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The impacts of financial development, urbanization, and globalization on income inequality: A regression-based decomposition approach

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ADB Working Paper Series

**THE IMPACTS OF FINANCIAL
DEVELOPMENT, URBANIZATION,
AND GLOBALIZATION ON INCOME
INEQUALITY: A REGRESSION-BASED
DECOMPOSITION APPROACH**

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Abstract

This paper aims to study the impacts of financial development, urbanization, and globalization on income inequality in the People's Republic of China. It applies the regression-based inequality decomposition approach on a panel dataset, which is aggregated from a unique database of financial development so as to quantify the relative contributions of these three factors, along with other variables such as physical capital and human capital, to income inequality. The findings suggest that financial development, urbanization, and globalization exert a positive impact on income. However, the contributions of urbanization, foreign investment, physical capital, and human capital to regional inequality are positive. Moreover, it is found that financial development is crucial for promoting inclusive growth, since it can stimulate economic growth and is found to be an equalizing factor of inequality.

JEL Classification:C43, F43, O16, R11

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1. INTRODUCTION

Since the initiation of economic reforms in 1978, the People's Republic of China (PRC) has transitioned from a centrally planned economy toward a market economy. With the deepening of financial development, urbanization, and globalization, the PRC has achieved remarkable economic growth for nearly 4 decades. Nowadays, the PRC is the second-largest economy in the world, and plays an influential role in the global economic system.

However, many studies report that the PRC's income inequality has increased considerably (for example, see Chen 2010; Liu 2013; Tian et al. 2016; Westerlund 2013; Zhang and Zou 2012; Cheong 2012; Cheong and Wu 2012, 2013a, 2013b, 2014, Forthcoming; Li and Cheong 2016; Chen and Groenewold 2010). The rise in income inequality is detrimental to economic growth (Wan, Lu, and Chen 2006), and may lead to social instability and even political upheaval (Alesina and Perotti 1996, Voitchovsky 2005, Cheong and Wu 2015, Tian and Lo 2009); therefore, it calls for a thorough examination of the impacts of the major income determinants on regional inequality.

Financial development, urbanization, and globalization are found to be the major determinants of income in the literature of development economics. Levin (2005) suggests that financial development can promote economic growth by facilitating investment and improving the efficiency of capital allocation. Many empirical studies report that the development of financial intermediation has a positive influence on economic growth in the PRC (Zhang, Wan, and Jin 2007; Zhang, Wang, and Wang 2012; Hsueh, Hu, and Tu 2013). However, Zhang, Wan, and Jin (2007) point out that the rising regional disparity in the PRC can be partly explained by the divergent pattern of financial development between coastal and inland provinces.

Turning to urbanization, it is worth noting that the PRC's urban population has increased significantly, and Clarke Annez and Buckley (2005) claim that the PRC's remarkable economic growth can be attributed to the shift from simple rural production to the development in the urban-based industrial and service sectors. Since the people in the rural areas are usually poorer than their urban counterparts, urbanization can be employed to boost the income of the rural residents so as to reduce the income gap. In fact, many researchers report that urbanization may lead to a reduction in the rural–urban disparity, and even overall income inequality (Kanbur and Zhuang 2013, Wan 2013, Wu and Rao 2016).

The PRC's international trade rocketed from \$20.6 billion in 1978 to \$2,378 billion in 2014 (State Statistical Bureau 2015). The total amount of foreign direct investment (FDI) was \$4.10 billion during 1979–1984, and reached \$120 billion in 2014 (State Statistical Bureau 2015). Many cross-country studies report that although globalization can promote economic growth, it would also lead to an increase in inequality (Borenstein, Gregorio, and Lee 1998; Basu and Guarglia 2007; Ezcurra and Rodríguez-Pose 2013). Similar observations can also be found in the PRC as reported by many researchers (Zhang and Zhang 2003; Nissanke and Thorbecke 2006; Ran, Voon, and Li 2007; Tsui 2007; Wan 2007, 2008; Wei and Ye 2009; Gries and Redlin 2011; Tian et al. 2011; Han, Liu, and Zhang 2012).

The aim of this study is to examine the impacts of financial development, urbanization, and globalization on regional inequality in the PRC. In this paper, the analysis is divided into two parts. In the first stage of the study, the impacts of the three major income determinants on provincial gross regional product (GRP) per capita in the PRC are examined; whereas in the second stage, the relative contributions of each

component to income inequality are quantified by employing regression-based inequality decomposition.

This paper makes three major contributions to the literature. First, the regression-based inequality decomposition approach is adopted in this study so that the relative contributions of financial development, urbanization, and globalization to regional income inequality in the PRC are quantified. The results derived from the analysis can highlight some important strategic directions in which policy makers should focus on in order to alleviate inequality while taking economic growth into consideration. Second, this study is based on a unique dataset of financial development compiled at the county level, which was offered by the China Banking Regulatory Commission. To the best of our knowledge, this is the first attempt of using this valuable database for inequality decomposition; therefore, the findings can shed light on regional inequality in the PRC, and fill the gap in the literature. Third, the explanatory power of our model is very high, so the inequality decomposition can be performed effectively with only a minimal portion assigned to the residual term, and thus it can offer the most relevant policy advice on alleviating inequality.

The rest of this paper is organized as follows. Section 2 presents a literature review. Section 3 describes the dataset and methods. Section 4 presents the results and discussion. Section 5 concludes the paper.

2. LITERATURE REVIEW

Financial development, urbanization, and globalization are the major determinants of income in growth-and-inequality studies. Many researchers report that these factors have a positive correlation with economic growth; however, many scholars also comment that they are the root causes behind the rising inequality.

2.1 Financial Development

The link between financial development and economic growth is a widely studied topic. The development of financial system may prove beneficial to economic growth through various channels, for example, pooling and mobilizing savings, ameliorating risks, exerting corporate governance, and facilitating the transactions of goods and services (Levin 2005).

Early cross-country studies report that financial development and economic growth are positively correlated (Goldsmith 1969; King and Levine 1993; La Porta, Lopez-de-Silanes, and Shleifer 2002). The causal relationship between finance and growth is investigated by other researchers (Levine and Zervos 1998, Beck and Levine 2004). All of them claim that financial development has a positive impact on economic growth. Using the panel dataset from PRC provinces and cities, some recent studies also report the positive influence of financial development on economic growth in post-reform PRC (Zhang, Wan, and Jin 2007; Zhang, Wang, and Wang 2012; Hsueh, Hu, and Tu 2013).

However, financial development may exacerbate income inequality because of the unequal access to finance. Using cross-country panel data of developing countries, Seven and Coskun (2016) find that although bank development contributes to economic growth, it also exerts a positive impact on the growth of the Gini coefficient. Zhang, Wan, and Jin (2007) report that the rising regional disparity in post-reform PRC can be partly attributed to the unequal financial development between the coastal and inland provinces. However, some other researchers claim that regional inequality can

be alleviated by speeding up financial reforms to improve the access to finance for the inland provinces (Zhang, Wan, and Jin 2007; Wang, Wan, and Yang 2015).

2.2 Urbanization

It is well known that urbanization is positively correlated with economic growth. Spence, Clarke Annez, and Buckley (2009) report that all high-income economies are 70%–80% urbanized, and nearly all economies become at least 50% urbanized before they attain the middle-income status. In general, urbanization contributes to economic growth via two channels: the rural–urban productivity difference and the rapid productivity growth in cities. When an economy begins to develop, the movement of the labor from the rural sector to the urban-based industrial and service sectors spurs income growth. Moreover, when cities expand, the agglomeration of people and industries would further facilitate economic growth (Spence, Clarke Annez, and Buckley 2009).

Zhou (2009) shows that there is an inverted-U pattern between overall income inequality and urbanization in the PRC. Kanbur and Zhuang (2013) also discover an inverted-U pattern between overall income inequality and urbanization. They also claim that the PRC has already passed the turning point. Wan (2013) finds that urbanization has led to a reduction in rural–urban disparity. When the PRC reaches a 55% urbanization rate, further urbanization is expected to narrow the income gap. Using provincial-level panel data, Wu and Rao (2016) find a negative relationship between inequality and urbanization in the PRC. Those provinces with low levels of urbanization experience rising income inequality, while a reduction in income inequality can be observed for those provinces with high urbanization levels.

2.3 Globalization

Globalization is commonly measured by the values of international trade and FDI. Theoretically, free trade can promote economic growth by allowing specialization according to comparative advantage as well as facilitating knowledge transfer and technology diffusion (Romer 1989, Grossman and Helpman 1990, Barro and Sala-i-Martin 1997). International trade is found to exert a positive impact on economic growth in the PRC (Tian 1999; Chen and Feng 2000; Dacosta and Carroll 2001; Yao and Zhang 2001a, 2001b; Liu, BurrIDGE, and Sinclair 2002; Yao and Zhang 2002; Yao 2006; Kei and Yao 2008; Lau 2010; Li, Chen, and San 2010; Li, Chen, and Wang 2010; Gries and Redlin 2011).

Similarly, foreign investment also plays a major role in promoting economic development. FDI inflows can boost growth for the recipient countries by increasing the capital stock, creating new job opportunities, and facilitating technology transfer (De Mello 1997; Borenstein, Gregorio, and Lee 1998). Many empirical studies find this positive influence of FDI on growth in many countries including the PRC (for example, Basu and Guarglia 2007; Borenstein, Gregorio, and Lee 1998; Chen, Chang, and Zhang 1995; Dees 2001; Tang, Selvanathan, and Selvanathan 2008; Yao 2006; Zhang 2001).

In the PRC, the coastal provinces gain more from globalization than the inland provinces due to preferential opening-up policies and geographical advantages. Many studies report that trade openness has played an important role in regional inequality (Jian, Sachs, and Warner 1996; Xu and Zou 2000; Fujita and Hu 2001; Zhang and Zhang 2003; Fu 2004; Kanbur and Zhang 2005; Fu 2007; Wan, Lu, and Chen 2007; Wan 2008; Gries and Redlin 2009; Pradhan 2009; Cai, Chen, and Zhou 2010;

Wei 2010; Ezcurra and Rodríguez-Pose 2013; Mah 2016). Besides, FDI is found to be positively correlated with regional inequality (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, Voon, and Li 2007; Tsui 2007; Wan 2007; Wan, Lu, and Chen 2007; Wan 2008; Wei, Yao, and Liu 2009; Li and Wei 2010; Tian et al. 2011). Wan, Lu, and Chen (2007) suggest that globalization is the most important determinant of regional inequality; however, a few studies argue that globalization exerts no, little, or even negative effect on inequality (Wei and Wu 2001; Cai, Chen, and Zhou 2010; Chen and Groenewold 2010; Yu et al. 2011; Mah 2016).

3. DATA AND METHODS

3.1 Income-Generating Function and Data

As the first step of the regression-based decomposition, an income-generating function must be specified and estimated. The standard production function is used in the econometric analysis. In this paper, the impacts of financial development, urbanization, globalization, and other inputs such as physical capital and human capital are investigated. The income-generating function takes the following semi-log form:

$$\ln(\text{GRPPC}_{it}) = \beta_k X_{it} + v_i + v_t + \varepsilon_t \quad (1)$$

where GRPPC_{it} is the GRP per capita for province i at time t , v_i is the fixed effect for province i , v_t is the time dummy, ε_t is the error term, β_k is the $k \times 1$ vector of the coefficients on X_{it} , and X_{it} is the matrix of the provincial characteristics. The provincial characteristics include financial development, urbanization, globalization, physical capital, and human capital.

The variables used in the baseline model are shown in Table 1.

Table 1: Variables Used in the Baseline Model

	Variable	Explanation
1	Rural loan	loan made to agricultural households (Yuan) divided by provincial population
2	Financial institutions	number of financial institutions which are authorized to make loan divided by provincial population
3	Urbanization	percentage of urban population to provincial population (%)
4	Foreign investment	foreign investment (Yuan) divided by provincial population
5	International trade	total value of international trade (Yuan) divided by provincial population
6	Capital	capital stock (Yuan) divided by provincial population
7	Illiteracy	percentage of population aged 15 and over who are unable or have difficulty in reading (%)

Source: Authors' definitions.

The data on financial development is based on a unique county-level financial development database offered by the China Banking Regulatory Commission via its website (<http://www.cbrc.gov.cn>), but is no longer available online. The database is very comprehensive and offers valuable information on the financial development in the PRC. However, the time span of that data only covers the period from 2006 to 2010.

It is regrettable to note that, except the data on financial development, most of the other data (as listed in Table 1) are only available at the provincial level. Therefore, to incorporate urbanization, economic globalization, physical capital, and human capital into this study, the data of financial development are aggregated for each province to produce a provincial-level dataset for the econometric analysis.

The variables of *Rural loan* and *Financial institutions* are compiled to examine the impacts of financial development. Given that many poor people live in the rural areas, and access to financial resources is crucial for boosting income, thus the amount of loans made to the rural households per capita is used to evaluate the effect of financial access. To study financial development in detail, it is also necessary to consider the importance of financial infrastructure; therefore, the total number of financial institutions which are authorized to make loan divided by provincial population is also included in the income-generating function. Another major variable of this study is *Urbanization*, which is calculated as the ratio of urban population to total population.

It is worth noting that globalization can best be examined by considering the impacts of FDI and international trade. However, individual value of provincial data on FDI is no longer available from the *China Statistical Yearbook*; therefore, *Foreign investment* in each province is used as a proxy. This refers to overseas (including Hong Kong, China; Macau, China; Taipei, China; and other foreign countries) funds received during the reference period for investment, including FDI, foreign borrowings, and other foreign investments. Although the value of FDI is included in *Foreign investment*, it should be noted that foreign borrowings and other foreign investments are also included, so caution should be exercised in interpreting the results. *International trade* is defined as per capita total value of imports and exports by location of importers and exporters.

Capital is defined as capital stock per capita, and is calculated by the authors based on an earlier study conducted by Wu (2009). *Illiteracy* is the illiterate rate, and it refers to the population aged 15 and over who are unable or have difficulty in reading. Illiteracy rate is used to evaluate the impacts of human capital on income. However, it should be noted that it is a negative relationship, whereby the lower the illiteracy rate, the higher the level of human capital.

The data, except the data on financial development, are all compiled from the *China Statistical Yearbook* (State Statistical Bureau 2007–2012). Moreover, the data are adjusted for inflation by converting them to 1997 constant prices. Most of the data are prepared in a way such that they are divided by provincial population; thereby expressed them as per capita values. All other variables are expressed as a percentage. The dataset used in the regression analysis is an unbalanced panel dataset, as some data are unavailable for some of the years. Table 2 shows the descriptive statistics for the explanatory variables that are employed in the baseline model.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GRPPC	155	22,041.15	13,275.73	5,371.85	62,169.73
Rural loan	152	1,060.42	794.20	35.84	5,448.70
Financial institutions	152	0.00013	0.00004	0.00008	0.00035
Urbanization	155	48.41	14.89	21.13	89.30
Foreign investment	153	302.78	360.86	0.00	1,554.06
International trade	155	12,225.15	22,413.75	318.63	102,759.60
Capital	155	70,075.74	41,300.03	19,902.85	218,391.10
Illiteracy	155	8.49	6.89	1.70	45.65

Source: Authors' calculation.

3.2 Regression-based Decomposition

The regression-based decomposition methodology has been employed by some researchers in evaluating the contributions of the regressors to overall inequality (for example, Blinder 1973; Fields and Yoo 2000; Bourguignon, Fournier, and Gurgand 2001; Morduch and Sicular 2002; Fields 2003). However, Wan (2002) points out the pitfalls of this decomposition approach and develops a new procedure which can greatly improve the performance. In this paper, two approaches are used to decompose total income inequality, namely the Fields decomposition method and the approach which is based on the Shapley value decomposition method as suggested by Wan (2002).

3.2.1 Fields Method

This approach is proposed by Fields (2003), and is based on an estimation of the share of the log-variance of income that can be attributable to the j^{th} independent variable as:

$$s_j = \frac{\hat{\beta} \text{cov}(x_j, \ln y)}{\sigma^2(\ln y)} \quad (2)$$

where $\text{cov}(x_j, \ln y)$ is the covariance between the j^{th} regressor and the regressand, $\sigma^2(\ln y)$ is the variance of the regressand, and $\hat{\beta}$ is the coefficient of the j^{th} regressor estimated by the OLS (Manna and Regoli 2012).

The sign of s_j reveals whether the contribution of the j^{th} regressor is inequality-worsening ($s_j > 0$) or inequality-alleviating ($s_j < 0$). The magnitude of s_j shows the relative contribution of the j^{th} regressor to explained overall inequality (Manna and Regoli 2012). It should be noted that:

$$\sum_{j=1}^k s_j = \frac{\sum_{j=1}^k \hat{\beta} \text{cov}(x_j, \ln y)}{\sigma^2(\ln y)} = \frac{\sigma^2(\ln \hat{y})}{\sigma^2(\ln y)} = R^2 \quad (3)$$

Therefore, the contribution of the residual term is not included in the analysis. This can be a problematic issue if the value of R^2 is low for the econometric model.

3.2.2 Wan's Approach with Shapley Value Decomposition

Wan (2002) proposes a procedure for implementing regression-based inequality decomposition which can be applied to any kind of inequality measures and does not impose any restrictions on the underlying regression model (Wan 2002, 2004). It is a very powerful approach when one combines it with the Shapley value approach developed by Shorrocks (unpublished).

In this innovative approach, $I(Y)$, the inequality measure of Y , can be decomposed into three components: CO_α , CO_e , and CO_{Y^*} . CO_α is the contribution of the constant term, α , while CO_e is the contribution of the residual term, e , and CO_{Y^*} represents the contributions of various individual variables X_s .

$$Y = \hat{Y} + e \quad (4)$$

$$\hat{Y} = \alpha + Y^* \quad (5)$$

Wan (2002) shows that the percentage contributions of the three components can be represented as:

$$PC_e = 100[I(Y) - I(\hat{Y})]/I(Y) \quad (6)$$

$$PC_\alpha = 100[I(\hat{Y}) - I(Y^*)]/I(Y) \quad (7)$$

$$PC_{Y^*} = 100[I(Y^*)]/I(Y) \quad (8)$$

$I(Y^*)$ can be decomposed into contributions of individual determinants X_s by employing the Shapley value approach developed by Shorrocks (unpublished) (for details, please refer to Wan 2002, 2004; Wan and Zhou 2005).

It is worth noting that Wan's approach takes the residual and the constant terms into consideration and does not impose any limitations on the inequality measurement indicators and functional forms. Therefore, it is much more flexible and powerful than the Fields method. However, the results derived from the Fields method and Wan's approach with Shapley value decomposition are presented in this study for the sake of comparison.

4. RESULTS AND DISCUSSION

4.1 Determinants of Income

The results of the ordinary least squares (OLS), fixed effects (FE), and random effects (RE) models are shown in Table 3. It should be noted that the adjusted R^2 of the OLS model is extremely high and has the value of 91.89%. The results show that the explanatory power of the model is very good. The coefficients of *Rural loan*, *Financial institutions*, *Urbanization*, *Foreign investment*, and *Capital* are all positive and significant. The coefficient of *Illiteracy* is significant but negative; this suggests that education is important for boosting income. These findings are consistent with earlier studies. However, the OLS model shows that the coefficient of *International trade* is negative but not significant. Turning to the FE model, the result shows that *Rural loan* and *Financial institutions* become insignificant, but the other variables retain their significance. To select the most appropriate model, the Hausman test is conducted. It is found that the p -value of the Hausman test is 0.128; therefore, the RE model is deemed to be better than the FE model.

It is worth noting that, in the early stage of this study, alternative specifications with interaction terms are tested; however, all the interaction terms are found to be insignificant. Given that the R^2 of the model (as shown in Table 3) is very high and the addition of interaction terms does not improve the econometric model, the interaction terms are not included in the baseline model.

Referring to the RE model, overall R^2 of the RE model is very high, with a value of 91.13%, implying that the explanatory power of the model is exceptionally high. The coefficients of all the independent variables are statistically significant at the 1% or 5% level. The results also indicate that although multicollinearity may exist among the regressors, it is not a concern as all the independent variables are statistically significant.

Table 3: Determinants of Income

Variable	OLS	FE	RE
Rural loan	9.47e-05***	-3.07e-06	3.4e-05**
Financial institutions	1,449.014**	692.470	1,371.371***
Urbanization	0.016***	0.048***	0.0224***
Foreign investment	1.78e-04***	9.49e-05**	1.13e-04**
International trade	-7.32e-07	-1.11e-06	-4.34e-06***
Capital	4.63e-06***	4.95e-06***	6.10e-06***
Illiteracy	-0.017***	-0.011***	-0.016***
Constant	8.543***	7.142***	8.273***
N	150	150	150
Adjusted R ²	0.9189		
Overall R ²		0.8664	0.9113

FE = fixed effects, OLS = ordinary least squares, RE = random effects.

Note: *Significant at the 10% level, ** significant at the 5% level, and *** significant at the 1% level.

Source: Authors' calculation.

The coefficients of *Rural loan*, *Financial institutions*, *Urbanization*, *Foreign investment*, and *Capital* are positive, whereas the coefficient of *Illiteracy* is negative. It shows that financial development, urbanization, globalization, physical capital, and human capital are major determinants of income. This study produces results that corroborate the findings of other research conducted in related areas, and provides empirical evidence supporting mainstream economic theories. However, it is of interest to note that the coefficient of *International trade* is negative, though the impact is negligible as its value is only -4.34e-06; in fact, the magnitude of this coefficient is the smallest among all the independent variables.

4.2 Robustness Test

The RE model of Table 3 is used as the baseline model, and robustness tests are performed to verify the results. The first attempt is to evaluate the variable of *Rural loan*, and a new variable *Rural loan proxy 1* is constructed for the robustness test. *Rural loan proxy 1* is defined as the ratio of loan made to agricultural households to total value of loan (%). That new variable is used to replace the original variable of *Rural loan*. The result is shown in column (1) of Table 4. It can be observed that every variable retains its significance and sign after the replacement.

To examine globalization, a new variable is constructed for replacing *Foreign investment*. The new variable of *Foreign investment proxy 1* is based on the total value of investment (Yuan) in fixed asset by Hong Kong, China; Macau, China; Taipei, China; and other foreign countries (according to the status of registration) divided by provincial population. The results are presented in column (2). Column (3) shows the results when both the variables of *Rural loan* and *Foreign investment* are replaced together. The results demonstrate that there is no change in sign for the variables in these specifications.

Table 4: Robustness Test

Variable	Baseline	(1)	(2)	(3)
Rural loan	3.4e-05**		4.1e-05**	
Rural loan proxy 1		0.011**		0.013***
Financial institutions	1,371.371***	1,266.139**	1,338.830***	1,257.990**
Urbanization	0.022***	0.024***	0.022***	0.023***
Foreign investment	1.13e-04**	1.1e-04**		
Foreign investment proxy 1			5.2e-05**	5.5e-05**
International trade	-4.34e-06***	-4.39e-06***	-3.88e-06**	-3.95e-06**
Capital	6.10e-06***	6.24e-06***	5.63e-06***	5.74e-06***
Illiteracy	-0.016***	-0.016***	-0.015***	-0.016***
Constant	8.273***	8.187***	8.295***	8.214***
N	150	150	152	152
Overall R ²	0.9113	0.9103	0.9097	0.9122
Variable	(4)	(5)	(6)	(7)
Rural loan	3.6e-05**	4.4e-05**		
Rural loan proxy 1			0.011**	
Rural loan proxy 2				0.003**
Financial institutions	1,249.911**	1,251.348**	1,266.139**	1,305.670***
Urbanization	0.021***	0.022***	0.024***	0.021***
Foreign investment	1.2e-04**		1.1e-04**	1.3e-04**
Foreign investment proxy 1		6.57e-05**		
International trade				
International trade proxy 1	-5.10e-06**	-4.99e-06**	-4.39e-06**	-4.50e-06**
Capital	6.16e-06***	5.56e-06***	6.24e-06***	6.52e-06***
Illiteracy	-0.015***	-0.015***	-0.016***	-0.016***
Constant	8.307***	8.318***	8.187***	8.293***
N	150	152	150	150
Overall R ²	0.9095	0.9068	0.9103	0.9009

Note: *Significant at the 10% level, ** significant at the 5% level, and *** significant at the 1% level.

Source: Authors' calculation.

It is worth noting that there is another way of measuring the total value of international trade. One can take the place of origin and the place of destination into consideration. Therefore, the new variable of *International trade proxy 1* is prepared by first calculating the total value (Yuan) of import and export whereby the import value is based on the place of destination and export value is based on the place of origin. Then the total value of import and export is divided by the provincial population. The results of this new specification are presented in column (4). Column (5) shows the results when both *Foreign investment* and *International trade* are both replaced by their new variables together. Similarly, column (6) presents the results when *Rural loan proxy 1* and *International trade proxy 1* are used together. It can be observed from all the specifications, as listed in columns (4), (5), and (6), that all the coefficients retain their sign and significance after the replacement.

Finally, to evaluate the effect of financial development, another new variable is compiled. *Rural loan proxy 2* is constructed by computing the ratio of total loan made to the agriculture sector to total value of loan (%). That variable is used to replace *Rural loan*. Column (7) shows the specification which includes that new variable along

with *International trade proxy 1*. Similarly, the results of the new specification show that every other variable retains its significance and sign after the replacement of the variables.

According to these results, it can be observed that all the variables are statistically significant at the 1% or 5% level for every specification listed in Table 4. Therefore, it shows that the results are robust to different choices of proxies and a wide range of specifications. It can thus be concluded confidently that financial development, urbanization, foreign investment, physical capital, and human capital are all positively correlated with income.

4.3 Regression-based Inequality Decomposition

The previous section reveals that *GRPPC* is positively correlated with financial development, urbanization, globalization, physical capital, and human capital. One can expect that regional inequality will be reduced if the benefits of financial development, urbanization, and globalization can be targeted at the poor and underdeveloped regions; however, inequality will be exacerbated further if the benefits of these income-boosting factors are diverted to the already affluent regions. Regression-based inequality decomposition is thus conducted in this section so as to reveal information on the contribution of each factor to overall regional inequality.

4.3.1 Fields Method

The results of the regression-based inequality decomposition derived from the Fields method are shown in Table 5. Recalling the fact that the Fields method should not be used if the value of R^2 is very low for the econometric model, it is not a concern in this study as the values of R^2 of the baseline model are extremely high for all the models shown in Table 3. The adjusted R^2 of the OLS model is 91.89%, whereas the overall R^2 of the RE model is 91.13%; therefore, a large portion of regional inequality within the PRC can be accounted for by the regressors as listed in the baseline model.

Table 5: Regression-based Inequality Decomposition Using Fields Method

	Relative Contribution (%)
Total	100
Rural loan	2.45
Financial institutions	-0.32
Urbanization	44.25
Foreign investment	8.89
International trade	-2.56
Capital	35.78
Illiteracy	11.51

Source: Authors' calculation.

Referring to the variables related to financial development (Table 5), it can be observed that the contribution of *Rural loan* is positive, implying that the uneven distribution of rural access to financial services was one of the driving forces behind the surge in regional inequality, though the effect is very small. Another finding is that the contribution of *Financial institutions* is negative. This is an encouraging finding as it indicates clearly that further development in financial infrastructure can boost income and also exert an equalizing effect on inequality.

Turning to other determinants of income, *Urbanization* contributes 44% to overall inequality, whereas *Capital* contributes about 36%. The contribution of *Illiteracy* is 12%. Together, these factors contribute about 92% to total regional inequality. Given that urbanization, physical capital, and human capital are vital in boosting economic growth, policy makers should keep on urbanization and building up the physical capital and human capital. Policy makers, however, should ensure that future developments can benefit the poor regions so as to alleviate regional inequality.

Referring to the variables related to globalization, *Foreign investment* contributes 9%; therefore, the government should encourage investment in the underdeveloped areas to narrow the income gap. It is found that the contribution of *International trade* is -2.6%; therefore, the contribution is very small and its impact is negligible.

4.3.2 Wan's Approach with Shapley Value Decomposition

The decomposition results for the whole study period and also for each individual year are presented in Table 6. Regression-based inequality decomposition is conducted for four inequality indicators: the Gini coefficient, the coefficient of variation, and the Theil-T and Theil-L indexes. Although the indicators differ, some common findings can still be observed. It is of interest to note that the findings derived from the Shapley value decomposition are very similar to those obtained from the Fields method.

**Table 6: Regression-based Inequality Decomposition
using the Shapley Value Approach**
(Relative contributions, %)

	Gini	CV	Theil-T	Theil-L	Year
Rural loan	3.62	1.76	-0.10	1.14	2006–2010
Financial institutions	1.38	1.62	0.01	-0.13	
Urbanization	38.53	42.20	45.40	43.05	
Foreign investment	7.80	8.13	9.00	8.67	
International trade	-1.58	-2.17	-3.28	-2.83	
Capital	31.50	35.50	38.18	35.61	
Illiteracy	8.96	8.30	8.98	9.73	
Residual	9.79	4.63	1.81	4.77	
Total	100	100	100	100	
Rural loan	2.62	-0.87	-4.28	-2.46	2006
Financial institutions	3.29	3.87	0.84	0.38	
Urbanization	38.26	40.84	43.88	42.43	
Foreign investment	6.26	6.83	7.65	7.27	
International trade	15.05	18.82	20.44	18.39	
Capital	14.82	17.46	19.18	17.68	
Illiteracy	11.81	10.54	11.81	13.02	
Residual	7.89	2.52	0.48	3.28	
Total	100	100	100	100	
Rural loan	6.07	2.84	0.27	1.98	2007
Financial institutions	1.89	2.22	0.52	0.33	
Urbanization	36.34	39.73	43.14	41.28	
Foreign investment	4.11	4.45	5.17	4.93	
International trade	-1.76	-2.52	-3.68	-3.18	
Capital	34.47	39.70	42.44	39.78	
Illiteracy	11.09	9.96	10.86	11.60	
Residual	7.78	3.59	1.28	3.29	
Total	100	100	100	100	

continued on next page

Table 6 *continued*

	Gini	CV	Theil-T	Theil-L	Year
Rural loan	4.42	3.02	0.95	2.06	2008
Financial institutions	0.36	0.06	-0.50	-0.43	
Urbanization	42.35	46.38	49.58	47.10	
Foreign investment	9.89	10.53	11.64	11.19	
International trade	-2.73	-3.79	-5.71	-4.94	
Capital	27.16	31.74	34.27	31.67	
Illiteracy	9.41	8.52	9.10	9.49	
Residual	9.13	3.51	0.67	3.84	
Total	100	100	100	100	
Rural loan	2.71	0.54	-2.41	-1.00	2009
Financial institutions	0.08	0.09	-0.15	-0.21	
Urbanization	48.20	52.43	51.53	53.45	
Foreign investment	8.62	8.50	16.31	9.12	
International trade	-0.22	-0.29	-0.42	-0.40	
Capital	24.74	27.79	28.12	28.61	
Illiteracy	5.37	5.09	4.86	5.41	
Residual	10.50	5.81	2.15	5.03	
Total	100	100	100	100	
Rural loan	1.22	-0.13	-2.19	-1.37	2010
Financial institutions	1.11	1.42	-1.01	-1.30	
Urbanization	51.64	55.25	59.68	57.47	
Foreign investment	8.15	8.14	9.10	9.03	
International trade	-1.53	-2.04	-3.31	-2.91	
Capital	24.54	27.12	30.36	28.59	
Illiteracy	4.87	4.44	4.92	5.49	
Residual	10.00	5.76	2.45	5.01	
Total	100	100	100	100	

CV = coefficient of variation.

Source: Authors' calculation.

For all the indicators, it can be observed that the highest contributor is *Urbanization*, whereas the second-highest contributor is *Capital*. Together, they account for 70%–80% of income inequality, depending on the indicators being used.

Turning to the variables of globalization, the contribution of *Foreign investment* is positive though not very large. The contribution of *International trade* is negative for the whole period and for most of the years in the research period. Nevertheless, it is of interest to note that the contribution of *International trade* is positive in 2006 for all the indicators; but this effect is short-lived and the contribution of *International trade* is negative from 2007 to 2010 though the impact is negligible.

It is worth noting that, apart from *International trade*, the contributions of the variables of the financial development are negative for many years; for example, the contributions of *Rural loan* is negative in 2006 and 2010 for coefficient of variation, Theil-T, and Theil-L. The contribution of *Financial institutions* is positive in 2006 and 2007 for Theil-T and Theil-L, but then it is negative from 2008 to 2010. One salient finding is that, for the Theil-T and Theil-L indexes, the contributions of all variables

of financial development are negative for many of the years, and they all become negative in 2009 and 2010. This is inspiring as it clearly indicates that financial development can boost income and also exert equalizing effect on inequality. Most of the poor regions lack the funds for development; and financial development is important to them as financial resources can be allocated more efficiently with the deepening of financial development. Funds can be supplied to the firms to stimulate production and business activities in the poor areas. Moreover, financial deepening can also exert positive effect on productivity growth (Zhang, Wan, and Jin 2007). Therefore, the government should take financial development into consideration when they formulate development policies. To magnify this equalizing impact, policy initiatives should be formulated to establish a network of banks and financial institutions in the poor provinces so as to stimulate income growth and narrow the income gap. New policies should be set up to encourage financial development in the underdeveloped regions through providing financial access to the poor and promoting investment in financial infrastructure.

5. CONCLUSIONS

The objective of this paper is to study the impacts of financial development, urbanization, and globalization on regional inequality in the PRC. It applies the regression-based inequality decomposition approach on a panel dataset, which is aggregated from a unique county-level financial development database so as to quantify the relative contributions of these three factors, along with other variables such as physical capital and human capital, to income inequality.

The analysis is divided into two parts. First, various models are employed to evaluate the impacts of financial development, urbanization, and globalization on income. Robustness tests are then conducted. Second, the regression-based inequality decomposition is performed. Both the Fields method and Wan's approach with Shapley value decomposition are used to provide a comprehensive analysis on the contribution of each factor to overall inequality.

The results derived from the first part of the study show that the explanatory power of the baseline model is exceptionally high. The adjusted R^2 of the OLS model is 91.89%, whereas the overall R^2 of the RE model is 91.13%. A large portion of the variation of the dependent variable can be accounted for by those regressors listed in the baseline model. The results show that financial development, urbanization, foreign investment, physical capital, and human capital are major determinants of income. However, the impact of international trade, although negative, is negligible. Different proxies of financial development and globalization are used in the robustness tests, and it is found that the results are robust to different choices of proxies and a wide range of specifications.

Turning to the decomposition analysis, it is found that the findings derived from the Fields method are very similar to those obtained from Wan's approach with Shapley value decomposition, though some minor differences can be observed. The results show that the contributions of urbanization, foreign investment, physical capital, and human capital are positive. However, given that these factors are vital in boosting economic growth, policy makers should continue to promote the development in these factors. However, policy makers should divert resources to the poor regions and encourage development in underdeveloped areas to alleviate income inequality. The contribution of international trade is very small, and its impact is negligible.

The findings also show that financial development is an indispensable tool in boosting income and alleviating inequality as the contributions of the two variables of financial development are negative in many years within the research period. This is a promising finding as it clearly indicates that financial development not only can boost income but also exert an equalizing effect on regional inequality in the PRC. Therefore, new policies should be set up to encourage financial development in the underdeveloped regions through providing financial access to the poor and promoting investment in financial infrastructure.

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