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Abstract

Labour markets in China have experienced remarkable changes in the past decade. In this paper we use above-scale industrial firm-level data of 2001-2008 to study how labour market developments have affected labour costs of firms across regions, and different levels of technology and ownership in China. Our estimates suggest that, labour market tightness has had some impact on the labour costs of Hong Kong-Macau-Taiwan (HMT) firms and private enterprises, particularly in coastal areas, but overall the impact is limited. Our research also shows that labour migration has had some impact on the labour costs and employment of HMT and private firms in East China.

Our analysis suggests that China has not yet seen an absolute shortage of labour, but there have been structural problems in the labour market. Demand for young low-end workers and skilled workers has outpaced supply, while the opposite is true for better educated workers such as young college graduates. As the majority of the employees of HMT and private enterprises are at the low-education end, wage pressures for these firms have increased accordingly. As such, it is necessary to remove the barriers that hinder rural labour forces from working in urban areas and to develop vocational and technical education. It is also useful to upgrade production chains to reduce the relative demand for low-end workers and increase that for better-educated workers to reduce skill mismatch in labour markets.

Keywords: Labour Market Tightness, Labour Migration, Labour Costs
JEL Classification: J21, J23, J31

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1. Introduction

China's labour market has experienced remarkable changes in the past decade. First of all, as shown in Figure 1, total working-age population has been growing at a decelerated pace and is expected to start declining in 2017 according to projections by the United Nations, while the young working-age population (15-29 years old) is expected to start shrinking in 2012.[1] Secondly, while China experienced a "flood of migrant workers" and substantial underemployment in state-owned enterprises (SOEs) in the 1990s, in recent years, there have been reports of shortages of labour, particularly in coastal areas. Minimum wages have been rising at a fast pace from an average of RMB368 in 2005 to RMB1,060 in 2011. The aggregate demand for labour was lower than supply in cities before 2010, but has outpaced supply in recent years, with the demand-to-supply ratio rising steadily to above unity in 2011 (Figure 2). A survey by the National Bureau of Statistics (NBS) also shows that migrant workers' wages increased significantly, by about 21% on average in 2011, while cross-province migrant workers have accounted for a progressively declining share of total migrant workers in recent years. This suggests more workers prefer to work in inland provinces (the major source of migrant workers), reducing the supply of labour in coastal areas in relative terms.

Against this backdrop, some commentators have argued that China has moved from a period of unlimited labor supply to a new era of labor shortages. For instance, Cai et al. (2007) argue that China passed the Lewis turning point as early as in 2004, while Cai (2010) and Cai and Wang (2008) also claim that there is no more surplus labour in China. On the other hand, Kwan (2009) and the International Monetary Fund (IMF, 2012) argue that China still has ample supply of labour, and the IMF (2012) further argues that China is unlikely to reach the Lewis turning point until 2020. Meng (2012) also argues that China has surplus labour supply, but that there are structural problems in the labour market that prevent surplus labour from being fully employed. Wang and Hu (2012) expect the labour supply in the non-farming sector to continue to grow steadily in the next decade.

Accordingly, discussions on the driving forces of wage growth in China have been inconclusive. Cai et al. (2007) ascribe rising migrant wages to labour shortages, while Li et al. (2012) argue that wage growth in China has been driven by improvements in labour productivity and demographic transition, but that wage pressures will rise along with shrinking demographic dividends going forward. On the other hand, Ge and Yang (2011), based on urban household survey data, find that wage growth has been mainly driven by improvements in human capital and external demand, while the migrant labour supply has not had a significant impact on wages.

The inconclusive nature of these studies can be partly ascribed to the data used to test different hypotheses. It is not easy to estimate employment and labour costs in China given on-going structural changes in the economy as well as the difficulty in collecting data on employment and wages for many private and small-sized firms. The official data on employment and wages at a macro level may

[1] According to the NBS, the working-age population (15-59 years old) started to decline in 2012.

not serve the purpose well when it comes to studying labour market developments, particularly for the employment and wages of migrant workers. For instance, Knight et al. (2010) argue that the approach by Cai and Wang (2008) is not persuasive as their analysis is based on assumptions about farm workers' working man-days using macro-level data, and the results are pretty sensitive to these assumptions.

As such, to have a better understanding of China's labour market developments, it is necessary to analyse the problems at a disaggregate level using micro-level data rather than at an aggregate level using macro-level data. In the research below we use above-scale industrial firm-level data for 2001-2008 to study the extent to which labour market developments have affected the labour costs of firms across regions, and different levels of technology and ownership. Our estimates suggest that, overall, the impact of labour market tightness and the changes in the migrant labour force on labour costs has been limited, but the effect has been more significant on the labour costs of Hong Kong-Macau-Taiwan (HMT) firms and private enterprises, particularly in coastal areas.

Our analysis suggests that China has not yet seen an absolute shortage of labour, but there have been some structural problems in the labour market. For instance, the demand for young low-end workers and skilled workers in urban areas has increased at a much faster pace than supply, while the opposite is true for better-educated workers such as young college graduates. As the majority of employees of HMT and private enterprises are less educated, wage pressures for these firms have increased accordingly. On the other hand, the unemployment rate for young college graduates has been much higher than that of low-end workers of a similar age. To solve these structural problems, it is necessary to remove the barriers that hinder rural labour forces from working in urban areas on a permanent basis, and to develop vocational and technical education. It is also useful to upgrade production chains to reduce the demand for low-end workers and increase that for better-educated workers to lessen skill mismatch in labour markets.

The remainder of this paper is organised as follows. In the second section we estimate the impact of labour market tightness on the labour costs of firms across regions, with different levels of technology and different ownership. In the third section we study how the changes in migrant labour forces have affected labour costs and employment of industrial firms in coastal areas. The fourth section discusses policy implications and the last section concludes.

2. How Significant has been the Impact of Labour Market Tightness on Labour Costs in China?

According to efficiency wage or bargaining models, the real labour cost depends on labour market tightness as well as firms' productivity, given reservation wages (Blanchard and Katz, 1999). While empirical studies suggest the reservation wage is shaped by workers' previous earnings, laboratory experiments show the reservation wage is also affected by the minimum wage because the presence of the minimum wage law may change workers' fairness concern which in turn affects individual

reservation wages (Falk, et al., 2005). Therefore, the real labour cost can be expressed as a function of its own lagged value, labour market tightness, real minimum wages, and firms' productivity. Following Brucker and Jahn (2010), we add time trend as a control variable, and the labour cost equation is estimated as follows for industrial firms across regions, with different levels of technology and different ownership:

$$w_{gqnt} = \beta_0 + \beta_1 w_{gqnt-1} + \beta_2 \phi_{nt} + \beta_3 mw_{gt} + \eta_1 x_{gqn_t} + \eta_2 t + \varepsilon_{gqnt} \quad (1)$$

where the subscribes *g*, *q*, and *n* represent region, technology level, and firm ownership respectively; *w* is the log real labour cost*, mw* is the log real minimum wage, x_t is firms' log real output, and *t* the time trend. The labour demand-to-supply ratio ϕ is measured as urban job openings by ownership divided by total labour supply in urban areas. While the short-term effect of labour market tightness on labour costs is captured by β_2, the long-term effect is captured by $\beta_2/(1-\beta_1)$.[2]

The generalised method of moments (GMM) approach is used to estimate the above dynamic panel model with annual data from 2001-2008. The nominal labour costs (which include a basket of labour compensation, such as salaries, benefits etc) and output are from China Annual Survey of Industries (CASI); Provincial minimum wages, and the urban sectoral job openings and labour supply used to construct ϕ are from the CEIC.[3] We use the national level CPI to deflate labour costs and output, and the provincial CPI to deflate the minimum wage.[4] The firm-level real labour costs and output are aggregated according to a firm's location, technology level, and ownership.

We split China into four regions: East China, Central China, West China and Northeast China.[5] For level of technology, following the OECD (2011), we divide firms into four groups ranging from low-tech to high-tech. High-tech industries mainly include electronic and communication equipment, while low-tech industries include food-beverage-tobacco, textiles-leather-footwear, and wood-paper products. There are four types of ownership in the analysis, namely SOEs, foreign enterprises, HMT firms and private firms. The equation is in first-order differences when estimated with the GMM, and the instruments include lagged independent variables (except the minimum wage) and lagged log

[2] Wage growth should be stationary to estimate the long-term effect. This is not a concern here as the equation is estimated with the GMM which transfers the equation into a first-difference form. Due to data limitations, the labour demand-to- supply ratio is constructed only according to firm ownership.

[3] CASI, originally from the NBS, contains 1.8 million financial and production records for above–scale industrial firms. We aggregate the labour costs, employment and output based on firm ownership, technology level, and location.

[4] Using provincial CPI to deflate the minimum wage can partly capture the effect of minimum wage variation resulting from the local price change. However using national level CPI to deflate the minimum wage will not cause much change to our results.

[5] East China includes almost all the coastal provinces (Beijing, Tianjin, Hebei, Shandong, Zhejiang, Jiangsu, Shanghai, Fujian, Guangdong, and Hainan); Central China includes Shanxi, Henan, Hubei, Hunan, Jiangxi, Anhui; West China includes Inner Mongolia, Xinjiang, Shaanxi, Gansu, Qinghai, Ningxia, Chongqing, Sichuan, Guizhou, Yunnan, and Guangxi: Northeast China includes Heilongjiang, Jilin, and Liaoning.

exports.[6] The detailed regression results are presented in Appendix 1, where J-statistics suggest that the over-identifying moment conditions are satisfied.

Our estimates indicate that the impact of labour market tightness is only statistically significant for labour costs of HMT and private firms in some areas, and it is insignificant for SOEs and foreign enterprises in all regions, as shown in Table 1 (which is abstracted from Appendix 1). The parameter β_2 has the right sign and relatively significant t-statistic for HMT and private firms in East China, private firms in West China and HMT firms in Northeast China. It has either a wrong sign or insignificant t-statistics for other firms. As the affected firms accounted for only about 40% of all industrial firms' employment and 30% of their value added in 2008 (Figure 3A), this suggests that, overall, the labour market tightness has not had much impact on labour costs in China. In East China, the affected firms accounted for close to 60% of industrial firms' employment and 45% of their value added (Figure 3B).

The estimation results reflect an important characteristic of the labour market in China – big differences in labour market tightness across groups of the labour force. As shown in Figure 4, the aggregate labour demand-to-supply ratio in cities has been trending upwards since 2001 and exceeded unity in 2010. This appears to indicate that China has labour shortages, as argued by some economists. However, the aggregate demand-to-supply ratio only tells part of the story and it is necessary to look at individual components to get a comprehensive picture of labour market tightness. The demand-to-supply ratios for better-educated workers, namely junior college graduates and university graduates, have been trendless and are still far below unity. In contrast, the demand-to-supply ratios for lower-educated workers, namely junior school or less and regular high-school graduates, have been generally trending upwards and approached unity in 2010.

The reason why the aggregate demand-to-supply ratio exceeded unity in 2010, while the ratios for the four sub-groups were below unity, is that there is a group of job seekers who did not report their education levels at all. As the demand for this group of job seekers has been much larger than supply, the aggregate demand-to-supply ratio has been pushed up to above unity. This group of job seekers have likely been those with little or no schooling at all since there is little obvious reason for well educated people to hide their education background.

The fact that HMT and private firms have had a relatively larger demand for low-end workers than SOEs and foreign firms, together with the above characteristic of China's labour market, may explain why labour market tightness has had a more significant impact on the labour costs of HMT and private firms than on those of SOEs and foreign enterprises. As shown in Table 2, the 2004 data indicates that 64% and 61% of the total staff of private firms and HMT firms had received junior school education or less, while only 49% and 53% of the total staff for SOEs and foreign firms had a similar

[6] The maximum of two years of lags is used for the instruments. While most regressions only need a one-year lag for the instruments, two years of lags for lagged labour costs and exports for private firms in East, two years of lags for lagged labour costs, labour market tightness, output and exports for SOEs in Central, and two years of lags for lagged labour costs for private firms in West are used in our estimation.

education background. On the other hand, 4-5% of the staff of SOEs and foreign firms had university degrees, but less than 2.5% of the staff for HMT and private firms had studied in universities. The long-term elasticity of labour costs with respect to labour market tightness is larger, particularly for private firms. It is 0.64 for HMT firms and 0.99 for private firms in East China (Table 3).

Our estimates also show that the impact of minimum wages on labour costs differs across regions and firm ownership. In East China, for instance, the impact has been significant for HMT and private firms and insignificant for SOEs and foreign firms. A 10% rise in minimum wages would push up the labour costs for HMT and private firms by 1.8% and 1.3% respectively in the short run (Table 4), and the impact would be larger from a long-term perspective. Our findings are somewhat different from those of Ma et al. (2012) who, using the same data as ours, find that minimum wages have not had a big impact on total wages or employment, with a 10% rise in minimum wages only driving up manufacturing sector wages by 0.4-0.5% and reducing employment by 0.6%. The major reason for the differences between the findings is that we look at the impact at the sectoral level rather than at an aggregate level. As minimum wages have not had a big impact on labour costs of SOEs and foreign firms, it is not surprising that Ma et al. (2012) find limited impact at the aggregate level.

One may argue that the estimation results would be different if the sample period is extended beyond 2008 to more recent years given changes in the labour market in the past 2-3 years. It is likely that the elasticity of labour costs to labour market tightness for HMT and private firms has been larger than our estimates suggest in view of the increasing tightness of the labour market at the low-end , but the main message from our research should not have changed. That is, there have been some structural problems in China's labour market but there should not have emerged an absolute shortage of labour because the demand-to-supply ratios for better-educated workers (junior college and university graduates, for instance) are still far below unity. This suggests that the elasticity of labour costs to labour market tightness for SOEs and foreign firms, whose employees are on average better educated than those of HMT and private firms, should not have changed much even if the sample period for estimation is extended to more recent years.

3. How Big has the Impact of Labour Migration been on Labour Costs in East China?

In recent years, there have been numerous reports of a shortage of migrant workers in East China, although this area remains the major destination for migrant workers.[7] According to the NBS survey, coastal areas have accounted for a declining share of migrant workers in recent years, with the share dropping from about 67% in 2010 to about 65% in 2011. Growth of migrant workers was 2% in coastal areas in 2011, compared with 8.1% and 9.6% in central and western areas respectively in the same year. Against this backdrop, this section attempts to explore the extent to which changes in migrant

[7] For instance, a report by Xinhua net on 8 April 2010 mentioned that there was a shortage of about one million migrant workers in two delta areas.

labour forces have affected labour costs and employment in East China. The migrant labour supply is measured as urban labour supply from other cities and from rural areas.[8]

Labour migration could affect the labour costs in East China in a dynamic way through both direct and indirect channels. A decline in migrant labour would reduce the supply of labour in East China, and increase pressure on the labour costs in this area accordingly. A rise in the labour costs would weigh on the demand for labour and thus reduce labour market tightness, which would in turn dampen the growth of the labour costs. Such a dynamic process would continue until the demand for and supply of labour reach a new equilibrium. Note that here we not only consider the direct impact of labour migration on the labour costs, but also its indirect impact stemming from labour substitution between firms with different technology and types of ownership. This is because changes in the labour costs would lead to a change in the relative demand for labour between firms, and thus generate some second-round effects on labour costs and employment. As such, the elasticity of labour substitution plays a big role in shaping the impact of labour migration on labour costs. The two key equations in this model are the labour cost equation and the labour demand function. As the labour cost equation is estimated in the previous section, we focus on the labour demand function next.

Following Brucker and Jahn (2010) and Ottaviano and Peri (2012), our analysis is based on a model in which firms maximise profits under a nested constant-elasticity-of-substitution (CES) form of labour demand function. The major difference between our model and standard models of labour demand is the structure of labour demand. Specifically, labour demand in East China is split into three parts in terms of firms' location (Bohai gulf, Yangtze delta, and Fujian-Guangdong-Hainan), each location's demand for labour is then divided into four technology levels, and labour demand at each level of technology is further grouped as four classes according to firm ownership. At each level, labour demand is summed up in the form of a CES function. Such a multi-layer structure allows us to estimate the elasticity of substitution for labour across different technology, firm ownership and sources of labour supply, and thus allows us to take into account the second-round impact of labour migration on labour costs in East China. Figure 5 shows the labour demand structure in our analysis. The details of the model and the estimation methodology are presented in Appendix 2.

Our estimates show that the labour substitutability across firms with different levels of technology and different ownership is low, other things being equal, but it is easy to substitute labour from different places if other things remain unchanged (the same firm ownership and the same technology). The estimates of elasticities for labour substitution are shown in Table 5. Obviously, elasticities of substitution are much lower than unity across ownerships (0.48) and technologies (0.54) but much higher than unity across regions (2.27).

[8] Original data on migrant labour are from CEIC. Missing observations for the sub-series of labour demand during 2001-2005 are estimated based on their co-movement with other sub-series for which data are complete for the whole sample period.

The impact of labour migration on labour costs is negligible for SOEs and foreign firms in East China, but larger for private firms and HMT firms in the same region (Table 6). The impact is calculated based on the estimates from our labour cost equation and labour demand equation. A 10% fall in labour migration would raise real labour costs by 0.9% for private firms and by 0.3% for HMT firms in the short run. Meanwhile, employment in private firms would fall by 0.9%, followed by a 0.6% fall for HMT firms and 0.5% for SOEs and foreign firms. The impact on labour costs and employment differs little across sub-regions in East China, as shown in Tables in Appendix 3.

The long-term effect on labour costs and employment would be noticeably larger for HMT and private firms, with a 10% fall in labour migration leading to a 3.6% rise in labour costs for private firms and a 0.9% rise in labour costs for HMT firms (Table 7). Meanwhile, the responses of employment to the shock are around 4 times those in the short run. As shown in Tables in Appendix A3, the long-run responses of labour costs and employment across ownership differ slightly across provinces in East China.

4. Discussions

The main message from our research is that, despite slower growth in the labour supply, labour market developments have not had significant impact on labour costs in China, suggesting that there is no absolute shortage of labour yet. In fact, the working-age population (15-64 years old) has trended upwards from around 340 million in early 1950s to about 970 million in 2010, while there is evidence that the unemployment rate is relatively high. For instance, according to China Household Finance Survey by Southwest University of Finance and Economics (SWUFE), urban unemployment rate reached 8.0% in 2011 (6.9% in East China, 8.3% in Central China and 14% in West China), much higher than the officially released registered unemployment rate of about 4.0% in the same year. This is different from the arguments by Cai et al. (2007), Cai (2010) and Cai and Wang (2008) that China has passed the Lewis turning point and there is no more surplus labour.

Nevertheless, labour market tightness and labour migration have had some impact on labour costs of HMT and private enterprises, particularly in coastal areas. Our research appears to support the argument of Knight et al. (2010) that the phenomenon of migrant labour scarcity co-exists with the fact that there has not yet emerged an absolute shortage of labour. The co-existence of migrant labour scarcity and surplus labour could partly be attributed to institutional factors.

First of all, there is a segmentation of labour markets in rural and urban areas. Despite the progress made in the past few decades in deregulating labour markets in China, there still exist institutional barriers that hinder rural labour forces working in cities, with the Hukou system being a typical hurdle. As discussed in Meng (2012), restrictions on migrant access to social welfare and social services in cities (e.g. children' schooling) have prevented rural labour forces from working in cities on a permanent basis. Meng (2012) further shows that migrant workers usually go to cities in their late teens, with female migrant workers typically starting to return home to get married and have children

at the age of 25 and male migrants starting to return home in their mid 30s. On average, migrants work in cities for only seven years. Using a Probit model, Knight et al. (2010) find that marriage reduces the probability of migration by 8 to 11 percentage points in 2007, especially for those with children, and the probability of migration declines sharply after age 31. As HMT and private enterprises are major employers of young migrant workers, such institutional factors have likely played a big role in pushing up wages for these firms.

Secondly, there seems to be a mismatch between labour demand and supply. China has played the role of "world-factory" in past decades and experienced a boom in construction with fast development of transportation and real estate in the past decade, with the demand for young skilled workers and low-end labour increasing rapidly accordingly, as pointed out by Wang el al. (2012). The one-child policy, which has partly contributed to negative growth in the supply of young workers since the 1990s, and the segmentation of rural and urban labour markets, have contributed to labour market tightness in some sectors, China's education system also appears to have been a major factor behind a skill-mismatch problem. China has expanded traditional high school and university enrolment at a rapid pace since the mid 1990s, while vocational training has lagged behind (Figure 6).

Although higher education supports an economy's growth from a long-term perspective, the rapid expansion in college enrolment in the past 15 years has created some structural problems in the Mainland's labour market in the short run as the level of education attainment has not matched the demand for labour. In other words, low-end industries are still important in the Chinese economy while the development of high-end sectors that demand high-end labour forces has been slow. For instance, China Household Finance Survey shows that among the working population aged 21-25, there is a positive relationship between the unemployment rate and level of education (Figure 7). Specifically, the unemployment rate for the group of primary school and less was 4.2% in 2011, while that for college graduates was 16.4% in the same year.

The structural problems, if not well addressed, would continue to add wage pressures for HMT and private enterprises, and weaken the competitiveness of China's exports. It has been reported that some foreign producers have shifted their production base from China to other Asian economies with lower labour costs like Indonesia. According to the World Investment Report 2012 by the United Nations, FDI to Indonesia grew by 26% in 2011, while FDI to China only grew by 8%.

Noticeable wage differentials between East China and inland provinces appear to suggest that HMT and private enterprises could relocate the production to reduce labour costs. Our estimates using the industrial firm-level data suggest that labour costs in East China for HMT and private enterprises were about 20-25% higher than their counterparts in inland provinces in 2008 (Figure 8). As the estimates in the previous section show, the elasticity of substitution for labour forces across regions, given other things unchanged, is pretty high (2.27) so producers could relocate productions to reduce labour costs in principle. In fact, some HMT firms (Foxconn, for instance) have attempted to shift production from coastal areas to inland provinces in China in recent years.

Nevertheless, labour cost is only one of the factors that determine the location of production. Many other factors, such as the public infrastructure, business climate, distance from the end markets, could be even more important. Despite labour cost differentials, Sun and Peng (2012) find that the scale of industrial transfer has been small, and only nine of the 20 manufacturing industries studied have attempted to move from East China to inland provinces, while the opposite is true for the remaining 11 manufacturing industries. They also find most of the industries that transferred from East China to inland provinces have been capital or resource-intensive rather than labour-intensive.

As such, it is necessary to address the fundamental issues of China's labour markets to reduce wage pressures. First of all, removing the restrictions on migration from rural areas to urban areas would be crucial. The initiatives to reform the "Hukou" system stated in the report of the 18th National Congress of the Communist Party of China are a welcome step in this direction. Secondly, it is useful to develop vocational and technical training to increase the supply of young skilled workers. Finally, it is imperative to upgrade production chains to increase demand for high-end labour to reduce the degree of skill mismatch in labour markets. As shown in Table 8, in 2004 around 64% of low-tech industrial firms' employees received education of junior school or less, compared with only 40% for high-tech industries. In contrast, about 8% of high-tech industries' employees were undergraduates or above, compared with only 1.7% for low-tech industries.

5. Concluding Remarks

Using above scale industrial firm-level data of 2001-2008, this paper studies the impact of labour market development on labour costs in China. The main findings are summarised as follows:

- Overall, the impact of labour market tightness on labour costs has been limited, but the effect has been more significant for HMT and private enterprises, particularly in coastal areas. Labour migration has had some impact on labour costs and employment for HMT and private firms in East China, and the impact on other firms in the same region has been small.

- Our analysis appears to suggest that China has not yet seen an absolute shortage of labour, but there have been structural problems in the labour market.

  - For instance, demand for young low-end labour and, in many cases, for young skilled workers has increased at a much faster pace than supply, while the opposite is true for better-educated workers such as young college graduates.

  - As the majority of the employees of HMT firms and private enterprises are less educated, wage pressures of these firms have increased accordingly.

- In order to reduce wage pressures for HMT and private firms, it is necessary to remove the barriers that hinder rural labour forces from working in urban areas, and to develop vocational and technical training. It is also useful to upgrade production chains to reduce the demand for low-end labour and increase that for better-educated labour such as college graduates.

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Table 1. Short-Term Elasticity of Labour Costs with Respect to Labor Market Tightness across Regions and Firm Ownerships

East China				Central China			
SOE	Foreign	HMT	Private	SOE	Foreign	HMT	Private
-0.035	-0.140	0.162**	0.234*	-0.009	-0.135	0.163	-0.413**
(-0.33)	(-0.83)	(2.21)	(1.61)	(-0.01)	(-0.65)	(1.20)	(-2.20)

West China				Northeast China			
SOE	Foreign	HMT	Private	SOE	Foreign	HMT	Private
0.116	-0.239	0.319	0.336*	-0.002	0.138	0.713***	-0.159
(0.65)	(-0.85)	(1.42)	(1.63)	(-0.01)	(0.31)	(4.05)	(-0.98)

Note: *t*-statistics in the parentheses. *, **, and *** denote statistical significance at 10%, 5% and 1% confidence levels respectively. Sources: CASI, CEIC and authors' estimates.

Table 2. Education Distribution of Employees across Firm Ownerships in 2004

	SOE	Foreign	HMT	Private
Junior school or less	49.4%	52.5%	61.4%	64.1%
High school	36.7%	35.6%	30.7%	28.7%
College	9.9%	7.3%	5.5%	5.2%
University	4.0%	4.6%	2.4%	1.9%

Sources: CASI and authors' estimates.

Table 3. Long-Term Elasticity of Labour Costs with Respect to Labor Market Tightness in East China

SOE	Foreign	HMT	Private
-	-	0.636***	0.987*
-	-	(2.74)	(1.62)

Note: t-statistics in the parentheses. * and *** denote statistical significance at 10% and 1% confidence levels respectively. Sources: CASI, CEIC and authors' estimates.

Table 4. Impact of 10% Rise in Minimum Wages on Labour Costs in East China

	SOE	Foreign	HMT	Private
Coefficient	0.50%	-0.70%	1.80%	1.28%
T-statistic	1.30	0.56	2.99	1.72

Source: CASI, CEIC and Authors' estimates.

Table 5. Elasticity of Substitution for Labor Forces

Ownership	Technology	Region
0.479***	0.539***	2.271***
(4.23)	(9.20)	(5.07)

Note: t-statistics in the parentheses. *** denotes statistical significance at 1% confidence level. Sources: CASI, CEIC and authors' estimates.

Table 6. Short-Run Effects of a 10% Fall in Labor Migration on Labour Costs and Employment in East China

	SOE	Foreign	HMT	Private
Real labor costs	0.0%	0.0%	0.3%	0.9%
Employment	-0.5%	-0.5%	-0.6%	-0.9%

Sources: CASI, CEIC and authors' estimates.

Table 7. Long-Run Effects of a 10% Fall in Labor Migration in East China

	SOE	Foreign	HMT	Private
Real labor costs	0.0%	0.0%	0.9%	3.6%
Employment	-2.0%	-2.0%	-2.5%	-3.8%

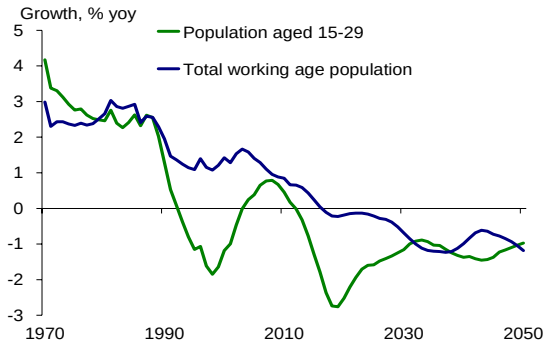
Sources: CASI, CEIC and authors' estimates.

Table 8. Education Background of Employees across Technology Levels

	High-tech	Medium-tech	Medium-low-tech	Low-tech
Junior school and below	39.6%	43.9%	56.4%	63.9%
High school	42.6%	39.1%	33.1%	29.2%
Junior college	10.1%	11.4%	7.6%	5.2%
University	7.6%	5.7%	2.9%	1.7%

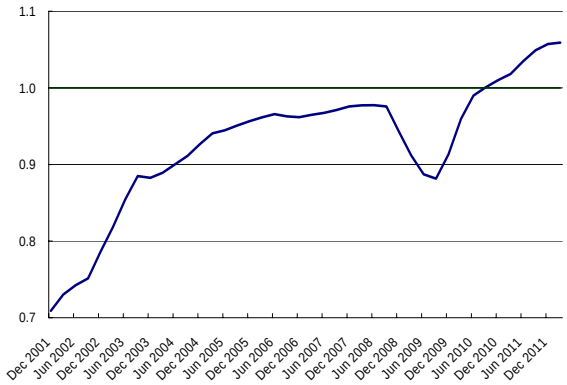
Sources: CASI and authors' estimates.

Figure 1. Working-Age Population



Sources: CEIC and United Nations.

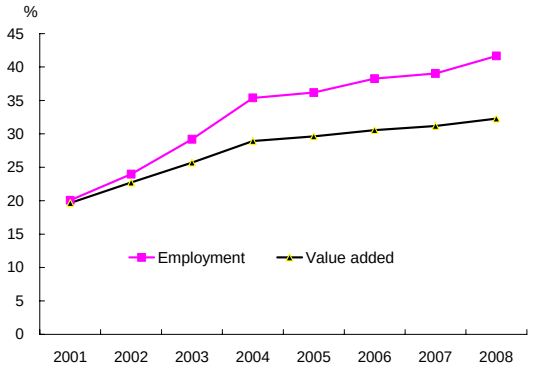
Figure 2. Labour Demand-Supply Ratio



Source: CEIC

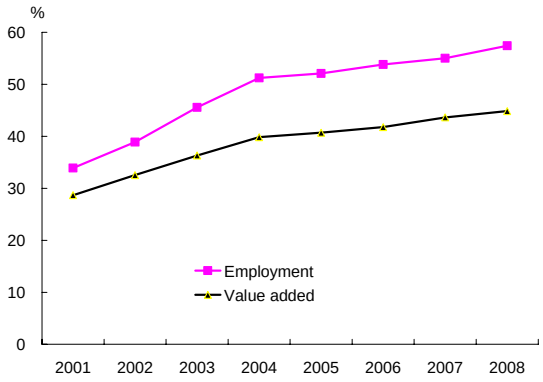
Figure 3. Share of the Affected Firms in Terms of Employment and Value Added

A: National level



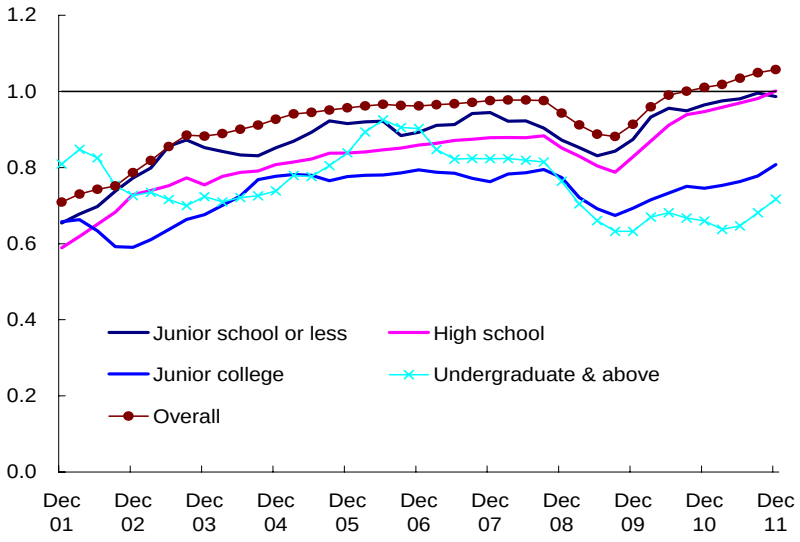
Sources: CASI and authors' estimates.

B: East China



Sources: CASI and authors' estimates.

Figure 4. Labour Demand-to-Supply Ratios by Education



Sources: CEIC and authors' calculations.

Figure 5. Labour Demand Structure

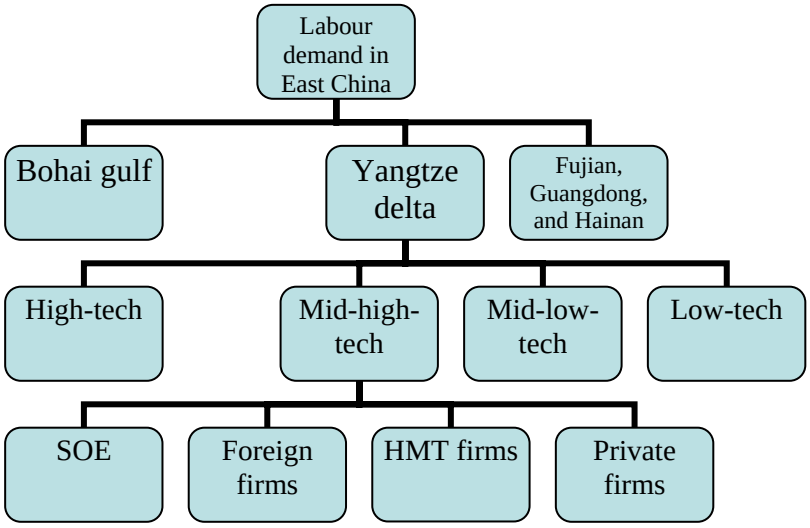
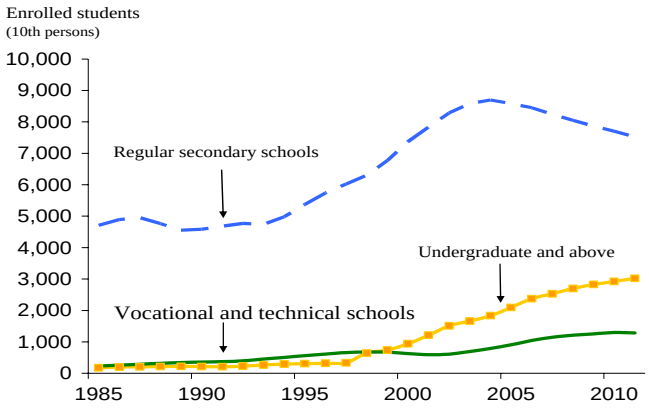
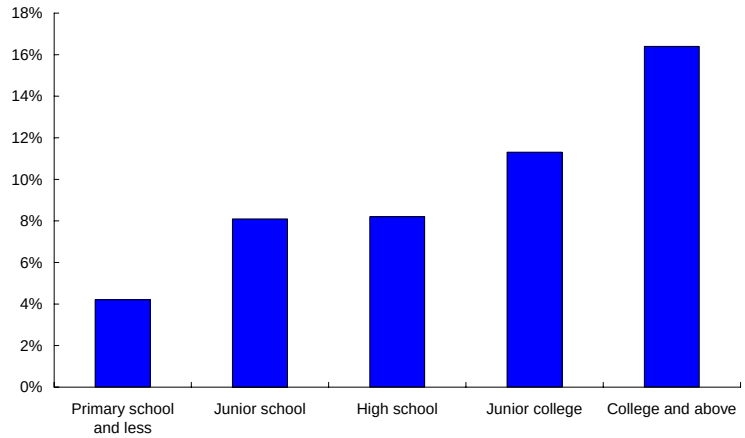


Figure 6. Student Enrolment



Sources: CEIC and authors' calculations.

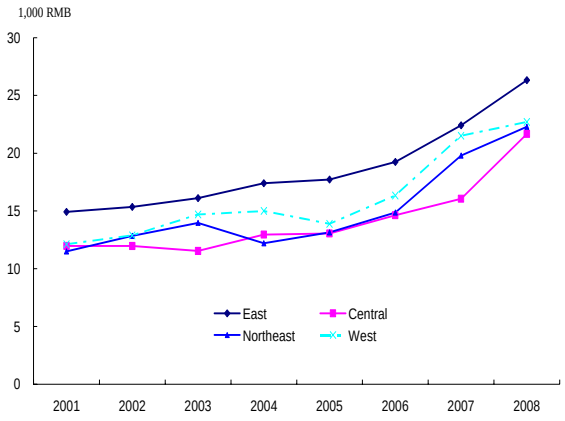
Figure 7. Unemployment Rate and Education Aged 21-25 in China (2011)



Source: China Household Finance Survey 2012 by Southwest University of Finance and Economics.

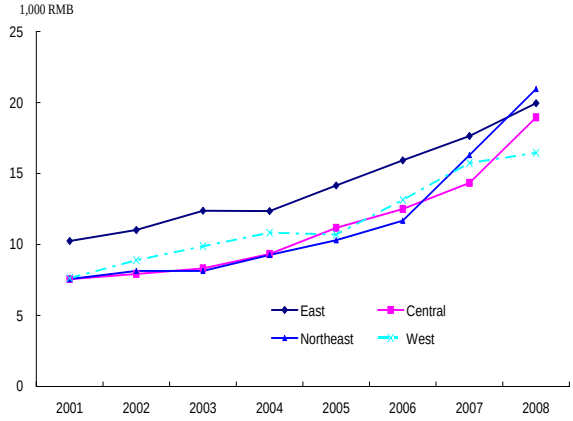
Figure 8. Labour Costs of HMT and Private Firms across Regions

HMT firms



Sources: CASI and authors' estimates.

Private firms



Sources: CASI and authors' estimates.

Appendix 1. GMM Estimates for Labour Cost Equation

Table A1-1. Estimated Results for Labour Cost Equation: East

	SOE	Foreign	HMT	Private
w_{-1}	0.797***	0.943***	0.744***	0.763***
	(15.52)	(13.89)	(15.32)	(6.79)
φ	-0.034	-0.140	0.162**	0.234*
	(-0.33)	(-0.83)	(2.21)	(1.61)
mw	0.050	-0.067	0.180***	0.128*
	(1.30)	(-0.56)	(2.99)	(1.72)
x	0.013*	0.009	0.012***	0.014*
	(1.85)	(1.29)	(2.50)	(1.91)
t	0.026***	0.030**	0.002	0.007
	(3.33)	(1.99)	(0.25)	(0.61)
Obs	276	275	276	236
Adj R^2	0.80	0.83	0.84	0.69
J-statistic	0.06	1.76	1.78	5.9

Note: *t*-statistics in the parentheses. *, ** and *** denote statistical significance at 10%, 5% and 1% confidence levels respectively.

Sources: CASI, CEIC and authors' estimates.

Table A1-2. Estimated Results for Labour Cost Equation: Central

	SOE	Foreign	HMT	Private
w_{-1}	0.899***	0.762***	0.638***	0.801***
	(11.44)	(17.10)	(7.16)	(10.95)
φ	-0.009	-0.135	0.163	-0.413**
	(-0.01)	(-0.65)	(1.20)	(-2.20)
mw	0.114	-0.095	0.114	-0.092
	(1.00)	(-1.02)	(1.05)	(-1.40)
x	-0.017	0.051***	0.055***	0.014
	(-0.86)	(2.68)	(3.00)	(1.48)
t	-0.002	0.045*	0.114	0.063***
	(-0.08)	(1.90)	(1.05)	(5.18)
Obs	144	168	168	168
Adj R^2	0.70	0.74	0.62	0.83
J-statistic	0.30	0.13	1.29	1.32

Note: t-statistics in the parentheses. *, ** and *** denote statistical significance at 10%, 5% and 1% confidence levels respectively.

Sources: CASI, CEIC and authors' estimates.

Table A1-3. Estimated Results for Labour Cost Equation: Northeast

	SOE	Foreign	HMT	Private
w_{-1}	0.356***	0.765***	0.228***	0.680***
	(3.05)	(9.02)	(3.77)	(7.83)
φ	-0.002	0.138	0.713***	-0.159
	(-0.01)	(0.31)	(4.05)	(-0.98)
Mw	0.001	0.130	0.737***	0.023
	(0.01)	(0.50)	(5.13)	(0.34)
X	0.098***	0.009	0.025	0.010
	(4.10)	(0.63)	(1.34)	(0.99)
t	0.080***	0.048	-0.072**	0.075***
	(5.53)	(1.07)	(-2.31)	(5.24)
Obs	84	84	83	84
Adj R^2	0.79	0.71	0.55	0.86
J-statistic	0.01	1.29	0.67	1.76

Note: *t*-statistics in the parentheses. *, ** and *** denote statistical significance at 10%, 5% and 1% confidence levels respectively.

Sources: CASI, CEIC and authors' estimates.

Table A1-4. Estimated Results for Labour Cost Equation: West

	SOE	Foreign	HMT	Private
w_{-1}	0.495***	0.557***	0.545***	0.927***
	(5.53)	(6.41)	(8.70)	(5.27)
φ	0.116	-0.239	0.319	0.336*
	(0.65)	(-0.85)	(1.42)	(1.63)
Mw	0.122***	-0.014	0.536***	0.100
	(3.14)	(-0.09)	(3.18)	(1.53)
X	0.046***	0.045***	0.155***	0.015*
	(3.38)	(2.86)	(6.04)	(1.72)
t	0.051***	0.043	-0.059*	-0.004
	(3.23)	(1.59)	(-1.73)	(-0.19)
Obs	269	251	236	234
Adj R^2	0.64	0.51	0.64	0.51
J-statistic	0.87	0.58	0.05	2.01

Note: *t*-statistics in the parentheses. * and *** denote statistical significance at 10% and 1% confidence levels respectively.

Sources: CASI, CEIC and authors' estimates.

Appendix 2. The Theoretical Framework for Labour Demand and Labour Migration

(1) Labour demand

A nested CES labour structure is used to capture the heterogeneity of labour demand. Suppose the aggregate production function is in a standard Cobb-Douglas form

$$Y_t = A_t K_t^{1-\alpha} L_t^{\alpha}, \quad \text{or } y_t = a_t + (1-\alpha)k_t + \alpha l_t \text{ in logs} \tag{A1}$$

where labour is grouped as three layers in terms of firms' locations (denoted as *"g"*), technology (denoted as *"q"*), and ownership (denoted as *"n"*). Accordingly, labour at each layer reads:

$$L_t = [\sum_{g=1}^{3} \theta_g L_{gt}^{(\delta-1)/\delta}]^{\delta/(\delta-1)}, \sum_{g=1}^{3} \theta_g = 1 \tag{A2}$$

$$L_{gt} = [\sum_{q=1}^{4} \theta_{gq} L_{gqt}^{(\rho-1)/\rho}]^{\rho/(\rho-1)}, \sum_{q=1}^{4} \theta_{gq} = 1 \tag{A3}$$

$$L_{gqt} = [\sum_{n=1}^{4} \theta_{gqn} L_{gqnt}^{(\sigma-1)/\sigma}]^{\sigma/\sigma-1}, \sum_{n=1}^{4} \theta_{gqn} = 1 \tag{A4}$$

where θ is the weight for each cell, σ, ρ, δ are elasticities of labour substitution between firms at each layer that are of interest, and

g = [Bohai gulf , Yangzi delta, Fujian, Guangdong and Hainan];

q = [Hi-tech, Mid-tech, Mid-low-tech, Low-tech];

n = [SOE, Foreign, HMT, Private].

Profit maximization with respect to labour composite L_{gt}, L_{gqt}, and L_{gqnt} given real labour costs results in the following labour demand equations:

$$w_{gt} = [\ln(\mu^{-1}\alpha) + y_t - l_t) + \tfrac{1}{\delta} l_t + \ln\theta_g - \tfrac{1}{\delta} l_{gt} \tag{A5}$$

$$w_{gqt} = [\ln(\mu^{-1}\alpha) + y_t - l_t) + \tfrac{1}{\delta} l_t + \ln\theta_g - (\tfrac{1}{\delta} - \tfrac{1}{\rho}) l_{gt} + \ln\theta_{gq} - \tfrac{1}{\rho} l_{gqt} \tag{A6}$$

$$w_{gqnt}=[\ln(\mu^{-1}\alpha)+y_t-l_t)+\tfrac{1}{\delta}l_t+\ln\theta_g-(\tfrac{1}{\delta}-\tfrac{1}{\rho})l_{gt}+\ln\theta_{gq}-(\tfrac{1}{\rho}-\tfrac{1}{\sigma})l_{gqt}+\ln\theta_{gqn}-\tfrac{1}{\sigma}l_{gqnt} \quad \text{(A7)}$$

where μ is the mark-up under imperfect goods market, and the labour costs and labour demand are in logs. The labour demand equations are estimated in three steps.

Step 1: Estimating the elasticity of labour substitution between foreign and other firm types based on equation (A7):

$$l_{gqjt}-l_{gqst}=D_{gqj}-\sigma(w_{gqjt}-w_{gqst})+\gamma x_t+\xi_{gqjt} \quad \text{(A8)}$$

where *j* = ["SOE", "Private", "HMT"]; *s* = ["Foreign"]. By definition,

$$D_{gqj}=\sigma(\ln\theta_{gqj}-\ln\theta_{gqs}) \ ,$$

which implies that

$$\widehat{\theta}_{gqj}=\exp(\tfrac{\hat{D}_{gqj}}{\hat{\sigma}})\Big/[1+\textstyle\sum_j\exp(\tfrac{\hat{D}_{gqj}}{\hat{\sigma}})] \quad \text{for each ownership } j \quad \text{(A9)}$$

and

$$\widehat{\theta}_{gqs}=1\Big/[1+\textstyle\sum_j\exp(\tfrac{\hat{D}_{gqj}}{\hat{\sigma}})] \quad \text{(A10)}$$

$\widehat{\theta}_{gqj}$, $\widehat{\theta}_{gqs}$, and $\hat{\sigma}$ are used to construct L_{gqt} according to equation (A4). L_{gqt} constructed is in turn used in Step 2.

Step 2: Estimating elasticity of labour substitution between firms with different technologies based on equation (A6):

$$l_{gqt}=D_t+D_{gt}+D_{gq}-\rho w_{gqt}+\zeta_{gqt} \quad \text{(A11)}$$

where D_t controls for $\rho[\ln(\mu^{-1}a)+y_t-l_t)]+\tfrac{\rho}{\delta}l_t=\rho\ln(\mu^{-1}MPL_t)+\tfrac{\rho}{\delta}l_t$, D_{gt} controls for $-\rho(\tfrac{1}{\delta}-\tfrac{1}{\rho})l_{gt}+\rho\ln\theta_g$, and D_{gq} controls for $\rho\ln\theta_{gq}$. The estimates of elasticity parameter ρ and the control variable D_{gq} are used to calculate the weight θ_{gq} as

$$\hat{\theta}_{gq} = \exp(\frac{\bar{D}_{gq}}{\bar{\rho}}) \Big/ \sum_q \exp(\frac{\hat{D}_{gq}}{\bar{\rho}}) \quad \text{for each technology } q, \tag{A12}$$

which along with $\hat{\rho}$ is used to construct labour composite L_{gt} defined in equation (A3). L_{gt} constructed is then used in Step 3.

Step 3: Estimating elasticity of labour substitution between firms at different locations based on equation (A5):

$$l_{gt} = D_t + D_g + \beta_g \tau_{gt} - \delta w_{gqt} + \zeta_{gqt} \tag{A13}$$

where D_t controls for $\rho[\ln(\mu^{-1}a) + y_t - l_t)] + \frac{\rho}{\delta} l_t = \rho \ln(\mu^{-1} MPL_t) + \frac{\rho}{\delta} l_t$, D_g is the location-specific fixed effect and τ_{gt} the location-specific time trend. The estimates of elasticity parameter δ and the control variable D_g are used to calculate the weight θ_g as

$$\hat{\theta}_g = \exp(\frac{\bar{D}_g}{\bar{\delta}}) \Big/ \sum_g \exp(\frac{\hat{D}_g}{\bar{\delta}}) \quad \text{for each location } g, \tag{A14}$$

which along with $\hat{\delta}$ is used to construct labour composite L_t defined in equation (A2).

(2) Impact of labour migration on wages

Labour migration changes labour supply and hence the labour demand-supply ratio ϕ, affecting cohorts' bargaining power. On the other hand, changes of labour demand in response to changes in labour costs may alter the capital-labour ratio and hence the marginal product of labour, in turn, causing labour costs to change. Let *M* denote the migrant labour forces and $\tilde{L}$ the labour supply, the real labour costs in equations (A5) - (A7) can be written as marginal product of labour:

$$W = \mu^{-1} MPL = \mu^{-1} MPL(L, K(\tilde{L}(M))) \tag{A15}$$

where *W*, *L* and *K* are vectors. The impact of labour migration on labour costs can be expressed as

$$\frac{dW}{dM} = \frac{\partial(\mu^{-1} MPL)}{\partial L} \frac{dL}{dM} + \frac{\partial(\mu^{-1} MPL)}{\partial K} \frac{\partial K}{\partial \tilde{L}} \frac{d\tilde{L}}{dM} \tag{A16}$$

On the other hand, the labour cost function can be re-written as

$$W = f(\phi) = f(\phi(L, \tilde{L})) \tag{A17}$$

It follows from equations (A15) - (A17) that

$$V = \mu^{-1} MPL(L, K(\tilde{L}(M))) - f(\phi(L, \tilde{L})) = 0 \tag{A18}$$

which indicates the response of labour demand to the migration shock reads:

$$\frac{dL}{dM} = \left(\frac{\partial(\mu^{-1}MPL)}{\partial L} - \frac{\partial f}{\partial \phi}\frac{\partial \phi}{\partial L}\right)^{-1}\left(\frac{\partial f}{\partial \phi}\frac{\partial \phi}{\partial \tilde{L}}\frac{d\tilde{L}}{dM} - \frac{\partial(\mu^{-1}MPL)}{\partial K}\frac{\partial K}{\partial \tilde{L}}\frac{d\tilde{L}}{dM}\right) \tag{A19}$$

$\frac{dL}{dM}$ calculated from Equation (A19) is then used to calculate $\frac{dW}{dM}$ in Equation (A16).

Appendix 3. Tables

Table A3-1. Short-Run Effects of a 10% Fall in Labor Migration on Labor Costs in East China

	SOE	Foreign	HMT	Private
Bohai gulf			0.3%	0.9%
Yangtze delta			0.2%	0.8%
Fujian-Guangdong-Hainan			0.3%	0.9%

Sources: CASI, CEIC and authors' estimates.

Table A3-2. Short-Run Effects of a 10% Fall in Labor Migration on Employment in East China

	SOE	Foreign	HMT	Private
Bohai gulf	-0.5%	-0.5%	-0.6%	-0.9%
Yangtze delta	-0.6%	-0.6%	-0.7%	-1.0%
Fujian-Guangdong-Hainan	-0.5%	-0.5%	-0.6%	-0.9%

Sources: CASI, CEIC and authors' estimates.

Table A3-3. Long-Run Effects of a 10% Fall in Labor Migration on Labor Costs in East China

	SOE	Foreign	HMT	Private
Bohai gulf			1.0%	3.7%
Yangtze delta			0.7%	3.5%
Fujian-Guangdong-Hainan			1.1%	3.7%

Sources: CASI, CEIC and authors' estimates.

Table A3-4. Long-Run Effects of a 10% Fall in Labor Migration on Employment in East China

	SOE	Foreign	HMT	Private
Bohai gulf	-1.9%	-1.9%	-2.4%	-3.7%
Yangtze delta	-2.3%	-1.3%	-2.7%	-4.0%
Fujian-Guangdong-Hainan	-1.8%	-1.8%	-2.3%	-3.6%

Sources: CASI, CEIC and authors' estimates.