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How does employment respond to minimum wage adjustment in China?

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Abstract

Under what circumstances can minimum wages increase without adverse effects on employment levels? In 31 Chinese provinces between 2004 and 2015, the employment effect of a minimum wage depended on the minimum wage level, foreign direct investment, per capita gross domestic product and labour productivity. A minimum wage increase reduced hiring as foreign direct investment inflow rose, regardless of the amount of investment. Any positive employment effect of a minimum wage increase was mitigated by per capita gross domestic product growth, except when per capita gross domestic product was above the average. Above-average labour productivity enhancement significantly mitigated the adverse employment effect of the minimum wage. Employers responded to a rising minimum wage by increasing hiring when the geometric growth rates of the minimum wage and foreign direct investment for a particular province within a period of time were above the overall average across provinces. However, they scrutinised both annual and overall economic growth within a time period when making hiring decisions in the face of minimum wage adjustments. An inverted U-shape relationship between minimum wages and employment suggest a maximum threshold value for the minimum wage. Thus, government policy measures should foster short-term and long-term economic growth, to facilitate employment creation when minimum wages increase.

JEL Codes: J38, J21, F16, O40

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Keywords
China, economic growth, employment, foreign direct investment, minimum wage, productivity

Introduction

Following China's entry into the World Trade Organisation (WTO) in 2001, trade liberalisation policies have elicited significant foreign direct investment (FDI) into this emerging economy. Most investors, especially from Hong Kong, Taiwan and Australia, have been attracted by the low labour costs of operating in Chinese markets (Liu and Pearson, 2010; Zhang, 2005). More recently, however, employers have experienced minimum wage increases that have varied across provinces and through time (Melnicoe, 2017). Provinces like Chongqing, Shaanxi, Shanghai and Beijing raised their minimum monthly and hourly wage in the first 6 months of 2019, while Hebei, Fujian and Qinghai followed in the second half of 2019. Shanghai recorded the highest monthly minimum wage in China (RMB 2480), followed by Shenzhen and Beijing, both at RMB 2200 (Koty and Zhou, 2020). Indeed, low labour costs are no longer a source of comparative advantage for China, especially compared with neighbouring countries like Vietnam where low labour costs have prompted potential investors to shift their production base southward (Lewis, 2016).

How do employers react to increased minimum wages in China? Analysts who see wages only as costs of production, would expect employers to reduce hiring (Fang and Lin, 2015; Jia, 2014). However, some foreign investors will still find Chinese markets promising in terms of both local absorptive capacity and innovation-complementary assets (Fu, 2008). They will still choose China as their investment destination, either by transferring technology from their home country (Young and Lan, 1997) or by engaging in high-technology production (Gaulier et al., 2007). Moreover, capital and technical intensity of a production structure substitute for labour in China (Zheng and Liu, 2004). It is proposed that this effect will be more substantial with an increase in minimum wages.

If skilled labour and unskilled labour have been complementarily needed for mass production in China, an increase in the minimum wage may not lead to a reduction in total employment. This is because the minimum wage increase may not be the primary basis for rising labour costs. Indeed in China, shortages of highly skilled labour may inflict crucial cost concerns, given population ageing and a tight supply of qualified candidates (Sheehan, 2017) as well as a shift of migrant workers to inland China (Koty and Zhou, 2020). In this scenario, employers would extend competitive wage offers to the highly skilled to retain talent, thereby driving up total labour costs. Thus, cost-inflicting skilled labour shortages during upwards adjustments of the minimum wage in China, given complementarity between skilled and minimum-wage-affected unskilled labour, will lead to an increase in the minimum wage, which in turn can result in a rise in the total employment available for production expansion.

In addition, Chinese firms may expect higher productivity from workers in receipt of a higher minimum wage, even increasing employment if wage levels and profit margins are

high (Huang et al., 2014). Since the beginning of China's economic reforms, labour productivity has remained high despite workers' deteriorating bargaining power and declining wage share (Piovani, 2014). Indeed, workers in all types of Chinese industrial enterprises were paid substantially lower than their marginal product of labour during 2005–2010 (Xu et al., 2015). Chinese firms may choose to better manage their inventory and invest more in capital to generate productivity gains without lowering fringe benefits, substituting existing workers by migrants, or imposing higher prices (Mayneris et al., 2018). Thus, not only may the adverse effect on employment of a minimum wage increase be mitigated, it could also increase capital-induced employment and profitability.

Should the above hypothesis of employers' or foreign investors' hiring response to minimum wage increases be supported, then the association between minimum wage and employment levels in China may not be linear. The minimum wage level may be associated in varying ways with different employment types and levels. Given the greater amount of FDI entering coastal provinces compared with the hinterland (Bao et al., 2002), the minimum-wage/employment nexus may differ provincially. Such variation may also reflect provincial differences in the cost of living and economic conditions. Similarly, firms may invest in enhancing labour productivity as a measure to absorb rising minimum wages without reducing employment. Putting these possible outcomes together, one might expect the minimum-wage/employment nexus to be characterised by a quadratic form, conditional on the levels of FDI, minimum wage, economic performance and labour productivity across Chinese provinces.

This article examines the employment effects of the minimum wage in 31 provinces in China under different regimes – that is, when the levels of FDI, minimum wage and economic performance are above and below the average across provinces. In addition, it examines the links among minimum wage levels, labour productivity and employment. The novelty of the analysis lies in the use of different regimes that characterise employers' hiring decisions following minimum wage rises. The choice of regimes reflects heterogeneity in levels of economic development that may intensify regional inequality in China (Jones et al., 2003). This study may thus assist minimum wage setting authorities at the provincial level to reconcile the interplay between keeping up with the rising cost of living facing workers and mitigating rising labour costs facing employers (especially foreign investors). By testing the minimum-wage-employment hypothesis under different regimes, the article adds to existing literature that assumes only a linear association between minimum wages and employment.

Literature

Effects of minimum wages on employment

Previous studies on the employment effect of minimum wages have produced mixed findings. These studies suggest the importance of keeping minimum wage at a moderate level to avoid trade-offs between wage increases and job losses as evidenced between East Germany and West Germany (König and Möller, 2009), and labour substitutability between formal and informal sectors as evidenced in Indonesia (Comola and De Mello, 2011).

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The positive employment effect of the minimum wage can be explained by the upwards-sloping labour-supply schedule resulting from employers' monopsonistic hiring behaviour (Card and Krueger, 1994; Ransom, 1993) and by the job-search model in which employees compare wages posted by different firms (Burdett and Mortensen, 1989; Card and Krueger, 1994). Continued employment growth following a minimum wage increase could be partially due to firms' pricing strategy, passing the cost burden to consumers (Card and Krueger, 1994), reducing hours worked, increasing work intensity, cutting special payments and non-wage benefits, reducing labour turnover, hiring more qualified staff, not complying with minimum wage law (Bruttel et al., 2018) and raising labour productivity (Riley and Bondibene, 2017).

In China, the Labour Contract Law came into force on 1 January 2008, providing greater protection to workers in terms of employment security and income generation. The Law has implications for human resource planning by prospective and existing foreign investors. While implementation of this new labour law is consistent with the Chinese government's intention to advance into a higher-wage, higher-technology nation, the Law has also triggered tremendous growth in informal employment in urban China, following reforms to the exploitative *hukou* system. Minimum wage policy revised during this period has focused on expanding coverage and increasing the amount paid. Despite burgeoning informal sector growth and the introduction of the minimum wage, reforms in the *hukou* system have reduced skilled–unskilled wage inequality in China, given the relatively greater capital intensity in the urban skilled than in the urban unskilled sector (Pi and Zhang, 2016). Thus, it is possible to expect a positive effect on employment of a minimum wage rise amid the influx of Chinese migrant workers into the informal sector.

Predictions that the introduction of a minimum wage will negatively affect employment are based on the perfectly competitive model assuming a product price increase (Aaronson and French, 2007). For example, a rise in the minimum wage adversely affected French youth employees (Bazen and Skourias, 1997) and young adults and individuals who had not completed high school, causing slower expansion in their employment than if the minimum wage had remained unchanged (Clemens and Strain, 2017). There is thus a need to weigh the benefits and costs of upwards adjustment in the minimum wage level (Neumark and Wascher, 2015).

In China, the minimum wage rise following enforcement of the Labour Contract Law may have adversely affected manufacturing employment growth without leading to overall increases in aggregate unemployment (Gallagher et al., 2013). The economic welfare of informal workers was compromised by incomplete enforcement of labour regulations and involvement from employment agencies and social security agencies (Cooke, 2011), employer coercion on employees prompting to relinquish seniority claims via resignation, and the shifting of production to other lower-wage Chinese regions or Southeast Asian economies (Wang et al., 2009). Moreover, the Law provides greater social benefits and remuneration to urban workers than to migrant workers (Cheng et al., 2015). Government intervention is thus pertinent to improving job prospects among informal migrant workers who have weak bargaining power and are less represented by trade unions (Wang et al., 2016).

There are studies where the employment effect of minimum wage increase is minimal or non-existent. Metcalf (2008) in a British study attributes this phenomenon to an

impact on hours rather than workers, employer wage setting and labour market frictions, offsets via the tax credit system, incomplete compliance, productivity improvements, price increases in consumer services and profits reduction. Similarly, Schmitt (2013) attributes minimal impact to reductions in labour turnover when a higher minimum wage is paid, with resulting improvement in organisational efficiency, as well as a reduction in wages of higher earners, and smaller price increases.

However, empirical studies have placed less focus on the potential role of FDI, economic performance and labour productivity in accounting for the employment effects of a higher minimum wage. An increase in minimum wages affects operating costs for foreign investors, who in turn may adjust their hiring strategy. Yet such an increase improves labour productivity and the economic welfare of the society, which in turn may affect consumption and hiring. It is thus important to incorporate FDI, economic growth and labour productivity in analysing the nexus between minimum wages and employment.

Minimum wage, FDI and employment

FDI may serve as a moderator in either enhancing or mitigating the employment effect of the minimum wage. Foreign firms have tended to hire unskilled, blue-collar labour at lower pay than domestic firms in developing countries (Coniglio et al., 2015). However, Payton and Woo (2014) argue that FDI inflows decrease with stricter labour regulations owing to rising costs of adherence, raising cost-efficiency concerns for foreign investors, even those intending to venture into developed Organisation for Economic Co-operation and Development (OECD) countries (Alam and Shah, 2013). So simply using minimum wages as the measurement of unit labour costs will definitely predict a reduced number of FDI projects in a country, as found in a hospitality industry study (Falk, 2016).

Meanwhile the impact of FDI on employment creation in host countries has been demonstrated, for example, in the Malaysian manufacturing sector (Bekhet and Mugableh, 2016) and in production-supporting ancillary sectors in Fiji's economy (Jayaraman and Singh, 2007). However, the magnitude of FDI-led direct and indirect employment growth may be negligible or even reduced when, for example, labour productivity is high, the value added of output is low, or domestic industrial linkage is limited, or when domestic investment is crowded out, as in the case of Vietnam (Jenkins, 2006). The channels through which FDI and employment are related are strategic asset-seeking FDI that creates new jobs for educated labour (Rozen-Bakher, 2017), and non-exporting and labour-intensive FDI that increases employment elasticity following changes in capital input and output (Chen et al., 2016).

Previous studies have tended to emphasise the adverse effect of minimum wages on FDI and the mixed effect of FDI on employment. Based on this reasoning, one hypothesis is that the employment effect of an increase in the minimum wage is conditional on the level of FDI. This hypothesis is justifiable on the ground that FDI providers are cost-conscious when facing with increasing minimum wages in host countries. An increase in the minimum wage in a host country with higher amount of FDI inflows may trigger foreign capital withdrawal, exacerbating employment reduction. However, should the effect of minimum wage on employment be positive, an increase in asset-seeking FDI

inflows may further enhance employment creation momentum in the host country. The present study tests these hypotheses.

Minimum wage, economic growth and employment

The growth effect of a minimum wage increase may not be destructive because a higher minimum wage leads to higher gross domestic product (GDP) per capita (Bhorat et al., 2017), whereas a lower minimum wage reduces the economic welfare of each market player (Cahuc and Michel, 1996). Human capital theory attributes this positive GDP effect to human capital accumulation by unskilled workers displaced following a minimum wage increase (Cahuc and Michel, 1996).

Economic growth has been linked to employment creation through increased production via new economic sectors (Saviotti and Pyka, 2004). However, a substitution effect may result in a negative employment effect of economic growth (Soto, 2009). Capital and high-skilled labour will be preferred over both traditionally skilled and unskilled labour following technology-led economic growth (Jung et al., 2017).

The above analysis suggests a positive effect of minimum wages on economic growth and a mixed effect of economic growth on employment. It can therefore be hypothesised that the relationship between minimum wages and employment depends on the level of economic growth. Dube et al. (2010) have particularly criticised studies for producing spurious negative employment effects of minimum wage policies by not considering local economic conditions. Rather, economic expansion may enhance the employment creation momentum of a minimum wage rise while also exacerbating the employment reduction effect of minimum wage rise through a substitution effect.

Minimum wage, labour productivity and employment

The effect of a minimum wage on employment may also be conditional on the level of labour productivity. Metcalf (2008) argues that productivity improvement had little or no apparent effect on employment when the British national minimum wage (NMW) was introduced in 1999. British firms reacted by increasing total factor productivity (TFP) without Bodn reducing their workforce or resorting to capital-labour substitution, consistent with theories of organisational change, training and efficiency wages (Riley and Bondibene, 2017). A NMW may thus enhance aggregate productivity, specifically for the low-paying sector, justifying management practice and public policy of offering higher wage incentives (Rizov et al., 2016). Productivity improvement is a more popular form of adjustment to minimum wage rises than employment reduction, as observed by Bodnár et al. (2018) in Central and Eastern European countries. In China, this adjustment channel has involved better inventory management and greater capital investment (Mayneris et al., 2018), with productive firms driving out unproductive ones (Mayneris et al., 2014). Chinese firms have thereby been able to remain profitable without cutting back on hiring amid minimum wage increases.

However, Alvarez and Fuentes (2018) argue that a minimum wage has a negative effect on TFP as a result of labour adjustment costs. Such adjustment costs may be a barrier to firms wishing to switch to capital-intensive production when facing higher

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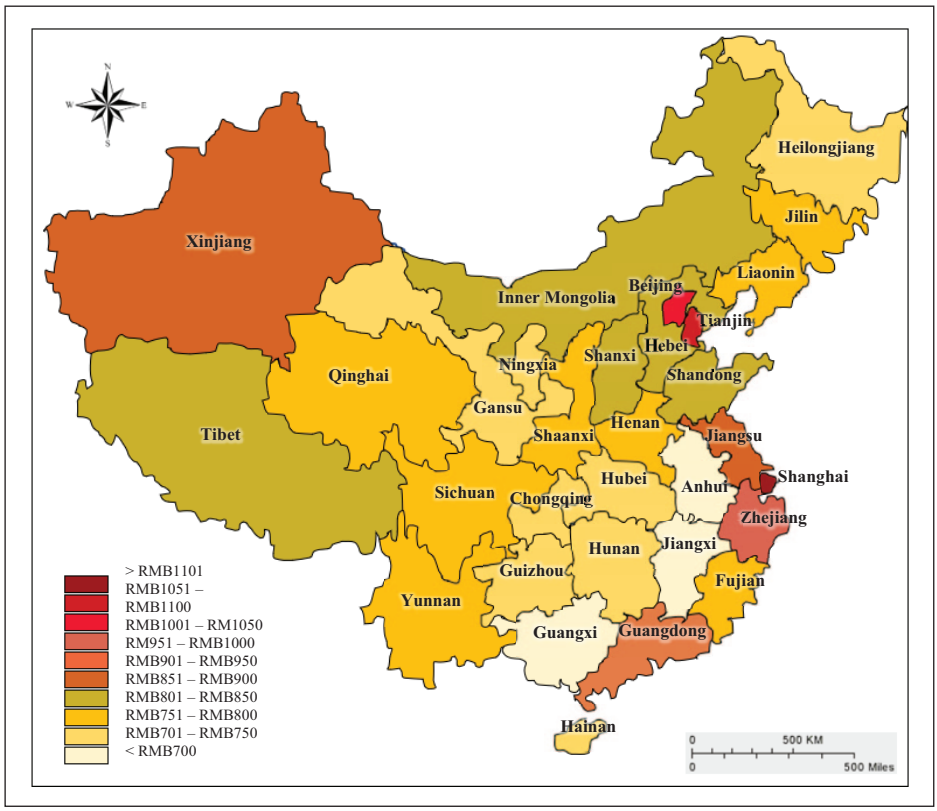

Figure 1. Distribution of minimum wage level in China by provinces.
Minimum wage based on average 2004–2015.

minimum wages, adversely affecting labour productivity. This constraint is specifically applicable to industries or occupations with an inelastic demand for labour (Wimmer, 2000). Such firms may not respond to a minimum wage rise by adjusting their production structure, with anomalous employment effects.

Minimum wage setting in China

Minimum wage levels vary greatly in China because authority to set and adjust the minimum wage falls within the jurisdiction of local government, although the central government requires minimum wage adjustments at least once every 2 years. Factors considered include rising prices, cost of living, average wages, employment conditions and economic growth (Koty, 2017; SafeGuards, 2017).

Figure 1 depicts the distribution of minimum wages by geographical location, based on data for each province, averaged between 2004 and 2015 and classified by range. As evidenced in Figure 1, regional variation in minimum wages has been due primarily to regional differences in economic growth, economic structure and consumption levels

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(Xing and Xu, 2016). Shanghai recorded the highest mean minimum wage, followed by Tianjin and Beijing. Zhejiang and Jiangsu, geographically adjacent to Shanghai, also recorded high mean minimum wage values. This graphical representation may drive us to link provincial minimum wage differences to a spatial spillover effect such as Li et al. (2019) have shown.

However, the reality is more complex. Mean minimum wages in certain provinces adjacent to each other may diverge, showing little mutual influence. For example, minimum wages in Anhui and Jiangxi are on average among the lowest in China, although these two provinces are geographically close to relatively high-paying provinces, like Shanghai, Zhejiang and Jiangsu. This calls into question the validity of spatial interdependence as an explanation of minimum wage standards in China as proposed by Li et al. (2019). Other geographical variations deserve closer attention.

For example, coastal provinces in East China have recorded the highest FDI and per capita GDP (Wye, 2018). The second highest minimum wage province – Tianjin – is located along the coastline adjacent to the third highest-paying Beijing. The per capita GDP, FDI and trade of these two provinces are also among the highest in China. The relatively high rates of FDI and economic growth in the provinces along the Chinese coast, rather than spillover effects, may contribute to higher minimum wage levels. By contrast, provinces like Anhui and Jiangxi located slightly away from the coastline record lower FDI and economic growth (Wye, 2018), hence lower minimum wages.

Therefore, provincial minimal wage variations may be due largely to geographical differences between the economically more active coastal region and economically less active hinterland, rather than a spatial spillover effect, even when these provinces are adjacent. Such factors highlight the importance for the present study of incorporating provincial differences in analyses of FDI and economic growth, when examining the effect of minimum wages on employment in China.

Model specification, methodology and data

Model specification

Empirical studies reviewed above highlight the potential employment effect of the minimum wage. Besides the minimum wage, FDI, economic growth and labour productivity have affected employment levels directly, as well as indirectly via the minimum wage. Thus, the baseline model employed in this study can be represented by equation (1) below

$$EMP = f(MW, FDI, PCGDP, PROD) \tag{1}$$

where EMP refers to total employment for each province and MW indicates the monthly minimum wage, measured in *yuan* or *Renminbi* (RMB), which varies across provinces and within the same province. We include *FDI* as a variable to capture the employment opportunity opened up for Chinese workers following China's entry into WTO. $PCGDP$ is the amount of per capita gross domestic products (*GDP*) measured in *yuan* per person, while *PROD* denotes labour productivity as measured by PCGDP per employment.

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However, the *MW, FDI, PCGDP* and *PROD* variables are likely to be endogenous, possibly because of the feedback effect running from *EMP* to *MW, FDI, PCGDP* and *PROD*. Therefore, this study uses generalised method-of-moments (GMM) estimations to deal with endogeneity and simultaneity bias. Data for 31 provinces in China ranging from 2004 to 2015 are used to investigate the relationship among variables. By taking into account the dynamic effect of employment, where the total employment in a current year is influenced by the total employment in the previous year, the impact of the minimum wage and other variables on employment in dynamic panel data can be expressed as follows

$$\ln EMP_{it} = \alpha \ln EMP_{it-1} + \beta_1 \ln MW_{it} + \beta_2 \ln FDI_{it} + \beta_3 \ln PCGDP_{it} + \beta_4 \ln PROD_{it} + \eta_i + \varepsilon_{it} \quad (2)$$

where α indicates the dynamic effect of lagged dependent, η_i is the unobserved province-specific effect term, ε_{it} is the error term, i is the province index and t is the time index.

To anticipate possible differences in employment effect between higher and lower minimum wage levels, FDI, per capita GDP and labour productivity, we strategise our study by interacting the minimum wage, FDI, per capita GDP and labour productivity with the levels of minimum wage, FDI, per capita GDP and labour productivity, respectively. Differences in level are captured by dummy variables *MWStatus*, *FDIStatus*, *PCGDPStatus* and *PRODStatus* that indicate whether the minimum wage, FDI, per capita GDP and labour productivity in a particular province in a particular year are above (denoted by a dummy of '1') or below (denoted by a dummy of '0') the average among all provinces in that particular year. However, we eliminate the dummy variable itself as categorical data to avoid the multicollinearity problem.[1] The following equations convey the impact of the level of minimum wage, FDI, per capita GDP and labour productivity on employment

$$\begin{aligned} \ln EMP_{it} = {} & \alpha_1 \ln EMP_{it-1} + \beta_{11} \ln MW_{it} + \beta_{21} \ln FDI_{it} + \beta_{31} \left(\ln MW_{it} \times MWStatus_{it} \right) \\ & + \beta_{41} \ln PCGDP_{it} + \beta_{51} \ln PROD_{it} + \eta_i + \varepsilon_{1it} \end{aligned} \quad (3.1)$$

$$\begin{aligned} \ln EMP_{it} = {} & \alpha_2 \ln EMP_{it-1} + \beta_{12} \ln MW_{it} + \beta_{22} \ln FDI_{it} + \beta_{32} \left(\ln FDI_{it} \times FDIStatus_{it} \right) \\ & + \beta_{42} \ln PCGDP_{it} + \beta_5 \ln PROD_{it} + \eta_i + \varepsilon_{2it} \end{aligned} \quad (3.2)$$

$$\begin{aligned} \ln EMP_{it} = {} & \alpha_3 \ln EMP_{it-1} + \beta_{13} \ln MW_{it} + \beta_{23} \ln FDI_{it} + \beta_{33} \ln PCGDP_{it} \\ & + \beta_{43} \left(\ln PCGDP_{it} \times PCGDPStatus_{it} \right) + \beta_{53} \ln PROD_{it} + \eta_i + \varepsilon_{3it} \end{aligned} \quad (3.3)$$

$$\begin{aligned} \ln EMP_{it} = {} & \alpha_4 \ln EMP_{it-1} + \beta_{14} \ln MW_{it} + \beta_{24} \ln FDI_{it} + \beta_{34} \ln PCGDP_{it} \\ & + \beta_{44} \ln PROD_{it} + \beta_{54} \left(\ln PROD_{it} \times PRODStatus_{it} \right) + \eta_i + \varepsilon_{4it} \end{aligned} \quad (3.4)$$

Next, we further investigate the role of FDI, per capita GDP and labour productivity in accounting for the effect of minimum wages on employment by interacting MW with

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FDI, $PCGDP$ and $PROD$, respectively. The following equations epitomise the interaction model of these variables:

$$\ln EMP_{it} = \alpha_5 \ln EMP_{it-1} + \beta_{15} \ln MW_{it} + \beta_{25} \ln FDI_{it} + \beta_{35} \left(\ln MW_{it} \times \ln FDI_{it} \right) + \beta_{45} \ln PCGDP_{it} + \beta_{55} \ln PROD_{it} + \eta_i + \varepsilon_{5it} \quad (4.1)$$

$$\ln EMP_{it} = \alpha_6 \ln EMP_{it-1} + \beta_{16} \ln MW_{it} + \beta_{26} \ln FDI_{it} + \beta_{36} \left(\ln MW_{it} \times \ln PCGDP_{it} \right) + \beta_{46} \ln PCGDP_{it} + \beta_{56} \ln PROD_{it} + \eta_i + \varepsilon_{6it} \quad (4.2)$$

$$\ln EMP_{it} = \alpha_7 \ln EMP_{it-1} + \beta_{17} \ln MW_{it} + \beta_{27} \ln FDI_{it} + \beta_{37} \left(\ln MW_{it} \times \ln PROD_{it} \right) + \beta_{47} \ln PCGDP_{it} + \beta_{57} \ln PROD_{it} + \eta_i + \varepsilon_{7it} \quad (4.3)$$

In addition, this study further investigates the role of levels of FDI, per capita GDP and labour productivity in accounting for the employment effect of the minimum wage. We anticipate that FDI, per capita GDP and labour productivity that are above the average will mitigate the negative effect of the minimum wage on employment. Therefore, we strategise our research by using models of interaction between MW and $FDIStatus$, $PCGDPStatus$ and $PRODStatus$, respectively. The models can be written as follows

$$\ln EMP_{it} = \alpha_8 \ln EMP_{it-1} + \beta_{18} \ln MW_{it} + \beta_{28} \ln FDI_{it} + \beta_{38} \left(\ln MW_{it} \times FDIStatus_{it} \right) + \beta_{48} \ln PCGDP_{it} + \beta_{58} \ln PROD_{it} + \eta_i + \varepsilon_{8it} \quad (5.1)$$

$$\ln EMP_{it} = \alpha_9 \ln EMP_{it-1} + \beta_{19} \ln MW_{it} + \beta_{29} \ln FDI_{it} + \beta_{39} \left(\ln MW_{it} \times PCGDPStatus_{it} \right) + \beta_{49} \ln PCGDP_{it} + \beta_{59} \ln PROD_{it} + \eta_i + \varepsilon_{9it} \quad (5.2)$$

$$\ln EMP_{it} = \alpha_{10} \ln EMP_{it-1} + \beta_{110} \ln MW_{it} + \beta_{210} \ln FDI_{it} + \beta_{310} \left(\ln MW_{it} \times PRODStatus_{it} \right) + \beta_{410} \ln PCGDP_{it} + \beta_{510} \ln PROD_{it} + \eta_i + \varepsilon_{10it} \quad (5.3)$$

Equations (2)–(5.3) above are estimated using GMM and the results are presented in Table 1.

Overall performance of indicators: Growth versus absolute value

Foreign direct investors and employers may make their decisions to hire or invest by studying the overall performance of economic growth, FDI amounts and the trend of changes in the minimum wage within a period of time in a province, rather than scrutinising the performance of these indicators in a particular year. The present study therefore calculates the average absolute value and geometric growth of these indicators within the period 2004–2015 for every province. Subsequently, the average absolute value and geometric growth for each province are compared across all provinces to identify those provinces with values for these indicators that are either above or below the provincial

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Table 1. The determinants of employment in China: Two-step system-GMM.

	Model 1	Model 2a	Model 2b	Model 2c	Model 2d	Model 3a	Model 3b	Model 3c	Model 4a	Model 4b	Model 4c
EMP (−1)	0.733***	0.944***	0.955***	0.997***	0.649***	0.943***	0.923***	0.726***	0.960***	0.995***	0.655***
MW	−0.028**	−0.014	−0.021*	−0.026**	−0.083***	0.156***	0.240***	−0.260***	−0.026**	−0.027**	−0.050***
FDI	0.028**	0.033***	−0.004	0.000	−0.004	0.125***	0.037***	0.016*	0.008	0.002	0.019*
PCGDP	0.149***	−0.013	0.001	0.020*	0.320***	−0.008	0.085**	0.186***	0.022*	0.019*	0.239***
PROD	−1.078***	–	–	–	−1.831***	–	–	−2.251***	–	–	−1.639***
MW × MWStatus	–	0.000	–	–		–	–	–	–	–	–
FDI × FDIStatus	–	–	0.001	–		–	–	–	–	–	–
PCGDP × PCGDPStatus	–	–	–	0.004***		–	–	–	–	–	–
PROD × PRODStatus	–	–	–	–	0.005	–	–	–	–	–	–
MW × FDI	–	–	–	–		−0.014***	–	–	–	–	–
MW × PCGDP	–	–	–	–		–	−0.020***	–	–	–	–
MW × PROD	–	–	–	–	–	–	–	0.159***	–	–	–
MW × FDIStatus	–	–	–	–		–	–	–	−0.000	–	–
MW × PCGDPStatus	–	–	–	–		–	–	–	–	0.007***	–
MW × PRODStatus	–	–	–	–	–	–	–	–	–	–	0.003**
Constant	1.841***	0.280***	0.243***	0.011		−0.892***	−0.923**	3.358***	0.188***	0.022	2.523***
AR(1) (p-value)	0.304	0.272	0.266	0.256	0.281	0.252	0.273	0.278	0.262	0.257	0.308
AR(2)[a] (p-value)	0.610	0.448	0.373	0.435	0.563	0.321	0.514	0.422	0.387	0.439	0.964
J-test[b] (p-value)	0.133	0.306	0.120	0.336	0.158	0.282	0.242	0.258	0.180	0.330	0.423
No. of groups	31	31	31	31	31	31	31	31	31	31	31
No. of instruments	16	26	21	21	16	21	30	16	22	21	25

FDI: foreign direct investment; PCGDP = amount of per capita gross domestic product; PROD: labour productivity as measured by PCGDP per employment.
[a]AR(2) is the test for autocorrelation.
[b]J-test is the test for overidentification.
Collapse of lag length technique is used to overcome the instrument proliferation problem as proposed by Roodman (2009).
All variables are expressed in their natural logarithmic form.
***, ** and * denote significance level at 1%, 5% and 10%, respectively.

average. This approach allows us to differentiate provinces with a larger amount of these indicators in terms of average absolute values, but smaller amount of these indicators in terms of geometric growth – and vice versa. It recognises that foreign investors and employers may base their investment and hiring decisions on the overall performance of these indicators in terms of growth as opposed to their average absolute value.

To identify provinces with average absolute value and geometric growth of the minimum wage, FDI and per capita GDP within 2004–2015 that are above or below the average across all provinces, we use the same dummy variables as in Equations (3.1), (5.1) and (5.2), that is, *MWStatus*, *FDIStatus* and *PCGDPStatus*. However, the only difference is that the value of these dummy variables is province-variant but time-invariant – each of these dummy variables is subscripted with '*i*' instead of '*it*'. The result of the analysis for the effect of minimum wage on employment is shown in Table 2.

Nonlinear relationship between minimum wage and employment

Finally, the study hypothesises the existence of an optimum minimum wage level due to labour cost constraints in production (Coniglio et al., 2015). Hence, we investigate the nonlinear relationship between the minimum wage and employment. The quadratic model employed to examine this nonlinear relationship can be expressed as follows

$$\begin{aligned}\ln EMP_{it} = {} & \alpha_{11}\ln EMP_{it-1} + \beta_{111}\ln MW_{it} + \beta^{*}_{111}\ln MW^{2}_{it} + \beta_{211}\ln FDI_{it} \\ & + \beta_{311}\ln PCGDP_{it} + \beta_{411}\ln PROD_{it} + \eta_{i} + \varepsilon_{11it}\end{aligned} \tag{6.1}$$

If Kuznets' theory (1955) of the inverted U-shaped association between income per capita and income inequality applied to the association between minimum wage and employment, then the expected sign for β_{111} and β^{*}_{111} coefficients would be positive and negative, respectively. If both coefficients were statistically significant, the inverted U-shaped association would then reflect the findings by Soundararajan (2013).

Methodology

Two-step system-GMM estimator

The econometric method employed to estimate the equations is based on the dynamic panel GMM estimators suggested by Arellano and Bond (1991) and extended by Blundell and Bond (1998). This estimator is used to address endogeneity, simultaneity bias and province-specific effects. We use the two-step system-GMM estimator of Blundell and Bond (1998) because it is consistent in parameter estimation and unbiased compared to the pooled ordinary least squares (OLS), fixed effect (FE), random effect (RE) and difference GMM estimators.

U-test of Sasabuchi, Lind and Mehlum

Although the quadratic model is used to examine the nonlinear relationship between minimum wage and employment, the estimation may spuriously identify an extreme value and U-shaped properties (Lind and Mehlum, 2010). To test appropriately for the

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Table 2. The determinants of employment in China when MW, FDI and PCGDP are above or below their average absolute value and geometric growth across provinces within 2004–2015: System-GMM.

	Model 2a		Model 4a		Model 4b	
	Absolute value	Geometric growth	Absolute value	Geometric growth	Absolute value	Geometric growth
	Two-step	Two-step	Two-step	Two-step	Two-step	Two-step
EMP (−1)	0.953***	0.945***	0.940***	0.950***	0.948***	0.959***
MW	–0.013	–0.023**	–0.012	–0.019**	–0.024*	–0.029**
FDI	0.025***	0.037***	0.027***	0.027***	0.021***	0.010**
PCGDP	–0.009	–0.007	–0.008	–0.003	0.008	0.025*
MW × MWStatus(value)	0.002	–	–	–	–	–
MW × MWStatus(growth)	–	0.003***	–	–	–	–
MW × FDIStatus(value)	–	–	–0.000	–	–	–
MW × FDIStatus(growth)	–	–	–	0.001**	–	–
MW × PCGDPStatus(value)	–	–	–	–	–0.000	–
MW × PCGDPStatus(growth)	–	–	–	–	–	0.003**
Constant	0.244**	0.208***	0.306***	0.223***	0.246**	0.170**
AR(1) (p-value)	0.269	0.273	0.269	0.267	0.265	0.262
AR(2) (p-value)	0.429	0.435	0.426	0.417	0.403	0.387
J-test (p-value)	0.147	0.328	0.190	0.477	0.171	0.161
No. of groups	31	31	31	31	31	31
No. of instruments	22	30	22	30	22	22

FDI: foreign direct investment; PCGDP = amount of per capita gross domestic product; PROD: labour productivity as measured by PCGDP per employment.
[a]AR(2) is the test for autocorrelation.
[b]J-test is the test for overidentification.
Collapse of lag length technique is used to overcome the instrument proliferation problem as proposed by Roodman (2009).
All variables are expressed in their natural logarithmic form.
***, ** and * denote significance level at 1%, 5% and 10%, respectively.

presence of a U-shaped Kuznets curve profile, this study must provide sufficiently strong evidence of a slope that is positive at lower values of MW and negative at higher values of MW (Soundararajan, 2013). To confirm an inverted U-shaped or U-shaped relationship between the minimum wage and employment, we conduct the U-test of Sasabuchi (1980), extended by Lind and Mehlum (2010). In the quadratic case of equation (6.1), the composite null with the joint hypothesis was tested as follows:

$$H_0 : \left(\beta_1 + \beta_2 2MW_{min} \leqslant 0\right) \cup \left(\beta_1 + \beta_2 2MW_{max} \geqslant 0\right)$$

against the alternative hypothesis

$$H_1 : \left(\beta_1 + \beta_2 2MW_{min} > 0\right) \cup \left(\beta_1 + \beta_2 2MW_{max} < 0\right)$$

where MW_{min} and MW_{max} represent the minimum and maximum values of the minimum wage, respectively. Rejection of the full hypothesis would confirm the existence of an inverted U-shaped relationship between minimum wage and employment.

Data source

To estimate the models, the study employed panel data for 31 provinces in China obtained from the Wind Information database, recognised as China's leader in the provision of financial data and information services and solutions. The sample period spanned 12 years from 2004 through 2015 on a yearly basis. The dataset was averaged over 2-year periods to validate the use of GMM estimator, to meet the requirement for a large number of cross-section units (N) with a small number of time periods (T). A longer period could cause the autocorrelation problem. Therefore, a maximum of six observations was available for each variable per province.

Empirical results and discussion

Table 1 shows that significant adverse minimum wage effects on employment in almost all model specifications. The effect was persistent and indifferent to whether the minimum wage was above or below its average (as indicated by the insignificant coefficient for the interaction between MW and MWStatus in Model 2a). An exception was observed in Model 3a and Model 3b where the minimum wage exerted a positive effect on employment when it interacted with the level of FDI inflow and per capita GDP. With the negative and significant coefficient for the interaction term between MW and FDI in Model 3a, an increase in the minimum wage reduced hiring as FDI inflow rose, mitigating its positive impact on employment. This finding highlights labour cost concerns among foreign direct investors operating in China and their sensitivity to wage increases (Coniglio et al., 2015). Such concerns applied whether FDI was above or below average levels, as indicated by the insignificant coefficient for the interaction term between MW and FDIStatus in Model 4a. In fact, earlier empirical studies have identified changes in the labour cost or wages to be one of the important determinants for FDI in China, suggesting that low labour costs in China have been a major attraction to foreign investors (Dees, 1998; Liu et al., 1997; Zhang, 2005).

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In addition, the positive employment effect of a minimum wage increase was significantly mitigated by a growth in per capita GDP, as indicated by the negative and significant coefficient for the interaction term between MW and PCGDP in Model 3b. This could be explained by the argument for substitutability between low-skilled labour and capital following growth-led technological innovation (Jung et al., 2017; Soto, 2009). In fact, empirical studies on the potential for inter-factor substitution between capital, labour and energy in China have shown the effectiveness of capital in substituting labour and energy (Smyth et al., 2011; Zheng and Liu, 2004). However, the mitigating role played by the per capita GDP significantly depended on the extent to which it was increased.

The positive and significant coefficient for the interaction term between MW and PCGDPStatus in Model 4b indicates that a rise in the minimum wage may enhance employment growth in provinces with per capita GDP above the average, more than in provinces with per capita GDP below the average. Perhaps, a sufficiently high growth rate may increase employment via the creation of new sectors (Saviotti and Pyka, 2004), providing a rationale for capacity building among workers through human capital accumulation (Cahuc and Michel, 1996). In fact, human capital accumulation has been rapid since the economic reform in China and has significantly contributed to her growth and welfare (Wang and Yao, 2003), besides generating higher returns to education as economic reform has deepened in China (Li, 2003).

The interaction between the minimum wage and labour productivity exerted a significant positive impact on employment despite the significant direct negative employment effect of a minimum wage rise, as shown in Model 3c. This finding highlights the importance of labour productivity enhancement in mitigating the adverse effect on employment when the minimum wage is increased in China (Mayneris et al., 2014, 2018). Such an adjustment channel depends on the extent to which productivity is increased. The significant positive effect of the interaction between MW and PRODStatus in Model 4c indicates that a rise in the minimum wage may enhance employment growth in provinces with labour productivity above the average, compared to the rate in those with below average labour productivity.

In addition, FDI and per capita GDP were positively related to employment growth in almost all model specifications in Table 1. The positive association between FDI and employment is consistent with explanations based on FDI as motivated by strategic asset-seeking (Rozen-Bakher, 2017), and on the expansion of FDI-supporting ancillary sectors (Jayaraman and Singh, 2007), and labour intensity of FDI (Chen et al., 2016). Meanwhile, the positive association between growth and employment is consistent with an explanation based on technological innovation as favouring high-skilled rather than low-skilled labour (Jung et al., 2017) and new sector creation (Saviotti and Pyka, 2004). The positive link between FDI and employment growth still generally held whether the level of FDI was above or below its average (as shown by the insignificant coefficient for the interaction term between FDI and FDIStatus in Model 2b). However, when the increase in per capita GDP occurred at a level above its average, the resulting positive employment effect was significantly augmented (as shown by the positive and significant coefficient for the interaction term between PCGDP and PCGDPStatus in Model 2c).

Table 2 presents the employment effect of a minimum wage when the average absolute value and geometric growth of minimum wage, FDI and per capita GDP in a particular province within 2004–2015 were above or below the average across all provinces. An increase in the minimum wage caused employment reduction in all model specifications. However, the negative effect on employment was only statistically significant when geometric growth from 2004 to 2015 was used to classify each province as above or below the average across all provinces in terms of minimum wage, FDI and per capita GDP.

The positive and significant coefficient for the interaction terms between MW and MWStatus (growth), MW and FDIStatus (growth), and MW and PCGDPStatus (growth) indicates that the statistically significant adverse effect of the minimum wage on employment was mitigated when the geometric growth rate of the minimum wage, FDI and per capita GDP for a particular province within a specific period was above the average across all other provinces. When the minimum wage growth rate between 2004 and 2015 was sufficiently high, an upwards adjustment in the minimum wage slightly increased hiring. Possibly this above average minimum wage growth rate not only reflected a cost of living rise in a particular province, but was a reward for the rising skill levels of Chinese minimum wage earners. Furthermore, when the growth rate of FDI within these 12 years was sufficiently high, an upwards adjustment in the minimum wage slightly increased hiring. Perhaps, provinces with higher FDI growth rate reflect stronger future prospects, thus requiring slightly more employees even when the minimum wage is increased.

However, the above results for the interaction of wages and FDI did not apply for a comparison between the average absolute value in a particular province and the overall average across all provinces within 12 years (as in Table 2) or when the comparison was done on a yearly basis (as in Table 1). This suggests that when the minimum wage is increased, hiring decisions may vary depending on whether employers scrutinise changes in minimum wages on a year-on-year basis or on an overall basis within a time period.

By contrast, the role played by per capita GDP in mitigating the negative impact of the minimum wage on employment was applicable both where the comparison was between the geometric growth rate in a particular province and the overall average geometric growth rate across all provinces within 12 years (as in Table 2), and also where the comparison was on a yearly basis (as in Table 1). However, it was not applicable when average absolute value was used as the criterion for comparison. This result indicates that when the growth rate of the per capita GDP between 2004 and 2015 is sufficiently high in a particular province (i.e. above the average across provinces), an upwards adjustment in the minimum wage will slightly increase hiring, regardless of whether the per capita GDP status of being above or below the average is based on the geometric growth rate or on a year-on-year approach. In this case, employers will scrutinise the annual economic performance as well as the overall economic performance within a period of time when making hiring decision in the face of minimum wage adjustment.

Nonlinearity between the minimum wage and employment

Table 3 presents the nonlinear effect of the minimum wage on employment based on the specification in equation (6.1). The insignificant J-test and AR test prove that we have

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Table 3. Nonlinear effect of minimum wage on employment (two-step system-GMM).

	Nonlinear model
EMP (−1)	0.886***
MW	0.614**
MW^2	–0.043**
FDI	0.035***
Per capita GDP	–0.021
PROD	–0.243
Constant	–1.139
AR(1) (p-value)	0.275
AR(2) (p-value)	0.510
J-test (p-value)	0.437
No. of groups	31
No. of instruments	16
Threshold value ($\delta EMP/\delta MW$)	7.028 (1128.31 yuan)[a]

FDI: foreign direct investment; GDP: gross domestic product; PCGDP = amount of per capita gross domestic product; PROD: labour productivity as measured by PCGDP per employment.
[a]The threshold value is calculated in highest precision before the respective coefficients are rounded up to three decimal places.
*** and ** denote significance level at 1% and 5%, respectively. All variables are expressed in their natural logarithmic form.

Table 4. Sasabuchi–Lind–Mehlum test for U-shaped relationship.

Descriptions	Values
Extreme (threshold) point	1128.31
95% Fieller interval	[147.65, 1612.80]
Slope at MWmin	0.112**
	(1.882)
Slope at MWmax	–0.046***
	(–2.577)
Hypothesis test	H_0: U-shaped
	H_1: Inverted U-shaped
SLM test for U-shaped (t-value)	1.88**
p-value	0.035

SLM: Sasabuchi–Lind–Mehlum.
t-value in parentheses.
*** and ** denotes significance level at 1% and 5%.

valid instruments for the model and that it does not suffer from autocorrelation problems. The relationship between the minimum wage and employment is found to be nonlinear and inverted U-shaped. This is further proven in Table 4 when the Sasabuchi–Lind–Mehlum test (SLM) results show that the slope of MWmin and MWmax is positive and negative, respectively, while the null hypothesis of a U-shaped relationship has been significantly rejected, at 5% level. The inverted U-shaped relationship implies that the

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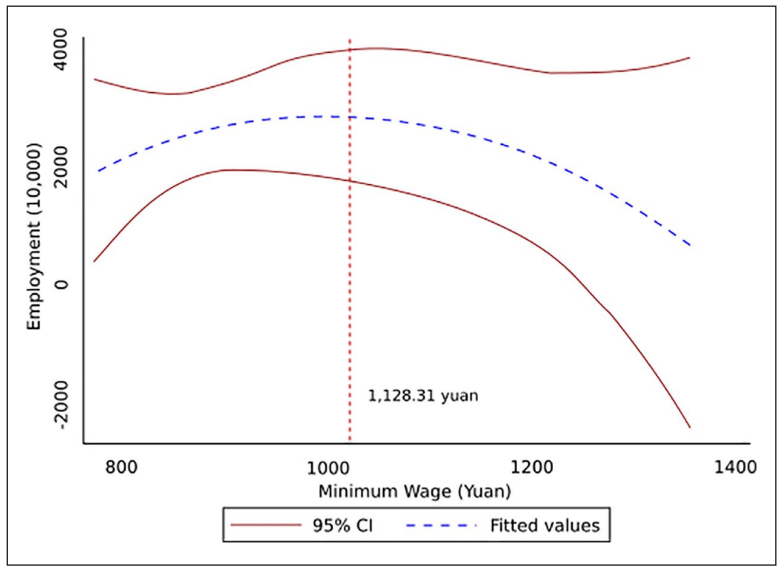

Figure 2. Scatter plot: employment versus minimum wage.
Source: Authors, (see text).

minimum wage has a positive effect on employment until a certain level of minimum wage. After passing the threshold point, the increase in minimum wage has a detrimental effect on employment. Non-monotonicity of the inverted U-shape implies the existence of a maximum threshold value of the minimum wage, with the amount of 7.028 in its logged form or 1128.31 yuan in its anti-logged form.

The simulated inverted U-shaped graph is shown in Figure 2. The solid line represents fitted values within a 95% confidence interval as depicted by the dashed line in the figure. This confirms the inverted U-shaped relationship between the minimum wage and employment. The minimum wage had a positive effect on employment when the minimum wage level was below 1128.31 yuan, whereas a further increase in the minimum wage beyond this threshold resulted in an employment reduction. Provinces with an average minimum wage below 1128.31 yuan within 2004–2015 are subsequently selected for drawing the scatterplot between FDI and GDP in Figure 3. Provinces with above-the-average FDI and GDP level are Shanghai, Beijing, Tianjin, Zhejiang, Fujian, Liaoning, Shandong, Guangdong and Jiangsu. All these provinces are located along the coastal line east of China that have attracted huge amount of FDI inflows, and hence, generated higher GDP level (Wye, 2018). It follows that provinces with greater amount of FDI and GDP may trigger a positive employment impact of minimum wage rise.

The inverted-U relationship between minimum wage and employment in China can be interpreted as a result of the varying goals to be achieved following the evolution of minimum wage policy since 2004. Our study is based on the period of 2004–2015, overlapping with the period where the 2004 minimum wage reform in China took place. Such a reform rectified the shortcomings found in the 1993 rules when minimum wage was

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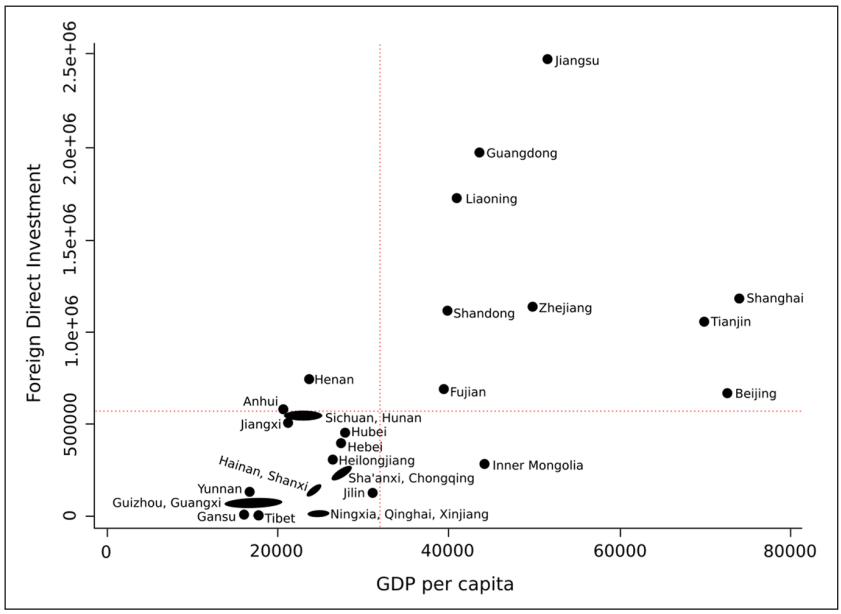

Figure 3. Scatter plot of total employment rates versus FDI (foreign direct investment).
Source: Authors, (see text).

first introduced, through its extended coverage to migrant workers and increased penalties for non-compliance. Obviously, the reform was meant to resolve social conflicts between migrant and non-migrant workers besides improving the social welfare of exploited workers. Chinese firms still managed to increase their labour productivity without harming employment and profitability, thanks to better inventory management and greater capital investment (Mayneris et al., 2018). Existing firms that were more productive drove out less productive firms, while new firms that could absorb the increased labour cost with higher productivity entered the industry, enhancing aggregate economic efficiency without reducing employment (Mayneris et al., 2014). Such a labour market cleansing effect explains the positive association between the minimum wage and employment in China after 2004.

The need for labour power to facilitate FDI in the coastal provinces from the beginning of China reform in 1978 could also explain the positive link between minimum wage and employment in China. Those provinces located adjacent to the coastal ones have been the net exporters of manpower to the FDI-attracting coastal provinces (e.g. Anhui and Jiangxi for Shanghai, and Guangxi and Jiangxi for Guangdong or Fujian). As such, these inland provinces generally maintained lower minimum wage level and served as reservoir of manpower to be supplied to the coastal provinces with higher minimum wage. To certain extent, this scenario explains the relatively high employment at relatively low minimum wage in our study.

On the contrary, the negative effect of minimum wages on employment observed in our study may be explained by the Chinese government's intention to achieve provincial

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rebalancing goals. Minimum wage policy in the aftermath of the 2008–2009 economic crisis mainly prompted firms towards production structure upgrading by offering higher minimum wages to attract high-skilled workers. Coastal province like Guangdong, for instance, achieved this goal by sacrificing its labour-intensive industries, thus cutting back on low-skilled workers amid rising minimum wages. The displaced workers were expected to return to their province of origin, thanks to the central government's proactive response via the 'Go Up' (industrial upgrading), 'Go West' (relocation to inland China) and 'Go Out' (relocation overseas) policies. Besides reversing the net exporters of manpower role in the western provinces, these policies also address the issue of rising labour cost due to labour shortage in the coastal regions (Zhu and Pickles, 2014). In fact, employment numbers in China have dropped in 2018, when migrant workers in wealthier coastal regions left for western inland provinces (Koty and Zhou, 2020), partly due to the household registration issue. Such a geographical rebalancing, combined with the industrial upgrading strategy of Chinese economic development, has driven the minimum wage policy of the recent decade in China to exert negative impact on employment through its cleansing role (Mayneris et al., 2014, 2018)

Limitation and future study

A limitation of the present study is its identification of the minimum wage in each province as an average between the lowest and the highest minimum wage band within a particular province. Since different cities within the same province have different minimum wages in China, future research may 'zoom in' the analysis to city level within the same province.

Concluding remarks and policy implications

This study examines if the effect of minimum wage on employment is conditional on the level of minimum wage, FDI, per capita GDP and labour productivity in 31 Chinese provinces in the period 2004–2015. In general, in that period, an increase in the minimum wage reduced hiring as FDI inflow rose, regardless of the amount of investment. This finding highlights labour cost concerns among foreign direct investors. The Chinese government may want to respond, either by reducing the magnitude and frequency of minimum wage adjustments or by increasing subsidies for foreign investment.

The positive employment effect of an increase in minimum wage, if any, may be mitigated by a growth in per capita GDP, owing to substitutability between low-skilled labour and capital following growth-led technological innovation. A rise in the minimum wage may enhance employment growth only when the per capita GDP is above the average, through creation of new sectors and human capital accumulation. As such, rapid economic growth in China should be complemented by a more balanced investment strategy between physical capital and human capital, and a more balanced human capital investment strategy across rural and urban regions (Heckman, 2005). In addition, labour productivity enhancement is an effective channel of adjustment in China to mitigate the adverse employment effects of rising minimum wages.

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When the minimum wage is increased, employers' hiring decision may vary according to whether they scrutinise changes in minimum wage, FDI and per capita GDP on a year-on-year basis or on an overall basis within a period of time. In terms of the minimum wage and FDI, the latter criterion, based on geometric growth, is more relevant. Employers would respond to rising minimum wage by increasing their hiring if the geometric growth of minimum wage and FDI for a particular province within a period of time is above the overall average across other provinces. Overall growth rates of minimum wage and FDI within a time period should be analysed by employers or foreign investors, and not the year-on-year comparison. In terms of per capita GDP, however, employers will scrutinise annual economic performance as well as overall economic performance, considering both short-term and long-term economic performance when deciding on hiring amid rising minimum wage. As such, the Chinese government should ensure rapid short-term and long-term economic growth to facilitate employment creation even when the minimum wage is increased.

The nonlinear, inverted-U-shaped relationship between the minimum wage and employment implies a maximum threshold to the minimum wage. Employers in provinces where the minimum wage exceeds this threshold may need to readjust their cost structures without resorting to retrenchment, especially in 2020 as almost all provinces recorded minimum wage beyond the 2019 threshold (Koty and Zhou, 2020).

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Note

1. The addition of interaction terms may lead to multicollinearity as the interaction terms tend to be strongly correlated with the original variables used to construct them (Darlington, 1990). In this study, we found that the variance inflation factor (VIF) of multicollinearity test is obviously high if *MWStatus, FDIStatus, PCGDPStatus* and *PRODStatus* are added as separate categorical variables into the models.

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