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GLOBALIZATION AND REGIONAL INEQUALITY IN CHINA

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DISCUSSION PAPER 13.10

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Abstract: This paper examines the impacts of globalization on intra-provincial inequality in China. The empirical analysis is based on a dataset of Chinese counties and county-level cities. It is found that foreign direct investment (FDI) and intra-provincial regional inequality are negatively correlated, whereas the relationship between international trade and regional inequality is statistically insignificant. In addition, it is shown that the level of industrialization and service development in Chinese provinces has a positive effect on intra-provincial inequality. It implies that intra-provincial regional inequality will increase as the primary sector declines. The results also show that domestic trade is negatively correlated with regional inequality, whereas the transportation infrastructure has a positive effect on inequality in the country.

Keywords: China, county-level, inequality, globalization, industrialization
JEL codes: D63, F19, F21, F69, O14, O53

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1. Introduction

China has experienced rapid economic growth since 1978, the year which marks the beginning of the economic reform and the open-up policy. Gross domestic product (GDP) of China reached 40.1 trillion Yuan in 2010, while GDP per capita increased from 381 Yuan in 1978 to 29992 Yuan (State Statistical Bureau, 2011). Many people attribute this impressive achievement to the successful implementation of globalization in the reform (for example, see Tian, 1999, Chen and Feng, 2000, Dacosta and Carroll, 2001, Yao and Zhang, 2001a, Yao and Zhang, 2001b, Liu et al., 2002, Yao and Zhang, 2002, Yao, 2006, Tian et al., 2007, Kei and Yao, 2008, Fleisher et al., 2010, Lau, 2010, Li et al., 2010a, Li et al., 2010b, Gries and Redlin, 2011).

Although growth of this magnitude may seem a miraculous achievement, inequality has escalated in unison with the remarkable economic growth. The noteworthy increase in regional inequality poses a question mark on the benefits of economic growth and calls for further exploration of the dynamics behind the scenes. It is of interest to know if globalization is also responsible for the increase in regional inequality in China[1].

Cheong and Wu (2012) show that intra-provincial regional inequality is the crux of the problem of regional inequality in China. However, to our knowledge, there is no study examining the relationship between globalization and intra-provincial regional inequalities in all the provinces. Regrettably, most of the studies on regional inequality in the literature are centered on inter-provincial inequality, while many aspects of intra-provincial inequality amongst the county-level units are still unknown because of the lack of research at this level. Another issue is that the policy implications derived from those provincial level studies are only valid for formulating policy for alleviating regional inequality amongst the provinces, and it is impractical for the policy makers to rely on this information to design policy for mitigating regional inequality amongst the counties and county-level cities within each province.

This paper contributes to the literature by studying the impacts of globalization on intra-provincial regional inequality in China from 1997 to 2007. This is the first time that

[1] The word ‘globalization’ could mean different things. It refers to economic globalization in this paper and it is measured by the scope of foreign direct investment (FDI) and international trade.

the intra-provincial regional inequalities are measured for all the provinces in China and then used as dependent variable in regression analysis with other provincial characteristic variables. It is hoped that the findings of this study can shed light on the relationship between regional inequality and globalization in greater depth so as to derive policy implications for mitigating regional inequality in each province. Moreover, the findings can contribute to the debate as to whether the link between globalization and inequality is justified.

The remainder of this paper is structured as follows. Section 2 presents a review of the literature which is related to the impacts of globalization on inequality. Section 3 presents the discussions of the econometric model. Section 4 introduces the data used in this paper. Section 5 presents the results and interpretations. Section 6 concludes with some policy recommendations.

2. Literature review

Economic globalization can be measured in different ways, but the most common practice in the literature is to measure globalization by foreign direct investment (FDI) and international trade. It is well known that FDI can boost economic growth. FDI can increase the capital stock of the recipient country, and also lead to technological progress, which is important to long term economic growth. De Mello (1997) suggests that the impact of FDI on growth can be explained by the efficiency spillovers to domestic firms. FDI can increase the value-added content of the FDI-related production, and also generate increasing returns in domestic production through positive externalities and productivity spillovers. Moreover, FDI is a source of human capital augmentation by knowledge transfers through labour training, skill acquisition and diffusion. FDI can bring in new production and managerial technologies as well as advanced organizational arrangements. Many cross-country studies suggest that FDI can boost economic growth (for example, Borensztein et al., 1998, Basu and Guariglia, 2007). For the case of China, Tian et al. (2007) find that the provinces with high FDI ratio will have faster technology updating and higher economic growth. In addition, FDI has also facilitated greatly the transformation of the collective and the state-owned enterprise (SOE) sectors (Fleisher et al., 2010). According to the State Statistical Bureau (2010), FDI increased enormously after 1978 with the total amount of FDI being US$

4.10 billion in the period of 1979-1984. After that, it increased immensely from US$1.96 billion in 1985 to US$105.7 billion in 2010 (State Statistical Bureau, 2011).

The increase in FDI has led to a surge in imports and exports in China (Zhang and Song, 2000). International trade in China increased from US$20.6 billion in 1978 to US$115.4 billion in 1990, and then surged to US$2.97 trillion in 2010 (State Statistical Bureau, 2011). Wei (1995) argues that international trade is good for economic growth because it can 'expose exporting firms to the rigor of international competition as well as to new techniques in marketing and processing.' Many studies suggest that international trade can boost economic growth in a country (for example, Young, 1991, Edwards, 1993, Greenaway and Sapsford, 1994, Greenaway et al., 2002). A lot of the scholars also report that trade exerts a positive impact on economic growth in China (for example, Tian, 1999, Chen and Feng, 2000, Dacosta and Carroll, 2001, Yao and Zhang, 2001a, Yao and Zhang, 2001b, Liu et al., 2002, Yao and Zhang, 2002, Yao, 2006, Kei and Yao, 2008, Li et al., 2010a, Li et al., 2010b, Lau, 2010, Gries and Redlin, 2011).

According to the statistics mentioned earlier, it can be observed that China's economy has become more and more globalized in terms of FDI and trade. The Chinese government has established many preferential policies aimed at attracting FDI (Demurger et al., 2002). Many special economic zones (SEZs), and open cities have been established since 1978 to attract foreign investors and promote international trade. Although both FDI and international trade have contributed to economic growth in China, they have also exerted their impacts on regional inequality. Dowrick and DeLong (2003) point out that, 'openness to the world economy does appear to provide a significant boost to growth, but it does not necessarily promote convergence.'

It is always debated whether the poor could benefit from globalization. Some argued that globalization could bring about a harmful effect on developing countries (Rodrik, 1997, Stiglitz, 2002). Tsai (1995) show that FDI aggravates inequality in the East and Southeastern Asian countries. Lindert and Williamson (2003) also find that globalization has led to an increase in inequality in China and other newly trading and industrializing countries. Lee (2006) examines the impact of globalization on income inequality and finds that income inequality in Europe has been exacerbated by FDI. Basu and Guariglia (2007) find that FDI can increase inequality using a panel of 119 developing

countries. Dreher and Gaston (2008) show that globalization has exacerbated inequality in the countries of Organisation for Economic Co-operation and Development (OECD).

On the contrary, many researchers argue that globalization can reduce inequality (Dollar, 2001, Wei and Wu, 2001, Dollar and Kraay, 2002, Chen et al., 2010). Dollar (2001) suggests that it is not globalization which is responsible for the increase in inequality in China, but rather the unevenness in levels of integration. He reports that '…within China we see the same pattern that we observe globally: locations that are integrating with the global economy growing rapidly while disconnected locations are left behind.' He claims that globalization can benefit the poor regions and therefore, if it is properly managed, it can promote convergence.

Despite the difference in conclusions of these studies, it seems that the common consensus is that globalization can increase the output of a region. However, globalization can work in two opposite directions. On the one hand, inequality can be reduced if globalization is targeted at the poor and underdeveloped regions (this is suggested by the pro-globalization side of the debate). On the other hand, inequality increases if globalization further reinforces the economic growth of the already globalized regions (this is suggested by the anti-globalization side). It is thus interesting to study the impacts of globalization on China and also understand the underlying direction of influence.

There are many studies on the impact of globalization on China's inequality, however, only a few studies claim that globalization can reduce inequality. Wei and Wu (2001) investigate the relationship between openness and the rural-urban inequality in Chinese cities. They find that a large increase in trade leads to a faster reduction in rural-urban inequality. Chen et al. (2010) find that exports are negatively correlated with rural-urban disparity.

Other studies report that globalization is a major driving force behind the increase in inequality. Nissanke and Thorbecke (2006) write that, 'China is a prime example of a country in which regional inequalities increased dramatically under the influence of the globalization process that brought about large flows of FDI to the coastal provinces but largely by-passing the inland provinces.' Wei et al. (2009) identify that FDI is

responsible for the differences in regional growth. However, they suggest that the uneven distribution of FDI, rather than FDI inflows per se, is the cause of the increase in regional inequality in China. Li and Wei (2010) report that globalization is the dominant mechanism causing inequality because FDI, which they claim is the most important driving force of growth, is distributed very unevenly in China. Similarly, many researchers report that FDI has a significant impact on inequality in China (for example, Sun and Chai, 1998, Fujita and Hu, 2001, Sun and Parikh, 2001, Ng and Leung, 2002, Zhang and Zhang, 2003, Fu, 2004, Nissanke and Thorbecke, 2006, Ran et al., 2007, Tsui, 2007, Wen, 2007, Wan, 2008a, Wei et al., 2009, Li and Wei, 2010, Tian et al., 2011).

It is worth noting that not only the uneven distribution of FDI can lead to an increase in regional inequality, but FDI can also exert different impacts on growth in different regions. Sun and Chai (1998) report that the impacts of FDI on economic growth were much stronger in the eastern zone, while the effects were weak in the inland region. Wen (2007) finds that the strength of the impacts of FDI on income growth varied dramatically amongst the three economic zones, thus contributing to further exacerbation of regional inequality in China. Moreover, Tian et al. (2011) find that the productivity of domestic firms in the peripheral inland region has been adversely affected by the FDI in the growth pole on the coast. Thus, they suggest that FDI contributes to the widening regional inequality in China.

Most of the studies mentioned earlier suggest that FDI would increase inequality. However, according to some recent studies, FDI is found to exert little or no effect on inequality. Some even find a negative correlation between FDI and inequality. For example, Gries and Redlin (2009) find that disparity in FDI is negatively correlated with income inequality. Cai et al. (2010) investigate the determinants of income inequality, and they find that the effect of FDI was not significant. Yu et al. (2011) examine the impacts of the stock of FDI on regional inequality using Shapley value regression-based decomposition. They find that the stock of FDI contributed only 2% to overall regional inequality.

Another major component of globalization is international trade and many studies have been conducted to examine its impacts on regional inequality in China. Many

researchers find that inequality increased with the exposure to international trade (Xu and Zou, 2000, Fujita and Hu, 2001, Zhang and Zhang, 2003, Fu, 2004, Wan, 2008a, Gries and Redlin, 2009, Pradhan, 2009, Cai et al., 2010). Furthermore, some studies report that international trade is a major driving force behind the marked disparity between the inland and coastal regions. Kanbur and Zhang (2005) find that a higher trade ratio increased inequality, particularly, the inland-coastal disparity in the reform period. Fu (2007) shows that the uneven distribution of trade in the inland and coastal regions has led to the widening of the income gap between these two regions. Hao and Wei (2010) also report that trade has increased the inequality between the two regions. Melchior (2010) argues that international trade has caused an increase in regional disparity in China because foreign trade is conducted through the coastal provinces.

Similar to the FDI, international trade is found to have different impacts on the growth rate in each economic zone (Sun and Parikh, 2001, Zou et al., 2008). Sun and Parikh (2001) find that the effects of exports on economic growth varied dramatically amongst the three economic zones. They show that export growth had a positive impact on GRP growth in the eastern zone, but its impact was significant and negative for the central zone, while no significant relationship was found for the western zone. Similarly, Zou et al. (2008) find that the ratio of export to GRP is positively correlated with the provincial growth rate in the developed province, while it is negatively correlated with the growth rate in the less-developed province. The differences in impacts of international trade on growth for the different regions may further aggravate regional inequality.

In summary, most of the studies report that the distribution of FDI and foreign trade are very uneven and most of them have concentrated on the coastal provinces. Moreover, FDI and trade are found to exert different impacts on the economic growth of different regions. These factors have exacerbated regional inequality in China, especially, the inequality between the inland and coastal regions. However, it should be noted that most of these studies mentioned earlier are based on provincial level data, while the impacts of globalization on intra-provincial regional inequality still remain virtually unknown to the academic community.

3. Methods

In order to examine the determinants of regional inequality, the regression approach is used. The model is:

$$GINI_{it} = \beta_k X_{it} + v_i + v_t + \varepsilon_{it} \quad (1)$$

where $GINI_{it}$ is the Gini coefficient for province *i* at time *t*, β_k is the *k* x 1 vector of the coefficients on X_{it}, X_{it} is the matrix for the provincial characteristics, v_i is the fixed effect for province *i*, v_t is the time dummy, and ε_{it} is the idiosyncratic disturbance. The idiosyncratic disturbances are uncorrelated across the provinces, but they may have province-specific patterns of serial correlation and heteroskedasticity (Roodman, 2006).

Several estimation methods are considered. Ordinary least squares (OLS) is used first to provide a preliminary study of the determinants. Fixed effects (FE) and random effects (RE) models are then employed to provide better estimation. A comparison between the two models is then performed by using the Hausman specification test, while the two-way effects model is used to examine the time effects. Generalized method of moments (GMM) estimator is then applied to handle possible endogeneity of the regressors (see Holtz-Eakin et al., 1988, Arellano and Bond, 1991, Arellano and Bover, 1995, Blundell and Bond, 1998). The problem of endogeneity is especially common in the case of research on the determinants of inequality, as the problems of simultaneity bias, reverse causality and omitted variables, may lead to endogeneity. One example is government expenditure for supporting underdeveloped areas. It can be expected that higher expenditure will lead to a reduction in inequality (the dependent variable); however, higher inequality may also lead to higher expenditure (the explanatory variable). GMM estimation can overcome the endogeneity bias, and control for fixed effects and time effects. Furthermore, it can be used for unbalanced panels and multiple endogenous variables. Because of these attractive features, the popularity of the GMM estimators has grown substantially (Roodman, 2009).

The difference GMM (DGMM) method is established by Arellano and Bond (1991). The assumption of the model is that ε_{it} is not serially correlated and the explanatory variables are weakly exogenous, that is, they are not correlated with future error terms. The method involves the removal of the individual effects by first-differencing of the

equation. The first-differences of the suspected endogenous explanatory variables are instrumented using internally generating instruments (that is, the lagged values in levels) to cope with the possible endogeneity of the explanatory variables. Current values are used as instruments for the exogenous variables. Lagged values for at least one period can be used as instruments for predetermined variables which are not correlated with present and future values of the error term but correlated with past values of the error term. Lagged values for at least two periods are used as instruments for all the endogenous variables which are correlated with past and present values of the error term, but are not correlated with the future error term (see Hao, 2006 for details).

However, there are some problems for the DGMM method. First of all, any time invariant variable would disappear in DGMM because of first-differencing. Second, Blundell and Bond (1998) claim that if the variables are persistent over time, then the lagged levels are correlated weakly with the first-differences, and so they are weak instruments for the first-differenced equations. In that case, the DGMM estimator would have poor finite sample properties. The coefficients will be biased for small samples if the series are near unit root processes. Binder et al. (2005) show that the DGMM estimator will break down if the data series have unit roots.

System GMM (SGMM) is developed by Arellano and Bover (1995) and Blundell and Bond (1998). By exploiting reasonable stationarity restrictions on the initial condition processes, SGMM expands DGMM by including an equation in levels in estimation, and instruments this equation by differences. For variables with random walk characteristics, prediction of current levels based on past changes may be better than prediction of current changes based on past levels (see Roodman, 2006, p.27). Therefore, SGMM is better than DGMM for variables that are close to be random walk and when the instruments are weak (Bond, 2002, Roodman, 2006, Roodman, 2009). Blundell and Bond (1998) show that SGMM is more efficient than DGMM by using Monte Carlo simulations. The biases due to the near unit root processes can be reduced significantly by SGMM. Blundell and Bond (2000) demonstrate the use of SGMM in studying the dynamic production function with persistent panel data. Another advantage of the SGMM framework is that time-invariant variables can also be included in the estimation.

There are some other considerations in the use of SGMM. Two-step GMM is used in this

research because it is robust to heteroskedasticity and this estimator is asymptotically efficient. However, there is a downward bias in the standard errors of the two-step estimator (Arellano and Bond, 1991). A small sample correction for the two-step standard errors is thus developed to cope with this problem (Windmeijer, 2005). Therefore, in this paper, the two-step estimator with corrected errors is used.

There are two approaches of transformation for GMM, namely, the first-difference and the orthogonal deviations approaches. For each missing value, the first-difference approach will generate two gaps after the transformation. The orthogonal deviations approach can overcome this problem by subtracting the average of all future available observations from the contemporaneous one (Arellano and Bover, 1995, Roodman, 2006).

The formula is $w^*_{i,t+1} \equiv \sqrt{T_{it}/(T_{it}+1)}\left(w_{it} - \frac{1}{T_{it}}\sum_{s>t} w_{is}\right)$ (2)

where w_{it} is any variable before transformation, w^*_{it} is the transformed variable, and T_{it} is the number of future observations.

It can be computed for any observation (except the last one in the data series) regardless of gaps in the original data. Only future values are used in the orthogonal deviations transformation and so the lagged values do not correlate with the error terms in the orthogonal deviations equation, therefore the lagged values can be used as instruments (Roodman, 2006). Moreover, the orthogonality among the transformed errors is preserved, thus if there is no autocorrelation in ε_{it}, and if it has constant variance, the transformed errors should have the same characteristics (Arellano and Bover, 1995). Since the inequality dataset in this study is an unbalanced one, orthogonal deviations transformation is found to be much more useful and thus it is adopted.

Another problem in using GMM is instrument proliferation. Several studies have revealed that the bias of GMM will be increased as more instruments are introduced in the calculation (Tauchen, 1986, Ziliak, 1997). The fact is further demonstrated by Windmeijer (2005) using Monte Carlo tests. Two techniques can be applied to reduce the number of instruments in GMM. The first approach is to limit the lags of the instruments and the second one is to combine the instruments into smaller sets by collapsing the

blocks in the instrument matrix (Roodman, 2006, Roodman, 2009). Both approaches are adopted in order to alleviate the problem of instrument proliferation.

The consistency of the GMM estimator depends on the validity of using the lagged values as instruments. The Sargan test of over-identifying restrictions is suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) to determine the validity of the instruments. It tests the overall validity of the instruments. The null hypothesis is that the residuals and the instrumental variables are not correlated. The Hansen test is another test of over-identifying restrictions. Both tests will be used in order to ensure the validity of the instruments. Another important test is the serial correlation test, that is the AR(2) test, which tests whether second order serial correlation exists in the errors in the transformed equation. However, all the residuals are interrelated if orthogonal deviations are used in the transformation, but because the orthogonality among the transformed errors is preserved after the orthogonal deviations transformation, the autocorrelation test is run on residuals in difference even if orthogonal deviations are used in estimation (Roodman, 2006).

One assumption of GMM is that there is no correlation across provinces in the idiosyncratic disturbances. Time dummies are thus added to prevent contemporaneous correlation which is the most common form of cross-individual correlation. No prior information is available for the exogeneity of the variables, it is thus inappropriate to treat the explanatory variables as strictly exogenous or predetermined. Therefore, all the variables in this study are treated as endogenous, which means that all the explanatory variables are assumed to be correlated with the present and past error terms, but not correlated with the future error terms.

4. Data

Intra-provincial regional inequality amongst the counties and county-level cities, which is measured by the Gini coefficient in every province, is used as the dependent variable in the regression analysis, while the explanatory variables are based on the provincial macroeconomic characteristics. Interested readers can refer to Cheong (2012) for the details of data preparation. All the provinces and autonomous regions in China are included in this study; however, the four municipalities are not included. The dataset

used in this paper is an unbalanced panel dataset from 1997 to 2007, as some of the data is unavailable. The data series of all the explanatory variables are compiled from the *China Statistical Yearbook* (State Statistical Bureau, 1998 - 2010). All the data are adjusted for inflation by converting them to 1997 constant prices using provincial consumer price index (CPI) as the deflator. However, national CPI in 1998 is used as deflator for Tibet because the provincial CPI of Tibet in 1998 is not available from the *China Statistical Yearbook.*

The explanatory variables used in the baseline model are:

1. *FDI*: FDI / provincial GRP
2. *Exports and Imports*: Total value of exports and imports / provincial GRP
3. *Retail Sales* : Retail sales of consumer goods / provincial GRP
4. *Secondary Proportion*: Secondary sector GRP / provincial GRP
5. *Tertiary Proportion*: Tertiary sector GRP / provincial GRP
6. *GRP pc*: Real GRP per capita (1000 Yuan)
7. *Transport* : Transportation infrastructure (1000km)
8. *Inflation*: Provincial CPI (price base of previous year is treated as 100)
9. *Gov. Exp.*: Government expenditure for supporting underdeveloped areas / provincial GRP
10. *Econ. Signif.*: Provincial GRP / national GDP
11. *Edu. Fund*: Educational funding / provincial GRP

- Variables 1 and 2 (*FDI, Exports and Imports*) are used to assess the effects of globalization. The indicator of FDI is based on the recommendations in *Measuring Globalisation: OECD Handbook on Economic Globalisation Indicators 2005* (OECD, 2005). It is expressed as a percentage of provincial GRP. International trade is measured as the proportion of total value of exports and imports to provincial GRP, many other researchers (Xu and Zou, 2000, Zhang and Zhang, 2003, Wan et al., 2007, Hao and Wei, 2010) use this variable as a measure of globalization in studying regional inequality in China. However, it is worth noting that *Measuring Globalisation: OECD Handbook on Economic Globalisation Indicators 2005* (OECD, 2005) suggests the use of total exports only, without the value of imports, in measuring globalization. Therefore, the data series of the proportion of total exports to provincial GRP were compiled for the robustness tests. In addition, the data series of the total value of exports and imports per capita, as well as total exports per capita, were also compiled for the robustness tests.

- Variable 3 (*Retail Sales*) is domestic trade, and it is included as a comparison to

international trade. It is measured as the proportion of retail sales of consumer goods to provincial GRP.

- Variables 4 and 5 (*Secondary Proportion*, *Tertiary Proportion*) are used to examine the effects of the secondary and tertiary industries. Kuznets (1955) argues that inequality increases with industrialization in the early stages of economic development. Many researchers report that industrialization in China has increased output but has also led to a surge in inequality (Rozelle, 1994, Rozelle, 1996, Tsui, 1996, Yao, 1997, Golley, 2002, Yang, 2002, Huang et al., 2003, Wan, 2004, Kanbur and Zhang, 2005, Tsui, 2007, Pradhan, 2009).

  The variable *Secondary Proportion* is used to examine the impacts of industrialization. It is worth noting that the development of the tertiary industry sector in China has been very fast in recent years. The share of the tertiary industry outputs to provincial GRP was 43.0% in 2010, while the secondary industry outputs to provincial GRP was 46.9% (State Statistical Bureau, 2011). The development in tertiary industry may also affect regional inequality. Therefore, the share of the tertiary industry outputs to provincial GRP is also included in this study.

- Variable 6 (*GRP pc*) is the real GRP per capita for all the cities and counties in a province. It is used to determine if a rich province would also have a high level of inequality or not. It is worth noting that the regional inequality indicator used in this study refers to the inequality amongst the cities and counties within a province excluding the districts. Therefore, in order to capture the effect of income more precisely, the data series of the real GRP per capita for each province is calculated by using the data of all the cities and counties in that province, excluding the districts.

- Variable 7 (*Transport*) is transportation. Krugman and Venables (1995) investigate the relationship between globalization and inequality of nations by studying how globalization affects gain from trade and location of manufacturing. They show by a simple model that if the transportation cost falls below a threshold value, then a core-periphery pattern will emerge, and the periphery nations will have a drop in real income. However, convergence will be achieved if the transportation cost drops further. Their results prove that regional inequality can be affected by transportation. He and Duchin (2009) study the impact of transportation infrastructure on regional development in China and they claim that ‘a major impediment to economic development, especially in the poor, remote Western region, is the shortage of a transportation infrastructure.’ They suggest the government

should invest heavily in transportation infrastructure and optimize its spatial distribution. Chen and Groenewold (2010) find that an increase in the infrastructure provision in the inland region can reduce the disparity between the inland and coastal regions. Similarly, Fan et al. (2011) suggest that infrastructure investment, especially the improvement of roads and railways in the lagging regions, may reduce regional inequality.

However, Gries and Redlin (2009) find that transportation can aggravate inequality. Some other researchers conduct studies to examine the relationship between transportation infrastructure and inequality by studying its impact on growth or output (Fleisher and Chen, 1997, Demurger, 2001, Yao and Zhang, 2001b, Fan et al., 2004, Fan and Zhang, 2004, Yao and Wei, 2007, Fan and Chan-Kang, 2008, Li and Xu, 2008, Zou et al., 2008, Lau, 2010). However, the dependent variables used in all these studies are growth or output, rather than inequality itself. Moreover, except the study carried out by Fan and Zhang (2004), most of these studies are based on provincial level data. Therefore, it is of interest to examine the impact of transportation infrastructure on the intra-provincial regional inequality amongst the county-level units.

It is worth noting that there are three common modes of transportation within a province in China, namely, the highway, railway and the waterway. It is inappropriate to add the length of these three modes of transportation together in estimating the transportation infrastructure, because the transportation capacities are different for these three modes of transportation. The approach used by Yao and Wei (2007) and Wei et al. (2009) is adopted for handling this problem. The railways and waterways are converted into equivalent highways, and then the transportation infrastructure in a province is computed by adding up the length of the highways and the equivalent highways. The conversion ratios are 1.0 for highways, 4.27 for railways and 1.06 for waterways. This is a good estimation of the transportation infrastructure in a province because the conversion ratios are derived from the volumes of transport per mile by these three modes of transportation. The data series of the transportation infrastructure was compiled and was used in the regression analysis.

- Variable 8 (*Inflation*) is inflation. Lau (2010) shows that high inflation is detrimental to economic growth, and many researchers suggest that there is a correlation between income inequality and inflation (Sachs, 1989, Beetsma and Ploeg, 1996, Al-Marhubi, 1997, Xu and Zou, 2000, Desai et al., 2005). It is of interest to study if high inflation in China will lead to a further increase in intra-provincial inequality. For this purpose, the provincial CPI is included.

- Variable 9 (*Gov. Exp.*) is government expenditure for supporting underdeveloped areas and this data is available in the *China Statistical Yearbook*. It is worth noting that Wan (2008b) states that the effects of fiscal transfers on inequality are negligible and sometimes they are regressive at the provincial level. Fang and Rizzo (2011) also claim that government transfers have been ineffective in inequality reduction in rural China. However, the impacts of government expenditure on intra-provincial regional inequality are not studied. Therefore, government expenditure for supporting underdeveloped areas is included in the research.

- Variable 10 (*Econ. Signif.*) is 'Economic significance'. It is basically the share of provincial GRP to national GDP. It is included so as to observe whether the high output provinces would have high inequality, or the other way round.

- Variable 11 (*Edu. Fund*) is educational funding. Education is deemed to have a positive impact on economic growth and income. Barro (1991) shows that economic growth is positively correlated with human capital using cross-section data. Similarly, Li and Xu (2008) find that education is an important factor driving regional economic growth. Shindo (2010) studies the impact of education subsidies on regional economic growth in Liaoning and Jiangsu in China, and concludes that education subsidies can boost economic growth and improve overall welfare. Many other studies based on survey data also find education has a positive impact on income (for instance, see Gustafsson and Sai, 2009). However, it is reported that education is related to inequality. For example, Fu (2007) finds that human capital is a major determinant of the disparity between the inland and coastal regions. Goh et al. (2009) find that the disparity in income from 1989 to 2004 can be largely explained by the difference in educational level. Fleisher et al. (2010) report that increases in investment in human capital in underdeveloped areas in China can reduce regional inequality. It is worth noting that many scholars study the relationship between income inequality and educational level, however, most of these studies are based on household survey data, and therefore, these studies cannot reveal any information regarding the impacts of education on regional inequality. It is of interest to study the impact of human capital on regional inequality, hence educational funding in each province (this data is available in the *China Statistical Yearbook*) is included in the analysis. Moreover, two data series have been compiled and used in robustness tests to evaluate the impact of education. They are the number of secondary school enrolments, and the number of secondary school graduates.

Table 1 shows the descriptive statistics for the explanatory variables used in the baseline model.

Table 1 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Gini	279	0.283	0.072	0.141	0.469
FDI	294	0.013	0.012	0.000	0.062
Exports and Imports	297	0.240	0.320	0.040	1.875
Retail Sales	295	0.342	0.044	0.219	0.455
Secondary Proportion	297	0.450	0.081	0.198	0.600
Tertiary Proportion	297	0.369	0.044	0.254	0.556
GRP pc	297	9.552	5.566	2.215	33.681
Transport	297	0.084	0.047	0.013	0.257
Inflation	295	101.358	2.149	96.800	106.644
Gov. Exp.	270	0.003	0.004	0.000	0.017
Econ. Signif.	297	0.033	0.027	0.001	0.114
Edu. Fund	297	0.046	0.015	0.25	0.123

5. Results and discussions

The correlation between globalization and intra-provincial regional inequality can be observed from Figure 1 and Figure 2. It can be observed that regional inequality is negatively correlated with FDI, while international trade is positively correlated with it. This observation suggests that although FDI and international trade are major components of globalization, they have different impacts on inequality.

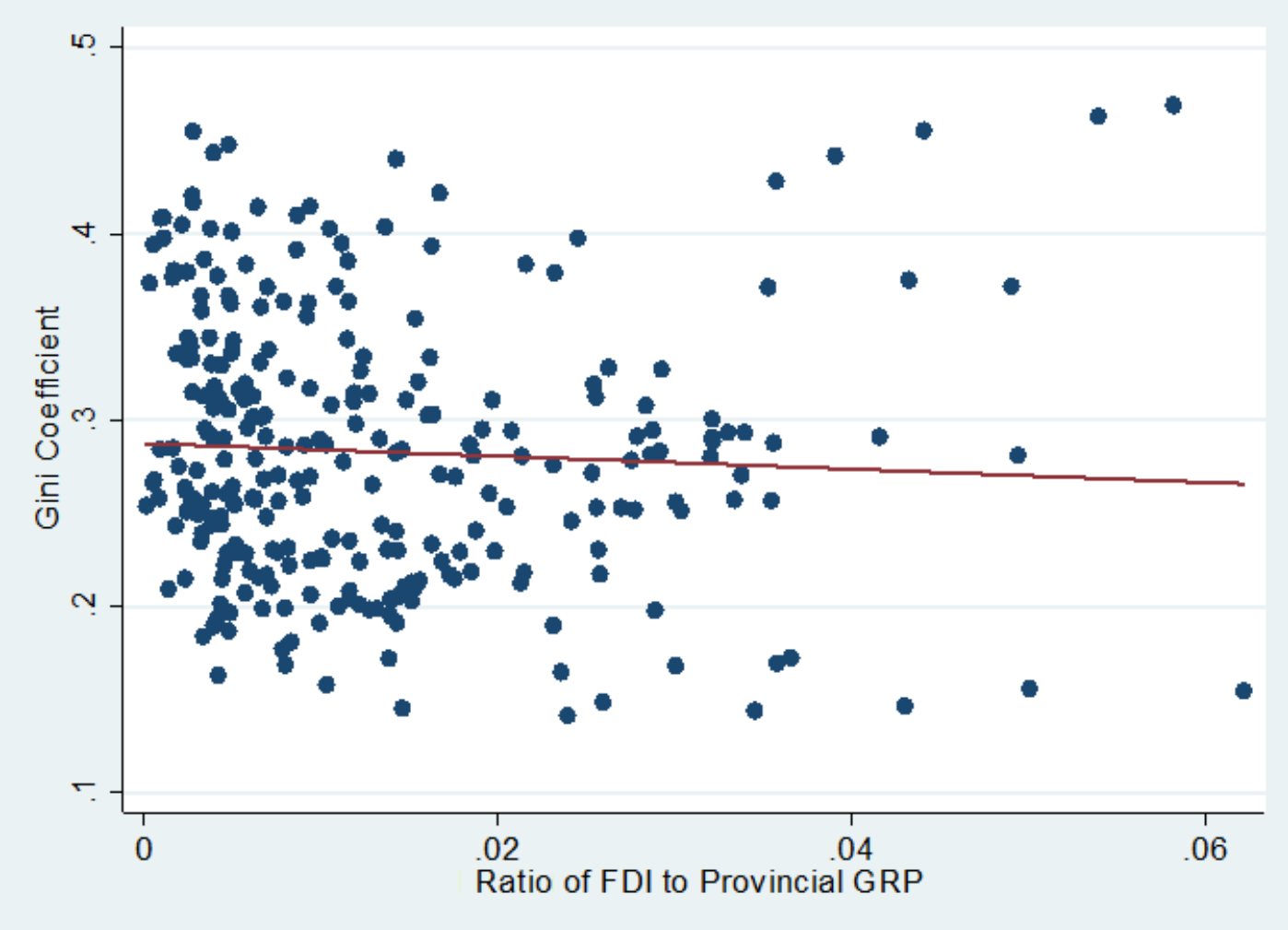

Figure 1 Intra-Provincial Regional Inequality and Ratio of FDI to Provincial GRP

Figure 2 Intra-Provincial Regional Inequality and Ratio of Total Value of Imports and Exports to Provincial GRP

The explanatory variables used in the baseline model are first checked for multicollinearity by the variance inflation factor (VIF). The results are shown in Table 2. The maximum value is 4.52 and the mean VIF is 2.43 which is much lower than 10, so it can be concluded that multicollinearity is not serious in the specification.

Table 2 Variance Inflation Factor (VIF)

Variable	VIF
Econ. Signif.	4.52
Exports and Imports	3.26
Gov. Exp.	2.74
GRP pc	2.66
Edu. Fund	2.49
FDI	2.46
Secondary Proportion	2.38
Tertiary Proportion	2.25
Transport	1.49
Retail Sales	1.35
Inflation	1.15
Mean VIF	2.43

Ramsey RESET test is then used to test if the model is mis-specified. The F-statistic and p-value are 0.5 and 0.684 respectively, and thus the null hypothesis of no mis-specification is not rejected. However, the null hypothesis of no heteroskedasticity is rejected by the Breusch-Pagan / Cook-Weisberg test for heteroskedasticity with a p-value of 0.0001. As a result, the standard errors are corrected for heteroskedasticity in the OLS by using robust standard errors.

The modified Wald statistic for groupwise heteroskedasticity is 822.25 with a p-value of 0.0000. It indicates that there is heteroskedasticity in the FE model. Therefore, the standard errors are corrected for heteroskedasticity in the FE. The standard errors in the RE model is also corrected for heteroskedasticity. The Hausman test is then used to choose between RE and FE estimators. The p-value of the Hausman test is 0.0074, and so FE is better than RE. Two-way FE with time dummies is also included for comparison.

Table 3 Regional Inequality and Globalization

	OLS		RE		FE		Two-way FE		SGMM	
FDI	0.186		-0.651	***	-0.627	***	-0.579	***	-3.526	**
	(0.503)		(0.200)		(0.203)		(0.218)		(1.497)	
Exports and Imports	0.016		0.007		0.007		-0.003		0.030	
	(0.018)		(0.022)		(0.020)		(0.020)		(0.033)	
Retail Sales	-0.481	***	0.102		0.175	**	0.122	*	-0.393	**
	(0.091)		(0.065)		(0.067)		(0.068)		(0.166)	
Secondary Proportion	0.518	***	0.558	***	0.574	***	0.669	***	0.708	**
	(0.062)		(0.073)		(0.082)		(0.096)		(0.269)	
Tertiary Proportion	0.144		0.311	***	0.308	***	0.409	***	1.020	*
	(0.122)		(0.078)		(0.075)		(0.098)		(0.503)	
GRP pc	0.001		0.003	**	0.003	**	0.004	***	0.011	*
	(0.002)		(0.001)		(0.001)		(0.001)		(0.006)	
Econ. Signif.	-0.006		-0.670	*	-0.230		-0.626		-1.028	
	(0.273)		(0.404)		(0.534)		(0.502)		(2.035)	
Transport	0.226	**	0.062		0.060		0.241	***	0.574	**
	(0.091)		(0.061)		(0.062)		(0.092)		(0.244)	
Inflation	-0.002		0.000		0.000		-0.000		-0.036	**
	(0.002)		(0.001)		(0.001)		(0.001)		(0.014)	
Gov. Exp.	9.705	***	0.617		-1.856		-2.378		-0.076	
	(1.735)		(1.404)		(1.535)		(1.676)		(4.538)	
Edu. Fund	0.303		-0.825	***	-0.884	***	-0.972	***	0.808	
	(0.483)		(0.249)		(0.229)		(0.263)		(2.147)	
Constant	0.309		-0.085		-0.128		-0.144		3.195	**
	(0.197)		(0.094)		(0.095)		(0.120)		(1.24)	
Number of observations:	251		251		251		251		251	
R^2	0.510				0.604		0.632			
Adjusted R^2	0.488				0.586		0.600			
Number of instruments:									32	
AR(2) p-value									0.107	
Sargan p-value									0.285	
Hansen p-value									0.998	

Notes. The dependent variable is intra-provincial regional inequality measured by the Gini coefficient in each province. Standard errors (in parentheses) are asymptotically robust to heteroskedasticity. AR(2) is Arellano-Bond test for AR(2) in first-differences. Both Sargan and Hansen are tests of the overidentifying restrictions.

* Significance at the 10% level. ** Idem, 5% level. *** Idem, 1% level.

Table 3 shows the results for OLS, RE, FE, two-way FE and SGMM. There is no time dummy in the preliminary models of OLS, RE and FE. Time dummies are then added to the two-way FE and SGMM. The coefficients of *FDI* and *Edu. Fund* are significant and negative in the RE, FE and two-way FE models, while the coefficient of *GRP pc* is positive. The coefficients of the variables of *Secondary Proportion* and *Tertiary Proportion* are both statistically significant and positive in the two-way FE model.

Indeed, the coefficient of *Secondary Proportion* is significant in every model, while that of the *Tertiary Proportion* is significant in all the models except the OLS. The coefficients of *Retail Sales* and *Transport* are significant and positive in the two-way FE model.

The adjusted R-square is 0.488 for OLS, 0.586 for FE and it increases to 0.600 for two-way FE. Although the explanatory power of the two-way FE is quite good in terms of adjusted R-square for panel data estimation, it may still be plagued by the problem of endogeneity. Therefore, GMM estimates are also provided.

All the data series are first tested for unit root using the Fisher ADF and Fisher PP test. However, most of the data series fail these two tests, and thus SGMM is used. Two-step GMM with small-sample correction for the two-step standard errors (Windmeijer, 2005) is employed. This two-step estimator is asymptotically efficient and robust to any pattern of cross-correlation and heteroskedasticity (Roodman, 2006). Since the panel dataset is unbalanced, the transformation of orthogonal deviations is used in order to minimize the number of gaps in the transformed equations. All the explanatory variables are treated as endogenous because there is no prior knowledge regarding exogeneity of these variables. In order to tackle the problem of instrument proliferation, the instruments are combined into smaller sets by collapsing blocks in the instrument matrix. Additionally, the number of instruments is minimized by limiting the number of lags. Only lag two of the explanatory variables is used as instrument for the transformed equations, and only the present value is used as instrument for the time dummies.

The result of the SGMM estimation is shown in the last column of Table 3. Autocorrelation AR(2) test, Sargan test and Hansen test are performed to ensure the validity of the instruments. All the tests are passed and it implies that the instruments used in the model are valid. Compared with the two-way FE results, the *Edu. Fund* becomes insignificant, while *Inflation* becomes significant. The coefficient of *Retail Sales* changes its sign from positive to negative in the SGMM estimation. However, most of the coefficients of the variables retain their significance and sign in both the two-way FE and the SGMM models. It shows that the analysis results are fairly robust for a variety of models.

The coefficients of *Exports and Imports*, *Econ. Signif.* and *Edu. Fund* are insignificant in the SGMM estimation. The coefficient of *Gov. Exp.* is insignificant. This finding agrees with those suggested by other researchers (Wan, 2008b, Fang and Rizzo, 2011). The coefficient of *FDI* is significant and negative. This finding provides empirical evidence supporting the idea of Dollar (2001), who suggests that globalization can reduce inequality. The result also corroborates the findings of Gries and Redlin (2009). However, this result differs from some other studies (for instance, Ng and Leung, 2002, Zhang and Zhang, 2003, Wan et al., 2007). It is worth noting that those studies, which suggest that FDI would increase inequality, are all based on provincial level data. On the contrary, the results derived from county-level data in this study suggest that FDI can alleviate intra-provincial regional inequality.

The discrepancy in conclusions between the studies using provincial level data and intra-provincial level data can also be observed from the study on trade. Many studies based on provincial level data show that trade would increase inequality (for example, Xu and Zou, 2000, Zhang and Zhang, 2003, Kanbur and Zhang, 2005, Fu, 2007). However, Wei and Wu (2001) reach an opposite conclusion using prefectural level city and municipality data, and show that trade would reduce urban-rural income inequality.

Although FDI may be positively correlated with inter-provincial inequality, it is negatively correlated with intra-provincial regional inequality. The results pinpoint that policy formulation at the county-level should not be based on research carried out at the provincial level, and vice versa. Research on regional inequality should be carried out at various spatial levels so as to formulate pragmatic policies for each level.

According to the SGMM results, the proportion of retail sales of consumer goods to provincial GRP is negatively correlated with regional inequality. It should be noted that the variable of retail sales of consumer goods refers to the sum of retail sales of commodities sold by wholesale and retail trades, catering services, publishing, post and telecommunications and other services to urban and rural households for household consumption and to social institutions for public consumption. Most of these services do not require high skilled labour and so the expansion of these sectors can absorb the unskilled and surplus labour. Consequently, the backward regions within a province can enter these businesses easily and this can considerably improve the living standards of

the poor. The promotion of domestic trade in the underdeveloped regions can increase the outputs of these poor regions quickly, thus mitigating intra-provincial inequality.

The coefficient of the *Secondary Proportion* is positive and so is the coefficient of the *Tertiary Proportion*, implying inequality increases with the decline of agriculture. This finding is in agreement with other studies (Rozelle, 1994, Yao, 1997, Huang et al., 2003, Tsui, 2007, Goh et al., 2009, Liu and Sicular, 2009, Chen and Groenewold, 2010, Fang and Rizzo, 2011). The returns of the secondary and tertiary industries are higher than the return of primary industry. Coupled with the uneven distribution of industrialization and development across the regions, an expansion of these sectors would increase inequality.

As shown in Table 3, the coefficient of *GRP pc* is significant and positive. This result implies that the inequality levels in the rich provinces are higher than the poor provinces. Many campaigns have been launched in the poor provinces to promote economic development so as to reduce inequality. However, the result in this study suggests that, when governments try to formulate policy for inequality alleviation, they should not only focus exclusively on the poor provinces, but should also take the rich provinces into consideration. This calls for the design of a comprehensive and coherent strategy in managing inequality in all the provinces.

The results also show that the coefficient of transportation infrastructure is significant and positive. This finding is consistent with those of Gries and Redlin (2009). It is worth noting that Martin and Rogers (1995) report positive relationship between infrastructure and industrial concentration. The regions with agglomerated industries, tend to be richer and have much higher tax revenues, so they can finance the construction of new infrastructure, which in turn will attract more industries. This circularity can lead to a further increase in regional inequality, therefore, the finding calls for a concerted strategy of equalizing access for all the regions. It is thus necessary for the government to provide better access for the poor regions by improving their transportation infrastructure.

It is often suggested that income inequality and inflation are positively correlated (for instance, Sachs, 1989, Beetsma and Ploeg, 1996, Al-Marhubi, 1997, Desai et al., 2005).

Contrary to expectations, it is shown that inflation is negatively correlated with regional inequality. Generally, inflation has a much greater impact on regions relying on secondary and tertiary industries than those relying on primary industries. Therefore, the people in the urban areas might be experiencing larger reductions in their real incomes. The county-level units with a high level of urbanization, which are generally richer, will thus become poorer in real terms, while the county-level units with a low level of urbanization will be less affected and remain more or less the same; hence, inflation has an equalizing effect on regional income distribution.

The results in Table 3 are robust to a wide range of estimators. However, it is of interest to examine whether the results are also robust to different choices of proxies and specifications. Some scholars use only the value of exports as a proxy for international trade. Therefore, the variable of *Exports*, which is measured as the proportion of total value of exports to provincial GRP, is used in the robustness tests to examine its impacts on regional inequality. SGMM estimators are used in the robustness tests, and the results are shown in Table 4.

The variable of *Exports and Imports* is replaced by *Exports* in the robustness tests. In addition, because the variables of *GRP pc* and *Econ. Signif.* are somewhat similar, it is pertinent to check if the results are robust if one of them is removed in the robustness tests. Column (1) does not include the variable of *GRP pc*, while column (2) does not include *Econ. Signif*. Column (3) is constructed by including both *GRP pc* and *Econ. Signif.*

The AR(2), Sargan and Hansen tests are performed for all the specifications. The results show that the instruments are valid for all the specifications in Table 4. Column (1) shows that the coefficients of the *Exports*, *Secondary Proportion*, *Tertiary Proportion* and *Transport* are significant and positive, while the coefficients of the *FDI* and *Inflation* are significant and negative. *Retail Sales* is found to be insignificant. The results in Column (2) show that *Exports*, *GRP pc* and *Inflation* all lose their significance as compared with the baseline model in Table 3. Column (3) shows that the coefficient of *FDI* is significant and negative, whereas the coefficient of *Exports* is insignificant. Both coefficients of *Secondary Proportion* and *Tertiary Proportion* are significant and positive. For the other control variables, coefficients of *GRP pc* and *Transport* are both

significant and positive. On the contrary, coefficients of *Retail Sales* and *Inflation* are significant and negative.

Table 4 Robustness Test (I) for Regional Inequality and Globalization

	(1)		(2)		(3)	
FDI	-2.001	**	-3.117	**	-3.513	**
	(0.891)		(1.509)		(1.306)	
Exports	0.242	*	0.085		0.016	
	(0.137)		(0.221)		(0.058)	
Retail Sales	-0.424		-0.405		-0.461	***
	(0.346)		(0.337)		(0.149)	
Secondary Proportion	0.906	**	0.673	*	0.702	**
	(0.359)		(0.352)		(0.277)	
Tertiary Proportion	0.680	*	0.608	*	0.995	**
	(0.375)		(0.306)		(0.456)	
GRP pc			0.008		0.012	**
			(0.008)		(0.006)	
Econ. Signif.	-3.120				-1.238	
	(2.175)				(1.597)	
Transport	0.618	**	0.762	**	0.620	**
	(0.250)		(0.356)		(0.245)	
Inflation	-0.023	*	-0.018		-0.034	***
	(0.013)		(0.014)		(0.012)	
Gov. Exp.	1.399		5.467		-0.338	
	(5.540)		(5.060)		(4.823)	
Edu. Fund	-1.703		0.230		0.672	
	(1.308)		(1.727)		(1.788)	
Constant	2.191	*	1.593		3.067	***
	(1.221)		(1.135)		(1.063)	
Number of observations:	251		251		251	
Number of instruments:	30		30		32	
AR(2) p-value	0.127		0.127		0.111	
Sargan p-value	0.058		0.277		0.349	
Hansen p-value	0.950		0.905		0.999	

Notes. SGMM estimator is used in regression analyses. The dependent variable is intra-provincial regional inequality measured by the Gini coefficient in each province. Standard errors (in parentheses) are asymptotically robust to heteroskedasticity. AR(2) is Arellano-Bond test for AR(2) in first-differences. Both Sargan and Hansen are tests of the overidentifying restrictions.

* Significance at the 10% level. ** Idem, 5% level. *** Idem, 1% level.

In summary, the robustness tests in Table 4 show that the variables of *FDI*, *Secondary Proportion*, *Tertiary Proportion* and *Transport* retain their significance in all the specifications. *Inflation* also retains its significance in almost all of the specifications. It is thus shown that the results are robust for various choices of proxies of international trade and a variety of specifications.

However, all the measurements of international trade in Tables 3 and 4 are based on the proportion of provincial GRP. It is of interest to test if the results are robust if the data series are on a per capita basis. The data series of the total value of exports and imports per capita (1000 Yuan) and the data series of the value of exports per capita (1000 Yuan) were compiled for the robustness tests. Another two data series were also compiled for the evaluation of the effects of education on intra-provincial regional inequality in the robustness tests, these being the number of the secondary school enrolments, and the number of secondary school graduates. All these two data series of education are in ratio form and they are compiled by dividing the data series by provincial population[2]. The results of the robustness tests are shown in Table 5.

Different proxies of education and international trade are used in the robustness tests to examine their impacts on regional inequality. The AR(2), Sargan and Hansen tests are conducted for all the specifications, it is shown that the instruments are valid. The educational variable of *Secondary School Enrolments* is added to column (4). Moreover, *Exports pc* is used as the proxy for international trade. Column (4) shows that the coefficient of *FDI* is significant and negative, whereas the coefficients of *Secondary Proportion* and *Transport* are significant and positive. The coefficient of the *Secondary School Enrolments* is negative but it is not significant.

In column (5), the educational variable of *Secondary School Enrolments* is replaced by *Secondary School Graduates*. Many variables become significant in column (5). The coefficients of *FDI* and *Inflation* are significant and negative. The coefficients of *Secondary Proportion*, *Tertiary Proportion*, *GRP pc* and *Transport* are all significant and positive. However, the coefficient of the educational variable of *Secondary School Graduates* is negative but not significant.

[2] It is better to use the number of population who are of secondary school enrolment age as denominator in the calculation. However, because the data is not available, the number of the total provincial population is used in calculation.

Table 5 Robustness Test (II) for Regional Inequality and Globalization

	(4)		(5)		(6)	
FDI	-3.261	*	-3.297	**	-3.274	**
	(1.689)		(1.535)		(1.543)	
Exports pc	-0.0005		-0.001			
	(0.003)		(0.003)			
Exports and Imports pc					-0.001	
					(0.002)	
Retail Sales	-0.237		-0.187		-0.181	
	(0.227)		(0.271)		(0.276)	
Secondary Proportion	1.025	*	0.996	*	0.972	*
	(0.547)		(0.519)		(0.539)	
Tertiary Proportion	1.049		1.053	*	1.052	*
	(0.699)		(0.582)		(0.603)	
GRP pc	0.007		0.010	**	0.009	**
	(0.005)		(0.004)		(0.004)	
Econ. Signif.	-0.783		-0.801		-0.532	
	(1.435)		(1.302)		(1.316)	
Transport	0.519	*	0.698	**	0.664	**
	(0.298)		(0.310)		(0.281)	
Inflation	-0.027		-0.027	*	-0.026	*
	(0.017)		(0.014)		(0.014)	
Gov. Exp.	-3.692		2.497		2.735	
	(9.096)		(6.656)		(7.299)	
Edu. Fund	1.151		0.736		0.936	
	(1.590)		(1.175)		(1.167)	
Secondary School Enrolments	-3.122					
	(2.484)					
Secondary School Graduates			-4.820		-4.661	
			(7.634)		(7.649)	
Constant	2.390	*	2.162	*	2.125	*
	(1.397)		(1.111)		(1.145)	
Number of observations:	251		251		251	
Number of instruments:	34		34		34	
AR(2) p-value	0.124		0.104		0.116	
Sargan p-value	0.101		0.153		0.112	
Hansen p-value	0.993		0.992		0.988	

Notes. SGMM estimator is used in regression analyses. The dependent variable is intra-provincial regional inequality measured by the Gini coefficient in each province. Standard errors (in parentheses) are asymptotically robust to heteroskedasticity. AR(2) is Arellano-Bond test for AR(2) in first-differences. Both Sargan and Hansen are tests of the overidentifying restrictions.

* Significance at the 10% level. ** Idem, 5% level. *** Idem, 1% level.

The proxy of international trade is then changed to *Exports and Imports pc* in column (6). It can be observed that the results in columns (5) and (6) are very similar. The coefficient of *FDI* is significant and negative, whereas the coefficient of *Exports and Imports pc* is negative but insignificant. The coefficients of the *Secondary Proportion*

and *Tertiary Proportion* are significant and positive. The results of the other control variable show that coefficients of the *GRP pc* and *Transport* are significant and positive, whereas the coefficient of *Inflation* is significant and negative. The coefficient of the educational variable of *Secondary School Graduates* is found to be negative but insignificant.

The results show that all the proxies of education are negative but insignificant in all the specifications. It means that education does not play a major role in intra-provincial regional inequality amongst the cities and counties. Moreover, the variables of international trade, which are based on per capita basis, are also insignificant in all the specifications. The coefficient of the *FDI* is significant and negative, whereas the coefficients of *Secondary Proportion* and *Transport* are significant and positive in all the specifications. *Tertiary Proportion*, *GRP pc* and *Inflation* retain their significance in many of the specifications.

In summary, the results in the baseline model in Table 3 are robust to various choices of proxies of globalization and a wide range of specifications as shown in Tables 4 and 5. It can be concluded that FDI is negatively correlated with regional inequality, whereas international trade is found to have no statistically significant relationship with regional inequality. In addition, it is found that industrialization and development in the tertiary industry are positively correlated with it.

6. Conclusions

This paper investigates the impacts of globalization on intra-provincial regional inequality in China. The analysis results show that FDI displays a negative correlation with intra-provincial regional inequality in China, whereas international trade does not seem to have any significant impact on inequality. The results in this study, which are based on the county-level data, are different from those which are based on provincial level data. Therefore, it pinpoints the importance of studying regional inequality at different spatial levels.

Another finding is that regional inequality will increase as the primary sector declines. Therefore, the government can reduce regional inequality by stimulating growth in the

primary industry sector. This is also suggested by the recent work of Montalvo and Ravallion (2010). However, it is inappropriate to restrict the development of the secondary and tertiary industries in redressing inequality because the development in these two sectors can greatly increase the incomes of the poor. Chen and Groenewold (2010) warn that improving the gap of output per capita may not necessarily improve the welfare gap. Restricting the development of the secondary and tertiary industries can make the people in the poor regions become worse-off even though regional inequality is reduced. Basically, the increase in inequality stems not from industrialization and development in the tertiary industry per se, but rather from the unevenness in distribution of the secondary and tertiary industries.

Globalization, industrialization, and development in the tertiary industry can greatly increase the output of the underdeveloped regions if they are targeted specifically at those regions. On the contrary, inequality will be reinforced if they are targeted at the rich regions. The crux of the problem of regional inequality in China is the unevenness in the distribution of globalization and industrialization. Therefore, the government should take these factors into consideration in formulating policies for inequality alleviation. Moreover, the government should not abandon globalization, industrialization and development in tertiary industries, but they should spread them into the disadvantaged regions and ensure the poor can benefit from them.

Several policy implications can be drawn from this study. First, FDI should be encouraged by the government, especially for the poor regions. More preferential administrative policies, tax incentives, and better transportation infrastructure should be provided to the underdeveloped regions in order to attract more FDI. Second, the government should promote retail trade and other industries which can absorb the unskilled and surplus labour. Finally, when the government tries to increase outputs by promoting industrialization and further development in the tertiary industries, it should ensure that the benefits can spread far into the poor regions within a province.

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