variables include logarithm of sales, markup, industry and ownership dummies. City-level control variables include minimum wages, exposure to exchange rates, initial city conditions interacted with time trend, and the Herfindahl index. Robust standard errors are clustered at the city level in all specifications.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Absolute t values in parentheses.

As shown in column (2), including the hukou reform does not alter the coefficients of the tariff rates. The coefficients of the interaction term, however, are negative and statistically significant in the case of output tariff rates. This implies that firms in hukou reform regions were different from those in non-reform regions in terms of employment adjustment following trade liberalisation. Specifically, with a reduction in import tariff rates, firms in reform locations tended to raise employment adjustment after the hukou reform whereas firms in the non-reform regions on average reduced their adjustment in labour use. This is consistent with hukou reform allowing low-skilled rural workers to move to urban areas and firms to cope with import competition by using cheaper labour.

Panel B of Table 6 deals with export tariff rates. Similar to the import tariffs, we start by examining the impact of tariff rates in China's export markets on firms' employment adjustment in column (3), and in column (4) we add the hukou reform. The coefficient of export tariff rates is positive and significant. This indicates that firms tend to increase (lower) employment adjustment with an increase (reduction) in tariff rates in export markets. The lower employment adjustment may result from a reduction in employment growth due to competition in the foreign markets. It is also possible that in order to export, firms increase the use of capital and mainly raise the demand for skilled labour while lowering the demand for unskilled labour. In column (4), we interact export tariff rates with the hukou reform policy variable. The coefficient of the interaction term is negative and significant at 5% level. This suggests that firms in the reform regions have higher average employment adjustment rate relative to firms in non-reform regions with lower tariff rates in the export market. This means that firms in the hukou reform region tend to use more cheap labour as a strategy to lower production costs.

One concern is that trade barrier reduction in export markets only affects exporters directly, while the impact on non-exporters is limited to indirect effects. In column (5) we report the regression result based on the sample of export firms only. The coefficient of the interaction term remains significantly negative and the coefficient is larger in absolute terms than for the full sample.

In panel C we consider both import tariff rates and export tariff rates simultaneously. While the coefficients of all interaction terms remain negative, the coefficient is only significant for the case of output tariffs. As the output tariff reduction mainly captures the competition effect, the significantly negative coefficient implies that the hukou reform allowed more flexible labour adjustment when firms face greater import competition. In column (7) we further control for measures of trade intensity. The coefficients of both import share and export share are insignificant. Despite the heterogenous effects of tariff rates, the coefficient of the policy variable remains positive and highly significant across all specifications. This further confirms the average positive effects of the hukou reform on firms employment adjustment.

Our main findings emphasise the role of labour market flexibility in shaping firms adjustment of labour in response to trade shocks. However, firms in labour-intensive and capital-intensive industries may react to lower trade costs with the presence of the hukou reform. In particular, we would expect that labour-intensive industries may take more advantage of the rising supply of cheap labour to cope with competition given their comparative advantage in labour use. Industries with a higher labour-capital ratio than the average are considered as labour-intensive ones and others are capital-intensive. We run regressions for the labour-intensive and capital-intensive industries separately and the results are present in Table 7.

The coefficients of the policy variable are positive and significant in both specifications, further confirming our earlier finding that more flexible labour market following the hukou reform is associated with higher employment adjustment. Comparing the magnitudes of the coefficients in column (1) and (2) shows that the average employment adjustment rate associated with the hukou reform is higher for labour-intensive industries than capital-intensive ones. This further implies that labour-intensive industries were constrained more by the hukou system in labour adjustment.

The coefficients of the policy variable are positive and significant in both specifications, further confirming our earlier finding that more flexible labour market following the hukou reform is associated with higher employment adjustment. Comparing the magnitudes of the coefficients in column (1) and (2) shows that the average employment adjustment rate associated with the hukou reform is higher for labour-intensive industries than capital-intensive ones. This further implies that labour-intensive industries were constrained more by the hukou system in labour adjustment. We find similar results regarding the relationship between tariff rates and employment adjustment for labour-intensive firms. That is, a reduction in both intermediate import tariffs and export tariffs is associated with lower employment adjustment, while the impact of output tariff rates is insignificant. The interaction terms, however, show that firms in the reform region tend to have higher employment adjustment than those in the non-reform region with a reduction in both output tariffs and input tariffs. Yet, such a differential effect is insignificant with decreased tariff rates in the export

Table 7: Hukou reform and firm-level employment adjustment: Labour intensity

	Labour-intensive industry	Capital-intensive industry
	(1)	(2)
Policy	0.083***	0.041***
	(3.986)	(2.770)
Output tariff	-0.000	0.002**
	(0.590)	(2.427)
Input tariff	0.003***	-0.003*
	(3.001)	(1.788)
Export tariff	0.001*	0.001
	(1.876)	(1.188)
Output tariff_Policy	-0.001**	-0.002
	(2.239)	(1.078)
Input tariff_Policy	-0.005**	0.003
	(2.155)	(1.605)
Export tariff_Policy	0.001	-0.005***
	(1.550)	(2.791)
Observations	638,938	113,768
R^2	0.050	0.063

Notes: This table shows regression results for labour-intensive and capital-intensive industries separately. Labour-intensive industries are defined as ones with a higher labour/capital ratio than the average of all industries. All tariff rates are lagged by one year. All specifications include firm fixed effects, year fixed effects, city-time trend, industry-level trade intensity and a full set of firm-level and city-level control variables. Firm-level control variables include logarithm of sales, markup, industry and ownership dummies. City-level control variables include minimum wages, exposure to exchange rates, initial city conditions interacted with time trend, and the Herfindahl index. Robust standard errors are clustered at the city level in all specifications.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Absolute t values in parentheses.

market. In contrast, capital-intensive firms tend to reduce employment adjustment with a reduction in output tariffs whereas increase employment adjustment with a reduction in intermediate tariffs. The former might reflect the competition effects and the latter might be due to the complementarity between relatively capital-intensive intermediate inputs and labour. Conditional on the hukou reform, firms in the reform and non-reform regions do not show significant differences in employment adjustment with lower import tariff rates. However, lower export tariff rates are related to higher employment adjustment for firms in the reform region than those in the non-reform region. Considering that an expansion of export market is often related to more intensive competition, the positive relationship may indicate that capital-intensive firms take advantage of the cheap labour as an alternative strategy to raise competitiveness.

By and large, we conclude that trade liberalisation has a negative effect on employment adjustment while labour market flexibility resulted from the hukou reform mitigates the negative effect by allowing firms to adjust along the employment margin more freely in response to trade shocks. The hukou reform mainly works through an imported competition channel for labour-intensive firms and through a foreign market competition for capital-intensive firms.

7 Conclusion

The recent literature on resource misallocation implies that a country suffers from productivity and output losses if resources are allocated inefficiently. One important source of misallocation comes from factor market distortions. In particular, in an economy with distorted factor markets, firms do not determine optimally their use of production inputs. This paper adds to the literature by empirically examining how a reduction in labour market distortions affects employment adjustment of firms in China, and thus sheds lights on understanding the mechanisms through which factor market distortions affect resource misallocation. China presents an especially interesting case due to its historically highly rigid labour market where distortions arise from the hukou system that restrict the free movement of workers across the country and the hukou reform initiated in 2001 that reduced barriers to mobility. This paper also provides the first empirical evidence of the impact of the hukou reform on firms in China.

In this paper, we use a rich panel of firm-level data of Chinese manufacturing firms and data on a set of cities that implemented hukou reform between 1998 and 2007. Our identification of a causal relationship between the hukou reform and firms employment adjustment relies on the non-uniform implementation of the reform across cities, which provides a useful source of variation that allows us to use a difference-in-differences approach, and the information on the pre-reform market structures. Our main findings indicate that labour market flexibility induced by the hukou reform is positively associated with employment adjustment at the firm level. Such positive effects occur along both the intensive margin for existing firms and the extensive margin by making it easier for new firms to enter the market. We also find that firms in reform regions

responded more strongly in terms of employment adjustment to reduced trade costs than those in non-reform regions. This highlights the fact that labour market conditions play an important role in shaping firms responses to shocks.

These findings offer important policy implications. Though some regions have attempted to remove barriers to labour movement in recent years, the Chinese labour market is still far from being flexible due to various additional constraints from the hukou system and the imperfect social welfare system. The positive association between the hukou reform and firms employment adjustment implies that many firms which continue to be subject to constrained labour mobility imposed by the hukou system are likely to have non-optimal factor mixes and lower productivity. Consequently, higher output levels could be achieved if those barriers were eliminated. Our findings also point to the potential benefits of labour market reforms in other countries that experience policy and other constraints that reduce the geographical mobility of labour.

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A Propensity score matching and the determinants of the hukou reform

The basic idea of matching is to select non-reform cities that are most similar to those reform cities based on the propensity score. The propensity score is the *ex ante* probability of being treated conditional on a set of pre-treatment characteristics. To estimate the propensity score, we run the following probit model:

$$P(city_{ct} = 1) = F(\mathbf{X}_{c,t-1}) \tag{7}$$

where $city_{ct}$ is an indicator variable that equals to 1 for reform cities and 0 otherwise, and $P(city_{ct} = 1)$ is the probability of being selected as a reform city. $F(\mathbf{X}_{c,t-1})$ is the normal cumulative distribution function of a set of lagged covariates $\mathbf{X}_{c,t-1}$. There is no conclusive evidence on the choice of the covariates. Basically, $\mathbf{X}_{c,t-1}$ should explain why a city is selected as a hukou reform city. The official reform guideline document indicates that cities with a need for workers but without a corresponding capacity to accommodate immigrants should be cautious of implementing the reform. Thus, the determinants of the hukou reform should at least include both the demand side and the capacity side. Specifically, we consider local GDP per capita, the share of non-SOEs, agricultural population share and industrial employment share to capture the demand side and local fiscal expenditure per capita to capture the capacity side.

Matching is performed based on the predicted probability, i.e. the propensity score, such that each reform city is matched with a non-reform city that has the closest probability. In other words, the matched counterpart city c_{nr} for reform city c_r is selected by minimising $|P_{rt} - P_{nrt}|$, where P_{rt} and P_{nrt} are the estimated propensity score for city c_r and c_{nr}.

One crucial assumption of the propensity score matching is the common support condition. It means that cities with the same pre-reform characteristics have a positive probability to be selected as a reform or a non-reform city. To satisfy this condition, all treated cities with a propensity score higher than the maximum or lower than the minimum score of the non-reform cities are dropped.

Since the timing of the hukou reform varied across cities, we do the matching year by year. For example, we treat cities that implemented the reform in 2003 as the treatment group and all other non-reform cities as the control group, and match non-reform cities for the 2003 cohort. To avoid potential impact of the timing on the selection of control cities, we put the matched ones back and do matching for other cohorts.[13] As such, a non-reform city could be matched more than once, which guarantees that we select the best matchings.

Table A.1: Determinants of the hukou reform: Probit regressions

	Cohort 2002	Cohort 2003	Cohort 2004	Cohort 2005	All
	(1)	(2)	(3)	(4)	
GDP per capita	0.179***	0.116***	0.078	0.047*	0.226***
	(3.668)	(3.003)	(1.507)	(1.956)	(4.418)
Agr. population share	0.006***	0.002*	0.000	0.002**	0.004**
	(4.019)	(1.797)	(0.272)	(2.413)	(2.120)
Non-SOE share	-0.001	0.003***	0.001	-0.000	0.003***
	(1.008)	(3.304)	(1.596)	(0.217)	(2.906)
Industrial employment share	-0.039	0.001	0.209	0.002***	0.004
	(0.224)	(0.644)	(1.180)	(3.171)	(0.981)
Fiscal expenditure	-0.072***	-0.110***	-0.042	-0.005	-0.107**
	(2.938)	(2.594)	(0.986)	(0.406)	(2.118)
Observations	262	266	266	248	315

Notes: This table shows the regression results of probit regressions: $reform_{ct} = \alpha + \beta \mathbf{X}_{c,t-1} + \varepsilon_{ct}$ where $reform_{ct}$ is a binary variable indicating whether a city is a reform city in year t, $\mathbf{X}_{c,t-1}$ is a vector of pre-reform city characteristics in year $t-1$, and ε_{ct} is the error term. Cohort 2002 includes cities that implemented the hukou reform in 2001 and 2002 and all non-reform cities. Cohorts 2003 to 2005 include cities that launched the hukou reform in that year and all non-reform cities. The regression is run for each cohort separately. All non-reform cities are included in all specifications.
* $p <0.1$, ** $p <0.05$, *** $p <0.01$. Absolute t values in parentheses.

Table A.1 shows the probit regression results that examine the determinants of the hukou reform. Cities with a higher level of GDP per capita and a high proportion of agriculture population are more likely to implement the hukou reform. The coefficient of the share of non-SOEs employment is positive and significant only for the 2003 cohort, indicating that a higher share of non-SOEs is associated with a higher probability of the reform. This is true given that migrant workers are usually not allowed to work in SOEs.

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[13]Considering that only two cities implemented the reform in 2001, we combine these two cities with the 2002 cohort and run regressions based on the city-level characteristics of 2000.

Cities with a higher share of industrial employment tend to be more likely to reform. We use fiscal expenditure per capita to capture fiscal pressure of the local government since hukou reform is costly and potentially involves higher fiscal expenditure on the immigrants. As expected, the estimated coefficients are negative and largely significant. This implies that cities that have high fiscal pressure are less motivated to reform the hukou system.

Based on the probit model regressions, we match reform and non-reform cities according to the propensity score. Table A.2 shows the number of cities and the number of firm-level observations for the treatment and the control groups before and after matching. We include all non-reform cities as the control group in the matching for each group of reform cities. While this promises the best matching between reform and non-reform cities, it reduces the number of control cities as a non-reform city could be matched more than once. We eventually have 41 non-reform cities that are matched with 50 reform cities. The corresponding number of firm-level observations reduces to 151,741 for the treatment group and 106,983 for the control group.

Table A.2: Number of cities and observations before and after matching

	Before matching		After matching	
	Treatment	Control	Treatment	Control
No. of cities	66	263	50	41
No. of observations	265,648	642,640	151,741	106,983

Table A.3 shows the mean difference in key city-level characteristics between reform and non-reform cities before and after matching. It is clear that after matching reform and non-reform cities have no systematic difference in observed characteristics. In other words, the matched reform and non-reform cities have similar probability to be selected as a reform city.

Table A.3: Mean differences of key variables between reform and non-reform cities before and after matching

| | Cohort 2002 | | Cohort 2003 | | Cohort 2004 | | Cohort 2005 | |
| | Before | After | Before | After | Before | After | Before | After |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP per capita	-0.48**	-0.24	-0.29*	0.08	-0.62***	-0.03	-0.29	-0.08
	(2.50)	(1.11)	(1.90)	(0.31)	(3.72)	(0.09)	(1.33)	(0.34)
Non-SOE share	-23.03***	-0.91	-20.70***	-0.96	-14.44***	6.04	-7.26	2.49
	(2.98)	(0.10)	(4.31)	(0.17)	(3.05)	(1.32)	(1.08)	(0.34)
Urban-rural income diff.	0.45*	0.02	0.28	-0.18	0.32*	0.08	0.07	-0.19
	(1.79)	(0.07)	(1.47)	(0.85)	(1.66)	(0.28)	(0.26)	(0.98)
Agr. population share	-9.23*	3.19	-1.70	1.94	10.17**	-0.43	-0.76	2.17
	(1.75)	(1.24)	(0.43)	(0.41)	(2.31)	(0.05)	(0.13)	(0.48)
Unemployment rate	-7.05	-0.75	7.28***	0.40	3.55	0.06	3.54	-0.70
	(1.40)	(0.10)	(2.84)	(0.31)	(1.30)	(0.02)	(1.06)	(0.58)
Transportation	-0.44	-0.63	0.38	-1.21	1.00	2.63	3.75	-0.19
	(0.11)	(0.25)	(0.12)	(0.27)	(0.32)	(0.46)	(0.90)	(0.10)
Fiscal expenditure	-0.04	-0.32	-0.03	0.08	-0.35**	0.14	0.13	-0.05
	(0.22)	(1.07)	(0.21)	(0.33)	(2.41)	(0.40)	(0.73)	(0.30)
Population density	-0.13	0.19	-0.54**	-0.38	-0.03	-0.37	-0.47	0.16
	(0.41)	(0.41)	(2.38)	(1.43)	(0.14)	(1.29)	(1.42)	(0.51)
Observations	275	16	285	30	284	34	274	20

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Absolute t values in parentheses.
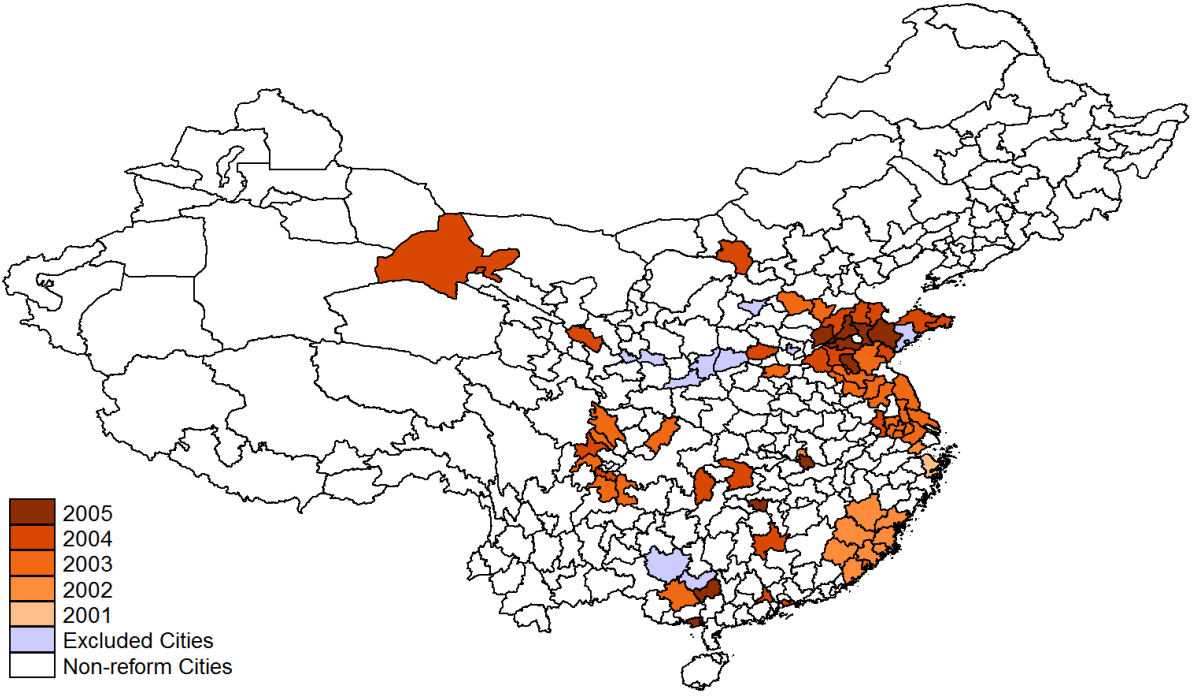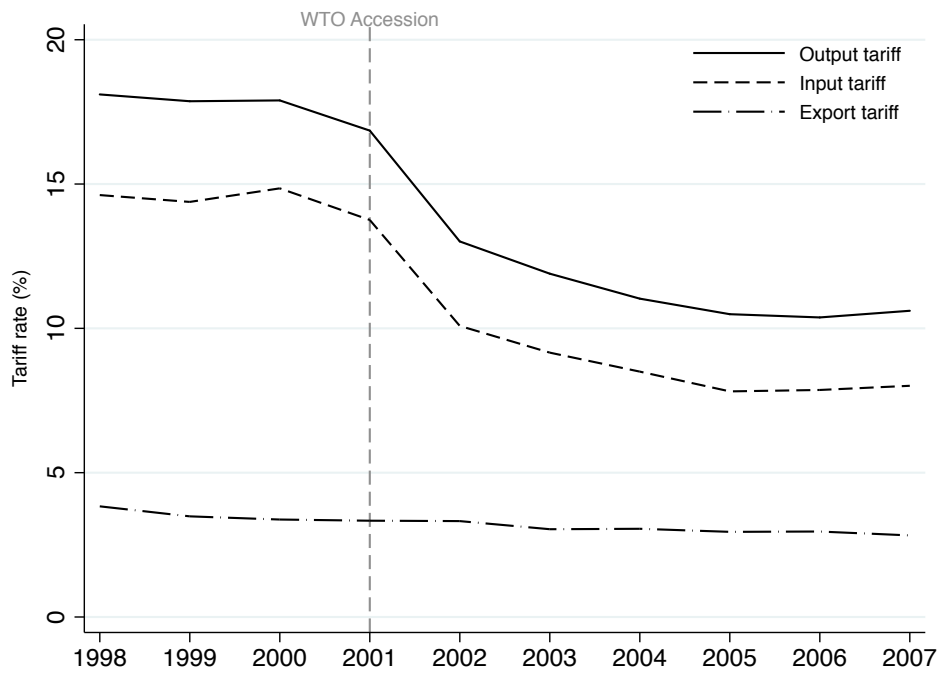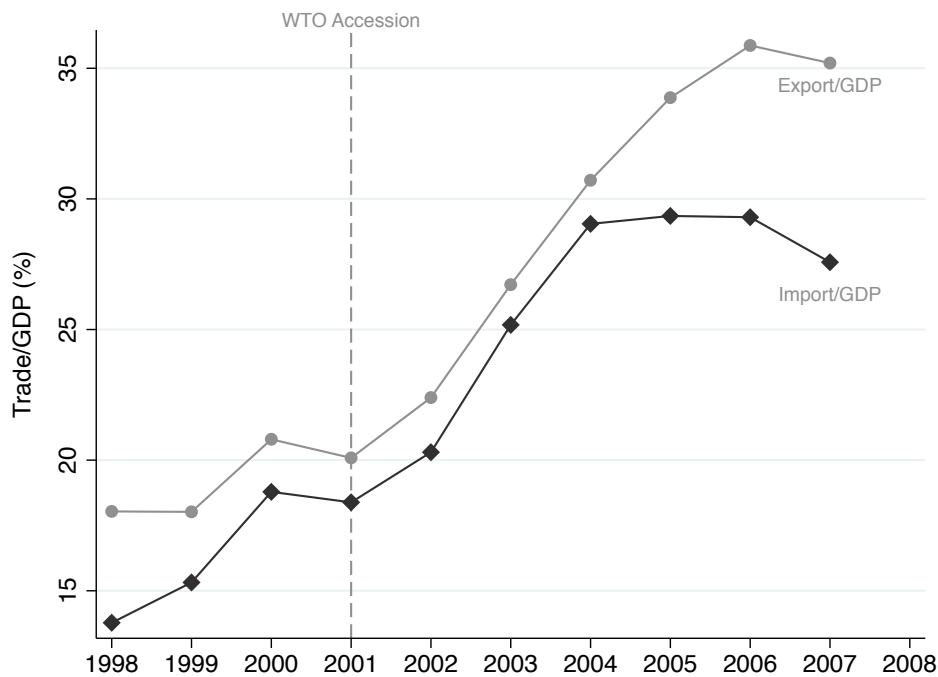
B Figures

Figure B.1: Map of Hukou Reform Cities

Notes: This map shows all cities that implemented the hukou reform between 2001and 2005. Excluded cities are those that launched the hukou reform in 2006 and 2007.

(a) Tariff rates

(b) Imports and exports share in total GDP

Figure B.2: Trade Liberalisation in China (1998-2007)

Source: Average tariff rates are calculate by the author based on the tariff rates data from the WITS database at HS-8 digit level. We then map the HS level to the Chinese industry classification (cic) at 4-digit level using the concordance table provided by Brandt et al. (2017). Input tariff rates are calculated using China's Input-Output Table 2002 and are at 3-digit cic level. Imports, exports and GDP are from the *Statistical Yearbook of China*.
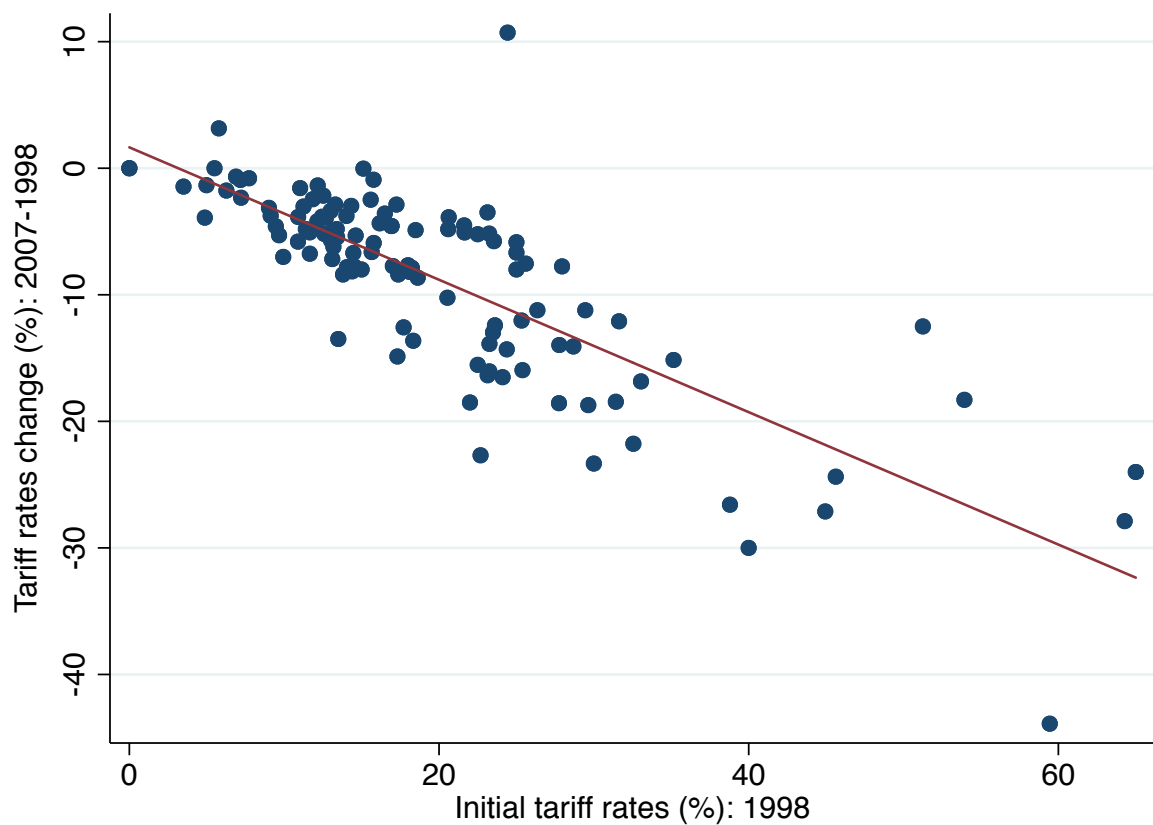
Figure B.3: Tariff Reductions and the Initial Tariff Rates across Industries (1998-2007)

C Tables

Table C.1: Summary statistics

Variable	Full sample Mean (1)	SD (2)	Reform region Mean (3)	SD (4)	Non-reform region Mean (5)	SD (6)
Firm-level Characteristics						
Employment	381.44	1709.79	418.14	1625.61	366.27	1743.18
Employment growth	0.07	0.47	0.06	0.43	0.07	0.48
Employment adjustment	0.23	0.41	0.21	0.38	0.24	0.42
ln(sales)	10.15	1.38	10.42	1.33	10.04	1.39
Markup	1.04	0.15	1.04	0.12	1.04	0.16
SOEs	0.13	0.34	0.08	0.27	0.16	0.36
Private	0.65	0.48	0.67	0.47	0.64	0.48
Foreign	0.22	0.41	0.25	0.43	0.21	0.41
Exporter	0.46	0.50	0.51	0.50	0.44	0.50
Eastern region	0.70	0.46	0.86	0.35	0.63	0.48
Middle region	0.19	0.39	0.03	0.18	0.25	0.43
Western region	0.11	0.31	0.11	0.31	0.11	0.32
Observations	908,288		265,648		642,640	
City-level Characteristics						
ln(GDP p/c) (2001)	8.80	0.68	9.17	0.66	8.70	0.65
Agr. pop. share (2001)	70.33	17.52	70.82	14.74	70.20	18.17
Non-SOE share (2001)	54.58	22.31	69.14	16.92	50.96	22.01
ln(fiscal expenditure) (2001)	6.54	0.62	6.57	0.72	6.53	0.60
Industrial employment share (2001)	0.21	0.12	0.26	0.12	0.20	0.11
Herfindahl index	0.13	0.15	0.09	0.15	0.14	0.15
ln(min. wages)	1.15	0.32	1.24	0.35	1.13	0.30
Exchange rates	3.68	0.45	3.63	0.43	3.69	0.46
Observations	3,213		641		2,572	
Industry-level Characteristics						
Output tariffs	13.80	9.61				
Input tariffs	11.06	5.20				
Export tariffs	3.22	4.10				
Observations	4,226					

Notes: Employment growth rate is calculated as the year-to-year employment difference divided by the simple average employment of the two periods. Employment adjustment rate is the absolute value of the employment growth rate. Markup is defined as the sales/(sales-profits). Initial city characteristics are values of 2001, including logarithm of local GDP per capita, share of agriculture population, employment share of Non-SOEs, logarithm of fiscal expenditure per capita and the employment share of the industry sector. Exchange rates are weighted averages using export share to each trade partner and industrial employment share within cities as weights. Output tariff rates are import tariff rates. Input tariffs are calculated as the weighted average of output tariffs using input share of each industry as weights based on the IO table of 2002. Export tariffs are weighted average of tariff rates imposed on China's exports using China's export share to each destination as weights.

Table C.2: Hukou reform and firm-level employment growth

Dependent variable:	Panel A: Full sample			Panel B: PSM matched sample		
$\frac{E_t - E_{t-1}}{(E_t + E_{t-1})/2}$	Baseline	+Firm controls	+City controls	Baseline	+Firm controls	+City controls
	(1)	(2)	(3)	(4)	(5)	(6)
Policy	0.056***	0.060***	0.057***	0.058***	0.058***	0.057***
	(5.334)	(5.326)	(4.881)	(4.577)	(4.420)	(4.326)
ln(sale)		0.011**	0.011**		0.015**	0.015**
		(2.019)	(2.123)		(2.169)	(2.173)
Markup		0.040***	0.040***		0.044***	0.044***
		(6.313)	(6.240)		(4.315)	(4.347)
Herfindahl index			0.055			0.119
			(1.062)			(1.640)
Constant	0.254***	0.017	0.385	0.240***	-0.053	-0.058
	(45.848)	(0.278)	(1.506)	(28.530)	(0.666)	(0.737)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	Yes	Yes	No	Yes	Yes
Ownership FE	No	Yes	Yes	No	Yes	Yes
Initial cond. $\times$ year	No	No	Yes	No	No	No
Observations	903,279	835,021	833,004	438,428	415,984	415,984
R^2	0.042	0.046	0.047	0.036	0.039	0.039

Notes: This table reports the DiD regression results using employment growth rate as the dependent variable based on the full sample (Panel A) and the PSM matched sample (Panel B) respectively. All specifications are the same as ones in Table 2 except the dependent variable. Robust standard errors are clustered at the city level in all specifications.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Absolute t values in parentheses.