Interregional Impact of Foreign Direct Investment on Urban-Rural Income Inequality in China's Inland Provinces

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Abstract: Foreign direct investment (FDI) in China is heavily concentrated in the coastal region which has attracted hundreds of millions of rural migrants from inland provinces. This paper aims to investigate the interregional impact of FDI on urban-rural income inequality in inland provinces in China. Through the application of a provincial level panel dataset and regression techniques, this paper shows empirically that on average FDI's interregional effect has contributed to the increase in urban-rural income inequality in inland provinces. However, FDI in the inland and coastal provinces has different spillover effects. Specifically, urban-rural income inequality in an inland province could fall due to spillover effects from FDI in other inland provinces while it may increase because of the spillover effects from FDI in the coastal provinces. This variation may result from the difference in the trade mode (processing vs ordinary trade) which FDI in the coastal and inland areas is engaged in.

Key words: Foreign direct investment; interregional spillovers; urban-rural income inequality; Kuznets curve; China

JEL codes: C36, D31, F16, F21, F63, F69

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1. Introduction

FDI inflows into China have been heavily concentrated in the coastal region which now accounts for over 80 per cent of total FDI inflows. This uneven regional distribution of FDI in China has, directly through capital input and indirectly through intraregional and interregional spillovers, contributed to the increasing income gap between the coastal and inland regions in China (Fujita and Hu, 2001; Zhang and Zhang, 2003; Fu, 2004; Ng and Tuan, 2006; Wan *et al*., 2007; Chen, 2015). With the widening of the income gap between the coastal and inland regions, income inequality within the inland region has also worsened substantially as compared to that in the coastal region. During the period 1983-2010, the urban-rural household per capita income ratio in the inland region increased from 1.69 to 3.34 while that in the coastal region rose from 1.43 to 2.55. Has the uneven regional distribution of FDI contributed to the widening gap between urban and rural household per capita income in the inland region? This is the key question to be explored here.

A growing number of studies on the impact of FDI on income inequality of host countries across the world have reached mixed conclusions. However, empirical studies on the impact of FDI on income inequality in China are very limited, and in particular, empirical studies on the interregional impact of FDI on income inequality are rare. This paper attempts to fill the gap in the literature and investigate empirically the interregional impact of FDI on urban-rural income inequality in inland provinces in China. Specifically, this paper aims to use Chinese provincial level data to test whether there is an interregional impact of FDI on urban-rural income inequality in inland provinces, and to determine the interregional impact of FDI in different regions.

This study contributes to the literature in two ways. First, this study investigates not only the impact of an inland province's own FDI on urban-rural income inequality but also the interregional impact of FDI on urban-rural income inequality in inland provinces. It thus presents new empirical evidence of the impact of FDI on income inequality in host countries. Second, this study explores how China's FDI located in different regions (coastal vs inland regions) and engaged in different trade activities (processing vs ordinary trade) affects urban-rural income inequality in inland provinces. Such empirical findings are important for policymakers designing and implementing policies to enhance and facilitate the diffusion of knowledge spillovers of FDI to local economies.

The structure of the paper is as follows. The next section discusses the channels through which FDI affects income inequality in developing countries and presents a literature review. Section 3 presents the empirical model, describes the data, specifies the variables and discusses econometric issues. Section 4 conducts the regression and explains the estimation results. Finally, Section 5 provides the conclusion and policy implications.

2. FDI and income inequality

Dunning (1993) argued that multinational enterprises (MNEs) bring a package of capital, technology, production know-how, modern management, marketing skills and information, competition and so on. Therefore, in the context of developing countries, it is expected that FDI would not only contribute to economic growth and development but also affect income inequality through changing employment and wage structures of developing host countries. First, FDI contributes to host countries' economic growth and development through capital formation, employment creation, technology transfer and knowledge spillovers (Dunning, 1993; Caves, 1996). Although FDI may initially stimulate growth only in some leading or

favoured sectors, which may increase income inequality, its benefits eventually spread throughout the whole economy and it could in the long run facilitate more even income distribution (Tsai, 1995). This argument is in line with the Kuznets inverted-U curve hypothesis (Kuznets, 1955), which states that income inequality increases at the early stage of development but declines later once a certain stage of development is reached. Therefore, FDI may contribute to reducing income inequality in developing host countries through its economic growth and development effect.

Second, FDI creates employment, which is especially important in the developing host countries where there is a large amount of surplus labour. If developing host countries are relatively abundant in unskilled labour, to take advantage of the relatively abundant factors of production, FDI, especially efficiency-seeking and export-oriented FDI, should be concentrated in activities that use unskilled labour intensively in these economies (Lee and Vivarelli, 2006; Ucal *et al*., 2014). As a result, FDI should lead to an increase in the demand for unskilled labour, which not only increases the income of previously unemployed workers but also drives up wages of the unskilled workers relative to the wages of the skilled workers in developing host countries. Therefore, income inequality will decline in these countries as FDI increases.

However, FDI may also increase income inequality in developing host countries. Because of the high technology content embodied in production, MNEs will tend to demand more skilled labour, thus increasing the skill intensity of production in developing host countries (Feenstra and Hanson, 1997). Second, through competition and knowledge spillovers, such as imitation and reverse engineering, vertical industrial linkages leading to technology upgrading, and labour turnover, local firms are induced to undertake R&D, innovation and skill-biased

technological changes (Wang and Blomstrom, 1992; Wood, 1995; Borensztein *et al*., 1998; de Mello, 1999; Saggi, 1999; Thoenig and Verdier, 2003). If these new technologies require relatively more skilled than unskilled labour, relative wages of skilled workers increase as FDI increases (teVelde, 2003; Figini and Gorg, 2011). Therefore, when allowing for capital deepening and skill-biased technological change, FDI not only promotes economic growth but also may increase income inequality in developing host countries.

Are there interregional effects of FDI on income inequality in a country? Theoretically, FDI can have interregional effects on income inequality in a developing host country through two channels, namely interregional knowledge spillovers and interregional migration and hence income remittance.

Due to its ownership advantages, FDI can generate positive interregional knowledge spillovers on economic growth and development in other regions. First, FDI stimulates interregional migration of labour and when employees trained or hired by MNEs move back to their own regions they can bring knowledge to local firms and knowledge diffusion may take place (Du *et al*., 2005; Fosfuri *et al*., 2001; Holger and Strobl, 2005; Rozelle *et al*., 1999). Second, FDI may develop backward and forward industrial linkages with firms in other regions, providing firms in other regions the opportunities to gain scale economies and productivity improvement through links in the supply chain (Chen *et al*., 2013; Javorcik, 2004; Kugler, 2006; Liu, 2008). Third, innovations and R&D activities of MNEs might generate interregional knowledge spillovers through imitating and reverse engineering by firms in other regions (Bronzini and Piselli, 2009; Keller, 2002; Kuo and Yang, 2008). Fourth, macroeconomic consequences, such as increased market demand for products from other regions as a result of increasing income generated by FDI (Brun *et al*., 2002; Zhang and

Felmingham, 2002). However, FDI may also compete with local firms in other regions, for example, crowding them out from the product market and competing with them in the labour and resources markets (Aitken and Harrison, 1999; Branstetter and Feenstra, 2002; Fu, 2011; Hu *et al.*, 2005). Thus FDI may have negative interregional spillovers on economic growth in other regions. Therefore, if FDI has positive interregional spillovers on economic growth, it will contribute to reducing income inequality in other regions; on the contrary, if FDI has negative interregional spillovers on economic growth, it will contribute to increasing income inequality in other regions.

In terms of interregional migration and income remittance, FDI attracts interregional migration of surplus labour from other regions. In the case of China, FDI in the coastal region has attracted hundreds of millions of rural migrant workers from inland regions. On the one hand, interregional migration of rural migrant workers from inland regions causes a loss in income at home, which is the opportunity cost of interregional migration. On the other hand, interregional rural migrant workers from inland regions remit money back to their home towns. Therefore, if the amount of remittance of interregional rural migrant workers is higher than the lost income at home, rural households' income will increase, thus reducing urban-rural income inequality in inland regions. On the contrary, if the amount of remittance of interregional rural migrant workers is lower than the lost income at home, rural households' income will decrease, thus increasing urban-rural income inequality in inland provinces.

Therefore, theoretically FDI could improve or worsen income inequality in other regions. The exact interregional impact of FDI on income inequality is subjected to empirical investigations. There are a growing number of studies analysing the impact of FDI on income inequality in host countries. The conclusions are mixed. Most studies find that FDI increases

income inequality in host countries (Choi, 2006; Lee, 2006; Basu and Guariglia, 2007; Herzer *et al*., 2014; Asteriou *et al*., 2014). On the contrary, a small number of studies, for example, Jensen and Rosas (2007), Chintrakarn *et al*. (2012) and Herzer and Nunnenkamp (2013), show that FDI reduces income inequality in host countries. A few studies, for example, Tsai (1995), Mahler *et al*. (1999), Mah (2003), Sylwester (2005), Bhandari (2007), Adam (2008) and Lin *et al*. (2013), find that FDI has either a mixed impact or no impact on income inequality in host countries. In the case of China, most of the studies are concerned with the impact of FDI on regional income inequality. For example, Zhang and Zhang (2003), Fu (2004) and Wan *et al*. (2007) illustrate that FDI contributes to the increase in inequality between inland and coastal regions in China.

However, previous empirical studies mentioned above exclusively focused on investigating the impact of a host region's own FDI on its income inequality. There is no empirical study of the interregional impact of FDI on income inequality in a host country. This paper will fill the gap in the field and contribute to the existing literature by examining the intra- and inter-regional impact of FDI on urban-rural income inequality in inland provinces of China. In this study, three questions are discussed: (1) What is the (intra-regional) impact of an inland province's own FDI on its urban-rural income inequality?; (2) What is the (interregional) impact of other provinces' FDI on urban-rural income inequality in an inland province?; and (3) Does FDI associated with processing trade and ordinary trade have different interregional impacts on urban-rural income inequality in an inland province?

3. Data and methodological issues

3.1 The empirical model

The analytical framework in this paper follows the conventional literature on the determinants of income inequality (Ravallion and Chen, 1999; De Gregorio and Lee, 2002). The main modification in this paper is to introduce FDI-related variables into the model so that the relationship between FDI and income inequality can be investigated. On the basis of the discussions in Section 2, the empirical version of the model is expressed as follows:

$$UR_{it} = \beta_0 + \beta_1 LnPGDP_{it-1} + \beta_2 (LnPGDP_{it-1})^2 + \beta_3 FDI/TK_{it-1} + \beta_4 LnRFDI_{it-1} + \beta_5 T/GDP_{it-1} + \beta_6 GEDU/GDP_{it-4} + \varepsilon_{it} \quad (1)$$

where UR_{it} is the ratio of urban household per capita disposable income and rural household per capita net income of inland province i in year t; $PGDP_{it-1}$ is per capita GDP (yuan at 1978 prices) in inland province i in year t-1; FDI/TK_{it-1} is the share of FDI stock in total capital stock in inland province i in year t-1, which captures the impact of inland province i's own FDI; $RFDI_{it-1}$ is the total FDI stock outside inland province *i* in year *t*-1, which captures the interregional impact of FDI on inland province i; T/GDP_{it-1} is total trade (import plus export) over GDP in inland province i in year t-1; $GEDU/GDP_{it-4}$ is the share of government expenditure on education over GDP in inland province i in year t-4, assuming that education will have a longer period of time lag before it can have an effect on income inequality;[1] and ε_{it} is the error term.

This model, equation (1), allows us to test the impact of FDI on urban-rural income inequality in inland provinces in two aspects. First, we can test the impact of an inland

[1] In empirical analysis, different lag numbers are also considered.

province's own FDI on urban-rural income inequality. Second, we can test the interregional impact of FDI on urban-rural income inequality in inland provinces. If the coefficients of β_3 and β_4 are positive and statistically significant, then inland provinces' own FDI (*FDI/TK*) and FDI (*RFDI*) outside inland provinces have contributed to an increase in urban-rural income inequality in inland provinces. On the contrary, if they are negative and statistically significant, then they have contributed to the reduction in urban-rural income inequality in inland provinces. The following sections describe the data, specify the variables and discuss the econometric issues.

3.2 Data and variable specification

This study uses a provincial level dataset containing China's 31 provinces and covering the period from 1987 to 2010.[2] The 31 provinces are divided into 11 coastal provinces and 20 inland provinces.[3] All data used in this study are from *China Statistical Yearbook* (NBS, various issues) except those stated otherwise.

The dependent variable used in this study is the ratio of urban household per capita disposable income to rural household per capita net income (*UR*). The World Bank (1997) estimated that urban-rural income inequality accounted for more than half of overall income inequality in 1995, and the change in urban-rural inequality explained about 75 per cent of the change in overall income inequality during 1984-1995. Yang (1999) estimated that urban-rural inequality explained 82 per cent in Jiangsu province and virtually 100 per cent in

[2] According to China's administrative division, China has 22 provinces, 4 municipalities and 5 autonomous regions. For simplicity, in this paper "province" is used to represent provinces, municipalities and autonomous regions.

[3] The 11 coastal provinces include Beijing, Fujian, Guangdong, Hainan, Hebei, Jiangsu, Liaoning, Shandong, Shanghai, Tianjin and Zhejiang. The 20 inland provinces include 9 central region provinces which are Anhui, Guangxi, Heilongjiang, Henan, Hubei, Hunan, Jiangxi, Jilin and Shanxi and 11 western region provinces which are Chongqing, Gansu, Guizhou, Inner Mongolia, Ningxia, Qinghai, Shaanxi, Sichuan, Tibet, Xinjiang and Yunnan.

Sichuan province of the change in the overall income inequality during 1986-1994. While the exact estimates differ among researchers, all agree that urban-rural inequality is a major component of overall income inequality in China (Wei and Wu, 2001; Hu and Chen, 2015).

Calculating the share of foreign capital

We use the share of FDI stock over total capital stock of an inland province (*FDI/TK*) to capture the impact of FDI on urban-rural income inequality in inland provinces. FDI stock at the end of each year is calculated by using the perpetual inventory method assuming the depreciation rate is 5 per cent.[4] The data for provincial total capital stock are drawn from Wu (2009).

Measuring regional FDI stock

We use the formula $\Sigma_j FDI_{jt} * e^{-\delta Dij}$ (j≠i) to measure the total external FDI stock (*RFDI*) to which an inland province is exposed.[5] FDI_{jt} is the amount of FDI stock in province *j* in year *t*; D_{ij} is the distance in 1,000 km between inland province *i* and province *j*; and $e^{-\delta Dij}$ is a discount factor. Therefore, $FDI_{jt} * e^{-\delta Dij}$ measures the amount of FDI stock in province *j* that might affect inland province *i* in year *t*, and $\Sigma_j FDI_{jt} * e^{-\delta Dij}$ (j≠i) is the total amount of FDI stock to which an inland province *i* is exposed in year *t*. The value of δ represents the speed at which the interregional effects of FDI diminish as distance increases. Following Keller (2002), we assume δ equals 1, and the external FDI stock variable (*RFDI*) becomes $\Sigma_j FDI_{jt} * e^{-Dij}$ (j≠i).

[4] Data for FDI inflows are from, before 2005 (including 2005), *China Statistical Yearbook* (NBS, various issues); after 2005, *Provincial National Economic and Social Development Statistics Bulletin* (PBS, various issues of each province).

[5] This method is also used by other studies (e.g. Keller, 2002; Ouyang and Fu, 2012; Chen, 2015).

Controlling for other provincial variables

Other province-specific variables which are expected to have an impact on urban-rural income inequality include the provincial per capita GDP (*PGDP*) and trade (export plus import) to GDP ratio (*T/GDP*). *PGDP* is used to represent the level of economic development of a province, which is measured as RMB yuan at 1978 prices. According to the Kuznets inverted-U curve hypothesis, the coefficient of the *PGDP* variable is expected to be positive (increasing urban-rural income inequality) and the coefficient of the square term of *PGDP* is expected to be negative (reducing urban-rural income inequality).

T/GDP is usually used as an indicator for the degree of openness of an economy. Based on the traditional trade theories, trade liberalisation will lead countries to specialise in the production in which they have a comparative advantage, and as a consequence, trade liberalisation will benefit the exporting sector and hurt the import competing sector (Krugman and Obstfeld, 1991). Since inland provinces have a comparative advantage in labour-intensive agricultural activities, like animal husbandry and horticultural production, and in natural resource-based industries, in general agricultural sectors and primary industries in the rural areas will benefit from trade liberalisation in inland provinces. As a result, trade liberalisation will tend to reduce urban-rural income inequality in inland provinces, and the sign of the coefficient of the *T/GDP* variable is expected to be negative.

Finally, we control for the improvement of human capital. It is assumed that improvement in human capital can help reduce the urban-rural income inequality. The share of government expenditure on education over GDP, denoted as *GEDU/GDP*, is used as an indicator to measure the improvement of human capital. It is expected that the sign of the *GEDU/GDP* variable is negative. Since education takes a relatively long period to have an effect on

improving labour quality, the variable of *GEDU/GDP* is lagged for 4 years, which is approximately equal to the period of primary schooling.[6]

3.3 Dealing with endogeneity issues

A major concern with the regression is the potential endogeneity problem. First, FDI tends to flow into provinces with a high level of economic development. Second, some macroeconomic policies may affect economic growth and FDI inflows across all provinces simultaneously. Third, the FDI variable may be correlated with those uncontrolled factors in the regression model. It is believed that many unobserved time-invariant and time-variant macro and province-specific factors affect provincial economic growth and income distribution and are also correlated with FDI inflows into provinces. Since economic growth and the development level affect income inequality, thus FDI variables may be endogenous. The endogeneity problem could distort the estimated impact of FDI on urban-rural income inequality in inland provinces. This potential endogeneity problem is handled in several ways.

First, all FDI variables are lagged by one year to reduce reverse causality. Second, inward FDI into nine ASEAN countries is used as the instruments for FDI variables of *FDI/TK* and *RFDI*.[7] The idea is similar to that in Haskel *et al*. (2007) and Chen (2015). China and ASEAN countries have many similarities in terms of economic development stage, economic and industrial structure, trade and investment liberalisation policies, and policies towards FDI inflows. According to the level of economic development and the attractiveness to FDI inflows, the nine ASEAN countries can be divided into three groups. Group 1 includes Singapore, Malaysia and Thailand, which have higher levels of economic development and

[6] Different lags for the variable of *GEDU/GDP* are tested in the empirical model. The results show that the coefficient of *GEDU/GDP* is insignificant for lags shorter than 4 years and becomes significant for lags longer than 4 years (including 4, 5 and 6 years).

[7] The nine ASEAN countries include Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.

attracted higher levels of FDI inflows. Group 2 includes Indonesia, Philippines and Vietnam, which have medium levels of economic development and attracted medium levels of FDI inflows. Group 3 includes Cambodia, Lao and Myanmar, which have lower levels of economic development and attracted lower levels of FDI inflows. Similarly, based on the level of economic development and the attractiveness to FDI inflows, China's 31 provinces can also be divided into three groups, namely the coastal region provinces, the central region provinces and the west region provinces which are parallel to the three groups of ASEAN. This instrumenting strategy maintains the key assumption that FDI inflows into ASEAN countries do not affect economic growth and, therefore, urban-rural income inequality of a single inland province in China (Chen *et al*., 2013; Chen, 2015).

Specifically, we use the average value of FDI stock and the average share of FDI stock in total capital stock of ASEAN's three country groups as instrumental variables for the value of FDI stock and share of FDI stock in total capital stock for each province of the corresponding China's three regional groups. ASEAN's FDI stock is calculated by using data from the World Investment Report (UNCTAD) and ASEAN's total capital stock is calculated by using data from the World Bank's World Development Indicators. Therefore, the FDI variables of FDI/TK and RFDI are instrumented by the corresponding variables of AFDI/ATK and ARFDI in the first-stage IV regressions respectively. In addition, fixed effect models are considered in order to take province-specific factors into consideration.

4. Regression results and interpretation

4.1 Interregional impact of FDI on urban-rural income inequality

Table 1 presents the estimation results from equation (1). Column (1) reports the estimation results of the random-effects model. Column (2) reports the estimation results of the fixed-

effects model. Based on the Hausman test, the fixed-effects model is preferred. Column (3) reports the estimation results of the IV model. The estimation results in column (3) show that all variables have the expected signs and are statistically significant at the 1 per cent level. As the level of significance of all coefficients in the IV model is higher than that in the fixed-effects model, our interpretation is based on the results from the IV estimation. In the first-stage IV regression (reported in Table 1A in the appendices), the estimated coefficients of *AFDI/ATK* and *ARFDI* are significant at the 1 per cent level and all the test statistics are significant, which confirms the strength of the instrumental variables.

Table 1 Estimation results of interregional impact of FDI on urban-rural income inequality in inland provinces (dependent variable: *UR*, 1987-2010)

Independent variables	Random-effects	Fixed-effects	IV
Constant	-5.2148 (-1.33)	-7.8502 (-1.80)*	
LPGDPt-1	1.9121 (1.75)*	2.6590 (2.22)**	4.5086 (4.27)***
LPGDPt-1^2	-0.1130 (-1.55)	-0.1573 (-1.99)*	-0.2755 (-4.03)***
FDI/TKt-1	-0.1488 (2.89)***	-0.1489 (-3.34)***	-0.6295 (-7.71)***
LRFDIt-1	0.1629 (3.14)***	0.1046 (2.18)**	0.2408 (3.79)***
T/GDPt-1	-0.0028 (-0.36)	0.0004 (0.05)	-0.0186 (-2.58)***
GEDU/GDPt-4	-0.0372 (-0.83)	-0.0881 (-1.91)*	-0.1680 (-3.54)***
No. of observations	456	456	456
No. of groups	19	19	19
R2	0.16	0.08	0.16
Wald Chi2	344.97***		
F-statistics		67.71***	64.33***

Notes: *** p<0.01, ** p<0.05, * p<0.1 and numbers in parentheses are t-statistics.
Hausman test: Chi2 (6) = 42.77 and Prob>chi2 = 0.0000, prefers fixed-effects model.

The regression results from the IV estimation show that the coefficient of *FDI/TK* is negative and statistically significant at the 1 per cent level, which reveals that an inland province's own FDI has contributed to the fall in urban-rural income inequality in that province. This

could be true because of the employment and spillover effects. First, MNEs directly employ rural unskilled workers. Apart from the direct employment effect, FDI also has an indirect employment effect through macroeconomic consequences, namely the employment of more rural unskilled workers locally due to economic growth caused by FDI. The direct and indirect employment effects of FDI will increase rural household income, contributing to the fall in urban-rural income inequality. Second, when rural workers hired by MNEs move back to their own hometowns and villages and set up their own businesses they can bring knowledge learned from MNEs to their own firms, which not only accelerates knowledge diffusion from MNEs to the local economies but also increases rural employment and rural household income, thus reducing urban-rural income inequality.

Furthermore, the coefficient of *RFDI* is positive and statistically significant at the 1 per cent level, which implies that interregional effects of FDI have contributed to the rise of urban-rural income inequality in inland provinces. This finding is somewhat surprising as it is expected that FDI outside an inland province could absorb rural migrant workers from that province, which would increase their income and contribute to the fall in urban-rural income inequality in that province. The possible explanations for this finding could be that FDI's interregional effects have generated negative spillovers on economic growth in inland provinces through competition in both factor and product markets, or interregional rural migrant workers have remitted less of their income back home which cannot compensate for the lost income of their hometowns. However, this unexpected finding may not reflect the true effect of FDI in different regions on urban-rural income inequality in inland provinces. Therefore, in the next section, *RFDI* will be divided into coastal FDI (*CRFDI*) and inland FDI (*IRFDI*) and their impacts on urban-rural income inequality in inland provinces will be investigated separately.

In addition, the coefficient of the *PGDP* variable is positive and while the coefficient of the square term of *PGDP* is negative. Both coefficients are statistically significant at the 1 per cent level. This finding reveals that there exists a Kuznets-type inverted-U curve relationship between urban-rural income inequality and economic development in inland provinces. It implies that with economic development and an increase in per capita income, urban-rural income inequality in inland provinces will eventually decline and more equal distribution of income will be achieved.

The coefficient of *T/GDP* is negative and statistically significant at the 1 per cent level, which reveals that trade liberalisation not only has a strong impact on income distribution but also contributes to reducing urban-rural income inequality in inland provinces. As discussed above, trade liberalisation will benefit the export sectors to which a country has a comparative advantage and hurt the import competing sectors to which a country has a comparative disadvantage. Because inland provinces have comparative advantages in labour-intensive agricultural activities, like animal husbandry and horticultural production, and in natural resource-based activities, which are mainly concentrated in the rural areas, therefore, trade liberalisation has benefited the rural areas in inland provinces. As a result, trade liberalisation has contributed to reducing urban-rural income inequality in China's inland provinces. Finally, the coefficient of *GEDU/GDP* is negative and statistically significant at the 1 per cent level, which implies that government spending on education contributes to reducing urban-rural income inequality. This finding indicates that human capital improvement is very important for the reduction in urban-rural income inequality.

4.2 Interregional impact of FDI: coastal vs inland provinces

There are two main features associated with FDI in China. First, FDI is overwhelmingly concentrated in the coastal provinces, accounting for over 80 per cent of total FDI inflows into China. Second, FDI in the coastal provinces is heavily engaged in processing trade. As Table 2 shows, the average share of processing trade was 46.61 per cent in coastal provinces as compared to only 12.84 per cent in inland provinces during the period 2003-2009. On average, FDI firms' trade accounts for over 50 per cent of China's total trade and is heavily engaged in processing trade particularly in coastal provinces. Therefore, in terms of trade patterns, FDI in inland provinces is less engaged in processing trade and hence may have extensive industrial linkages with the local economies through local sourcing, while FDI in coastal provinces is heavily engaged in processing trade and therefore may have no or very week industrial linkages with the local economies because processing trade FDI firms import inputs and intermediate products from overseas and export the final products abroad.

Table 2 Shares of processing trade in coastal and inland provinces

	2003	**2005**	**2007**	**2008**	**2009**
Coastal provinces	46.07	48.57	45.64	45.27	47.52
Inland provinces	12.06	12.72	13.92	12.64	12.85

Sources: Calculated from Qiu (2013) and China Statistical Yearbook (NBS, various issues).
Notes: The data for coastal region provinces include Beijing, Shanghai, Jiangsu, Fujian and Guangdong to which the data are available. The data for inland region provinces include Shanxi, Inner Mongolia, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, Shaanxi, Gansu and Xinjiang to which the data are available.

Knowledge spillovers through industrial linkages are one of the most important channels through which technology, management skills and marketing information are transferred from FDI firms to the local economies (Chen, 2015). Therefore, FDI associated with different degrees of processing trade may have different spillover effects on inland provinces. FDI, in coastal provinces is heavily engaged in processing trade and would have no knowledge

spillovers on inland provinces because of the lack of industrial linkages. It could even have negative spillovers on inland provinces because of its reducing demand for intermediate inputs from, and competing in world export markets with, inland provinces, which would have a negative impact on economic growth thus contributing to the rise in urban-rural income inequality in inland provinces. An inland province would benefit from positive spillovers from FDI in other inland provinces which are mainly engaged in ordinary trade and relies on local sources for raw materials and intermediate inputs. These positive spillovers may have a positive impact on economic growth thus contributing to the fall in urban-rural income inequality in inland provinces. Therefore, the interregional impacts of coastal FDI and inland FDI on urban-rural income inequality in an inland province could be different.

To explore the possible difference in the interregional impacts of coastal and inland FDI on urban-rural income inequality in an inland province, the following empirical model is considered:

$$UR_{it} = \beta_0 + \beta_1 LnPGDP_{it-1} + \beta_2 (LnPGDP_{it-1})^2 + \beta_3 FDI/TK_{it-1} + \beta_4 LnCRFDI_{it-1} + \beta_5 LnIRFDI_{it-1} + \beta_6 T/GDP_{it-1} + \beta_7 GEDU/GDP_{it-4} + \varepsilon_{it} \quad (2)$$

where *CRFDI* is total FDI stock in the coastal provinces and *IRFDI* is total FDI stock in inland provinces with the exception of inland province i. These two variables are estimated by using the method descripted in Section 3.2. Other variables are defined in the same way as discussed in equation (1).

For the IV model, the variables of *FDI/TK*, *CRFDI* and *IRFDI* are instrumented by *AFDI/ATK*, *ACRFDI* and *AIRFDI* respectively. The first-stage IV regression results are

reported in Table 2A in the appendices. The estimated coefficients of *AFDI/ATK*, *ACRFDI* and *AIRFDI* are significant at the 1 per cent level and all the test statistics are significant, which confirms the strength of the instrumental variables. Table 3 reports the estimation results for the random-effects model, the fixed-effects model and the IV model of equation (2). Since the IV model produces consistent estimates, our interpretation is based on the results from the IV estimation. First the regression results for the variables of PGDP, $PGDP^2$, T/GDP, GEDU/GDP and FDI/TK are basically the same as the regression results from equation (1) in Sub-section 4.1. The rest of the discussion focuses on the FDI-related variables.

Table 3 Estimation results of interregional impact of coastal and inland FDI on urban-rural income inequality in inland provinces (dependent variable: *UR*, 1987-2010)

Independent variables	Random-effects	Fixed-effects	IV
Constant	-5.2879 (-1.43)	-9.9478 (-2.27)**	
LPGDPt-1	1.8818 (1.79)*	2.9913 (2.48)**	5.2895 (6.45)***
LPGDPt-1^2	-0.1100 (-1.55)	-0.1727 (-2.16)**	-0.3026 (-5.77)***
FDI/TKt-1	-0.1484 (-2.85)***	-0.1425 (-3.31)***	-0.3809 (-5.08)***
LIRFDIt-1	-0.0606 (-0.47)	-0.3211 (-1.78)*	-1.1921 (-4.59)***
LCRFDIt-1	0.2299 (1.61)	0.4137 (2.17)**	1.2938 (5.21)***
T/GDPt-1	-0.0032 (-0.46)	-0.0003 (-0.04)	-0.0108 (-2.12)**
GEDU/GDPt-4	-0.2630 (-0.57)	-0.0780 (-1.62)	-0.1126 (-2.77)***
No. of observations No. of groups R2 Wald Chi2 F-statistics	456 19 0.15 340.71***	456 19 0.02 55.83***	456 19 0.45 91.85***

Notes: *** p<0.01, ** p<0.05, * p<0.1 and numbers in parentheses are t-statistics.

Hausman test: Chi2 (7) = 69.91 and Prob>chi2 = 0.0000, prefers fixed-effects model.

First, the coefficient of *CRFDI* is positive and statistically significant at the 1 per cent level, while that of *IRFDI* is negative and statistically significant at the 1 per cent level. These results reveal that coastal FDI has contributed to increasing, while inland FDI has contributed to reducing, urban-rural income inequality in an inland province.

Two factors may be responsible for the interregional impact of inland FDI on urban-rural income inequality in an inland province. The first is the interregional migration and income remittance effect of inland FDI on urban-rural income inequality in an inland province. Inland FDI provides employment opportunities and attracts rural migrant workers from an inland province to migrate and work in neighbouring inland provinces. According to the 2002 China Household Income Projects (CHIP) survey, on average per interregional rural migrant worker in inland provinces remitted RMB955 yuan back home in 2002, which is less than the average rural household per capita net income of RMB2027 yuan in inland provinces in that year. Also according to the Rural Urban Migration in China (RUMiC) survey, on average per interregional rural migrant worker in inland provinces remitted RMB2156 yuan back home in 2009, which is also less than the average rural household per capita net income of RMB4262 yuan in inland provinces in that year. Therefore, interregional rural migrant workers in inland provinces remitted an amount smaller than their income at home, which cannot compensate for their lost income at home. Because interregional rural migrant workers are still counted as part of the rural population in their hometown, the interregional migration and income remittance effect of inland FDI tends to reduce rural household income in the migrant workers' hometown. As a result, inland FDI tends to increase urban-rural income inequality in an inland province through interregional migration and income remittance effects, as the remittance cannot compensate for the lost income of rural migrant workers at home in an inland province.

The second factor is the interregional spillover effects of inland FDI on economic growth in an inland province. According to empirical studies (e.g. Chen, 2015), inland FDI has positive knowledge spillovers and contributes to economic growth in an inland province due to its low degree engagement in processing trade and extensive interregional industrial linkages with the local economy. Therefore, inland FDI will contribute to reducing urban-rural income inequality in an inland province through its positive knowledge spillover effects on economic growth in that province. In addition, the regression results also suggest that the interregional positive knowledge spillover effects of inland FDI on economic growth outweighs the interregional migration and income remittance effect on urban-rural income inequality in an inland province during the sample period. Therefore, the overall interregional effect of inland FDI is to reduce urban-rural income inequality in an inland province.

The interregional impact of coastal FDI on urban-rural income inequality in an inland province can also be explained in a similar way. First, in terms of the interregional migration and income remittance effect of coastal FDI on urban-rural income inequality in an inland province, coastal FDI attracts hundreds of millions of interregional rural migrant workers from inland provinces to migrate and work in coastal provinces. These rural migrant workers in coastal provinces also remitted an amount smaller than their income back home. According to the 2002 China Household Income Projects (CHIP) survey, on average rural migrant workers in coastal provinces remitted RMB1221 yuan back home in 2002, which is less than the average rural household net income per capita of RMB2027 yuan in inland provinces in that year. The Rural Urban Migration in China (RUMiC) survey shows that, on average each rural migrant worker in coastal provinces remitted RMB3554 yuan back home in 2009, which is also less than the average rural household net income per capita of RMB4262 yuan in

inland provinces in that year. Therefore, coastal FDI tends to increase urban-rural income inequality in an inland province through interregional migration and income remittance effects as the remittance cannot compensate for the lost income of rural migrant workers at home in an inland province.

Second, in terms of the interregional spillover effects of FDI on economic growth in inland provinces, coastal FDI has negative spillovers on economic growth in an inland province due to its heavy engagement in processing trade and fewer interregional industrial linkages according to empirical studies (e.g. Chen, 2015). Thus the interregional effect of coastal FDI may lead to a rise in urban-rural income inequality through coastal FDI's negative interregional spillovers on economic growth in an inland province. Overall, both the interregional spillover effect on economic growth and the interregional migration and income remittance effect of coastal FDI tend to increase urban-rural income inequality in an inland province. Therefore, coastal FDI unambiguously contributes to an increase in urban-rural income inequality in an inland province. Since coastal FDI has overwhelmingly dominated FDI in China and the rural migrant workers are also concentrated in coastal provinces, the overall interregional impact of FDI on urban-rural income inequality in an inland province is to increase urban-rural income inequality as discussed in Sub-section 4.1. It contributes to the worse-off in urban-rural income inequality in an inland province of China.

5. Conclusion

This study investigates empirically the interregional impact of FDI on urban-rural income inequality in inland provinces of China with a particular emphasis of FDI in different regions. The empirical exercises are based on the analysis of a panel dataset containing China's 19

inland provinces over the period 1987-2010 and the application of various regression techniques.

Several findings are observed. First, a Kuznets inverted-U curve relationship between urban-rural income inequality and economic development in inland China is confirmed. Thus urban-rural income inequality in China's inland provinces will be gradually reduced as economic growth continues and per capita income keeps rising. Second, an inland province's own FDI may help reduce urban-rural income inequality because of job creation for rural unskilled labour, knowledge spillovers from labour movement, and contribution to economic development of the local economy, all of which contribute to the increase in rural household income and thus the potential fall in urban-rural income inequality. Third, urban-rural income inequality in an inland province could be reduced due to FDI in other inland provinces as the latter can create positive knowledge spillovers on economic growth in that province. The positive knowledge spillovers may originate from other inland province FDI's low engagement in processing trade and extensive industrial linkages with the local economies. However, the interregional migration and income remittance effect tends to increase urban-rural income inequality in an inland province because the average remittance sent by rural migrant workers is less than the average rural household per capita net income in inland provinces. Fourth, FDI in coastal provinces contributes to an increase in urban-rural income inequality in an inland province because of its negative spillover effects on economic growth in that inland province. The latter is due to coastal FDI's heavy engagement in processing trade, less industrial linkages and even competition with inland provinces' firms in both factor and product markets. In addition, the interregional migration and income remittance effect associated with FDI in coastal provinces tends to increase urban-rural income inequality in an inland province due to the average remittance sent by rural migrant workers

being less than the average rural household per capita net income in inland provinces. Finally, openness to trade and government expenditure on education have significant impacts on reducing urban-rural income inequality in inland provinces, which implies that increasing openness and the overall quality of human resources will reduce income inequality in inland provinces.

The above-mentioned findings have important policy implications. First, China should design policies to help inland provinces improve local economic and technological conditions and their overall investment environment in order to attract more FDI inflows. The implementation of the "Western Development Strategy" and the "One Belt and One Road Development Strategy" have improved and will continue to improve the investment environment of inland provinces. Second, China should re-design FDI policies by shifting away from encouraging export-oriented FDI to encouraging FDI flows into industries and sectors in line with China's overall economic structural adjustments and industrial upgrading. In particular, China should re-design processing trade policies to focus on increasing local sourcing and enhancing industrial linkages. Third, China should encourage contact, information exchange, production and technological cooperation, and joint R&D activities between FDI firms and domestic firms in general and between coastal FDI firms and inland firms in particular, in order to enhance and accelerate the diffusion of positive knowledge spillovers from FDI to China's economy. Finally, China should accelerate the pace of urbanisation by focusing on urban-rural integrated development, household registration system reform, and proper settlement of rural migrant workers in urban areas. The implementation of the "New Urbanisation Program 2014-2020" will facilitate the development of urbanisation, thus reducing urban-rural income inequality in China.

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Appendices

Table 1A First-stage regression results of interregional impact of regional FDI on urban-rural income inequality in inland provinces

Independent variables	FDI/TKt-1	LRFDIt-1
LPGDPt-1	6.2780 (4.64)***	3.5259 (8.49)***
LPGDPt-1^2	-0.4081 (-4.53)***	-0.1904 (-6.83)***
AFDI/ATKt-1	**0.3431** **(9.92)*** **	0.0584 (4.75)***
LARFDIt-1	-0.1995 (-2.61)***	**0.7360** **(28.26)*** **
T/GDPt-1	-0.0124 (-1.42)	0.0138 (4.81)***
GEDU/GDPt-4	-0.1722 (-2.99)***	-0.1338 (-8.28)***
Number of observations	456	456
F test of excluded instruments	69.60	1011.91
Angrist-Pischke multivariate F test of excluded instruments	84.02	1272.56
Underidentification test (Kleibergen-Paap rk LM statistic)	55.60	
Weak identification test (Kleibergen-Paap rk Wald F statistic)	43.49	
Endogeneity test of endogenous regressors (Sargan-Hansen statistics)	86.28	

Note: *** p<0.01, ** p<0.05, * p<0.1 and numbers in parentheses are t-statistics.

Table 2A First-stage regression results of interregional impact of coastal regional FDI and inland regional FDI on urban-rural income inequality in inland provinces

Independent variables	FDI/TKt-1	LIRFDIt-1	LCRFDIt-1
LPGDPt-1	5.7184 (4.07)***	5.2987 (10.65)***	3.2639 (7.47)***
LPGDPt-1^2	-0.3748 (-4.03)***	-0.2908 (-8.80)***	-0.1768 (-6.10)***
AFDI/ATKt-1	**0.3830** **(10.51)*** **	0.0770 (4.65)***	0.0570 (3.91)***
LAIRFDIt-1	-0.3886 (-2.16)**	**0.4697** **(7.32)*** **	0.1602 (3.04)***
LACRFDIt-1	0.2021 (0.99)	0.1547 (2.29)**	**0.5953** **(10.69)*** **
T/GDPt-1	-0.0088 (-1.03)	0.0121 (4.28)***	0.0140 (4.60)***
GEDU/GDPt-4	-0.1522 (-2.64)***	-0.1307 (-7.04)***	-0.1383 (-8.30)***
Number of observations	456	456	456
F test of excluded instruments	53.31	579.89	685.37
Angrist-Pischke multivariate F test of excluded instruments	79.61	41.51	70.26
Underidentification test (Kleibergen-Paap rk LM statistic)	47.40		
Weak identification test (Kleibergen-Paap rk Wald F statistic)	20.24		
Endogeneity test of endogenous regressors (Sargan-Hansen statistics)	78.70		

Note: *** p<0.01, ** p<0.05, * p<0.1 and numbers in parentheses are t-statistics.