Variations in the determinants of regional development disparities in rural China

ZHENG, Lucy, SHEPHERD, David and BATUO, Michael Enowbi

Variations in the determinants of regional development disparities in rural China

Abstract

The presence of persistent regional development disparities in rural China has become one of the most important concerns about the country's further sustainable development. As the key engine driving the rural economy, rural industrial development plays a dominant role in understanding rural regional development disparities. This study utilizes a provincial panel dataset to examine the determinants of industrial development in rural China over the period 1992-2014. The analysis compares rural output growth and export growth as indicators of rural industrial development, and identifies significant regional variations in the determinants of these indicators across the three main regions of the country. The results suggest that domestic capital investment is the most important cause of regional rural output growth disparities, while FDI is the main reason for rising regional disparities in export growth. A strong self-reinforcing effect in output growth is identified for the Eastern region, which has generated faster economic growth compared to the other regions. There exists a regional divergence in export growth, accelerating the regional export disparity between the three regions. Based on the findings of this study, we argue that, to reduce regional development disparities, the formulation of policies to promote national economic goals should take explicit account of the regional context in which those policies operate.

Keywords

Regional development disparities, variation, determinant, rural industry, rural China

1. Introduction

The outstanding growth of the Chinese economy over the last 40 years stems from a combination of successful economic reforms, industrialisation, and highly promoted foreign direct investment (FDI) and exports (Zheng, 2017). However, despite China's success in raising economic prosperity, a number of economic, social, and environmental problems have arisen during the development process (Rogers, 2014). In particular, the increasing disparity in regional development between the three main regions (Eastern, Central, and Western) has become one of the major challenges for its further sustainable development of the country (Liu, et al. 2017; Long, et al. 2016).

Since the economic reforms of the early 1980's, rural China has experienced a significant transformation through population, employment, and industrial restructuring (Long and Woods, 2011). Rural development has mainly been driven by the rapid growth of rural industry, with the development of township village enterprises (TVEs) acting as a key factor in reducing rural poverty (Wang, et al. 2016; Rodriguez-Pose and Hardy, 2015). These developments in rural industry have been a major contributor to China's remarkable GDP and export growth, and absorbing more than 30% employment of the rural labor force (Long and Woods, 2011; Zhan, 2015). Despite this progress, however, there have been increasing regional disparities in rural industrial development (Li, et al. 2015; Rogers, 2014). The fast development in the Eastern costal region has left the inland regions, especially the remote Western region, far behind (Ito, 2010; Li, et al. 2015; Long and Woods, 2011). Rural regional development disparity has rapidly widened since the early 1990's, causing severe regional income inequality in rural China (Liu, 2006; Long et al. 2009). The Gini coefficient in rural inland regions rose from 0.40 in 1991 to 0.49 in 2000, which are much higher compared to that in rural coastal regions rising from 0.38 in

1991 to 0.39 in 2000 (Benjamin et al 2008). By contrast, the Gini coefficient in urban inland regions rose from 0.31 in 1991 to 0.39 in 2000 (while overall Gini coefficient combining rural and urban rose from 0.39 in 1991 to 0.48 in 2000 in inland regions), and in urban coastal region rising from 0.26 in 1991 to 0.37 in 2000 (while overall coefficient rose from 0.35 in 1991 to 0.39 in the coastal region) (Benjamin et al 2008). In comparison, rural regional inequality is severer than that of overall regional inequality and much severer than that of urban regional inequality. Rural income inequality reflects not only economic but social and political inequality. People living in deprived remote rural areas have fewer opportunities for education, healthcare, and other social services. Because of the priority given to industrialisation and urbanisation in the country's economic development, a large scale migration from rural inland areas to the prosperous Eastern coast caused a serious inland "rural hollowing" problem (Li, et al 2015; Liu, et al. 2014). Social problems related to migration such as crimes and labour right disputes have been increasing. Shortages of investment in both physical and human capital also contributed to rising poverty and even poorer living conditions in the already deprived remote rural areas, in which large ethnic minority populations are concentrated, causing political instability in the areas (Long et al. 2009; Rogers, 2014). As rural poverty, social conflict, and political instability are mounting in the remote areas, disparities in rural regional development continue to grow, posing challenges to the country's sustainable economic development (Gravier-Rymazewska, et al., 2010; Andersson, et al 2013).

Although there has been an increase in research on rural China, the literature has mainly focused on rural poverty (Liu, et al. 2017; Rogers, 2014; Ward, 2016), rural population and migration (Liu, et al. 2017; Liu, et al. 2014), rural restructuring (Li, et al. 2015; Long et al. 2009; Long et al, 2016; Long and Woods, 2011), and rural-urban integration (Liu, et al. 2013; Long et

al. 2011; Wang, et al. 2016). The development of rural industry is the main driver of the rural economy, but little attention has been paid to how this has affected regional development disparities. There remain important empirical questions to be answered about how and why the factors affecting industrial development have interacted with regional characteristics to generate increased regional disparities in rural China. Given the importance of industry in rural development, and its key role in China's GDP and export growth, it is important to understand the factors that determine sectoral growth and the extent to which variations in the determinants of growth in the rural areas have contributed to increased disparity between the three regions. Rising poverty and regional disparities in the rural economies of developing world are global phenomena and deserve more research (Rodriguez-Pose and Hardy, 2015). The present study aims to contribute to this research by shedding light on how rural industrial development affects rural regional disparities. Most of the previous disparity-related studies have focussed on a general regional disparity using a single economic growth indicator (measured by GDP) without an explicit industrial-specific dimension or a comparative analysis of different growth measures (Li, et al. 2015). In the present study, we allow for the possibility that different economic indicators may be determined by different sets of factors and compare the results so as to gain a more detailed (or more robust) picture of the factors influencing regional growth and disparities. The study differs from previous research in several ways. First, based on convergence and divergence theories, we develop a dynamic endogenous growth model to investigate divergence/convergence in rural industry and the path of regional development disparity. Second, we focus on rural industry and investigate regional variation in the determinants of rural industrial development. Third, in order to gain robust empirical evidence, we employ two economic growth indicators (rural industrial output and export) to examine variation in the

determinants of regional development. Given that China's economic development is mainly driven by export-led growth, especially in the Eastern coast region, it is important to identify the determinants of export growth and how they vary across the regions. These specific and comparative approaches allow us to gain greater insight about the factors generating rural development and the findings will hopefully contribute to a better understanding of the policies that might help to reduce regional development disparities in rural China.

Following the current introductory discussion, the remainder of the paper is organised as follows. Section Two reviews regional development disparities in rural China. Section Three sets out the theoretical framework used to examine the regional growth process. Section Four discusses the methodology for modelling and data analysis. Section Five presents the empirical findings of the comparative analysis of regional output and export growth, and the final section draws conclusions and policy implications on regional development disparity in rural China.

2. Rural regional development disparity

As a large developing country, China has a strong traditional rural root (Rodriguez-Pose and Hardy, 2015; Wang, et al. 2016; Long, et al. 2011). Despite rapid industrialisation and urbanisation in rural China, rural poverty is still a serious and persistent problem in the inland remote regions (Liu, et al. 2017; Rogers, 2014). Liu, et al (2017) point out that unbalanced social-economic development results in regional disparities in rural poverty. The complex geographic environment, natural disasters, poor infrastructure, and minority population concentration are the main causes of persistent rural poverty (Liu, et al. 2017). Liu, et al (2013) report that the rural regional gap is widening, which is reflected not only in income inequality but rural industrial employment, infrastructure, health care, and social security. Wang, et al (2016) reveal that rural development transformation has involved significant spatial differences

between regions. The Eastern region has experienced the fastest transformation with the highest rural development level among the regions due to the advantages in physical environment, optimal location, and socioeconomic foundation (Long, et al. 2011; Wang, et al. 2016). These advantages promote rural industrialisation, and the transfer of rural labour from traditional rural farming to the modern urban industrial sector (Wang, et al. 2016). In contrast, the Western region has experienced a slower transformation than other regions (Long, et al. 2011; Wang, et al. 2016). Li, et al (2015) note that rurality index can largely reflect the spatial pattern of rural development in China. They find a negative relationship between rurality index and rural development and argue that "counties with high rurality have been marginalised both geographically and economically" (Li, et al. 2015, p23). Studying rural development in the Eastern region, Long et al. (2009) divide rural development into four types as industry dominated, farming dominated, business dominated, and urban-rural balanced. They assert that industry dominated rural development has advantages over other the three types in generating more employment opportunities and improving the productivity of the rural labour force.

Industry dominated rural development has been greatly boosted by the growth of TVEs in rural industrialisation (Long et al. 2009), but the rural TVEs have developed unevenly across the regions (Ito, 2010; Mukherjee and Zhang, 2007; Rodriguez-Pose and Hardy, 2015). Regional differences in factor endowments, such as natural resources, finance, capital, and infrastructure have been suggested as the major causes of uneven regional rural industrial development (Ito, 2010; Long, et al. 2011; Rogers, 2014; Shen and Tsai, 2016). Rogers (2014) indicates that the regional variation in wealth and resources reflects an uneven spatial distribution of rural industry. The rural TVEs have developed rapidly in regions with favourable conditions for rural industrialization, while they are under-developed in the poorer regions with limited factor

endowments (Rodriguez-Pose and Hardy, 2015; Shen and Tsai, 2016). Rural TVEs in the poorer regions suffer from resource availability constraints (Rozelle, 1994; Shen and Tsai, 2016). Due to social requirement in these poorer regions, the limited available resources have mainly been used to maintain local agriculture rather than for industrial development (Rozelle, 1994; Shen and Tsai, 2016; Tong, 1999). Development in the poorer regions has also been deterred by the preference of providing farming-related job opportunities for the local population, even at expense of efficiency and profit maximization (Tong, 1999). Moreover, the political controls over financial resource allocation typically imply less capital investment in poorer areas, which aggravates regional rural inequality (Rogers, 2014).

3. Theoretical Framework

The literature on regional development has been dominated by two opposing theories (convergence and divergence) in relation to the long-term development trajectory (Martin and Sunley, 1998). Rooted in neoclassical equilibrium economics, convergence theory argues a strong tendency toward regional convergence because the regional differences in production factors tend to diminish over time due to factor mobility and self-correcting mechanism (Borts and Stein's 1964; Solow, 1957). Poor regions are more likely to achieve faster development than richer ones in an open economy and regional development disparities are viewed as a transitory phenomenon which tends to decline over time (Borts and Stein's 1964). The convergence theory has been controversial, however, and has been challenged by economists who favour endogenous growth models, which point to possible divergence in development disparities (Barro and Sala-I-Martin, 1991; Martin and Sunley, 1998). This approach argues that regional divergence is more likely due to market imperfections and uneven spatial (cumulative) concentrations of capital and labour (Barro and Sala-I-Martin, 1991; Lucas, 1988). According to this view, uneven regional

development is a self-reinforcing rather than a self-correcting process (Kaldor, 1981; Quah, 1996). The divergence theory regards regional disparity as a persistent phenomenon because of the increased regional differences in (both physical and human) capital accumulation and the cumulative nature of institutional and other factors affecting regional development pattern (Lucas, 1988). Regional development pattern is shaped by regional industry clustering and agglomeration in capital investment, human capital and technology development, which exhibit strong self-reinforcing effects (Martin and Sunley, 1998).

The traditional neo-classical analysis of the production function points to the central roles of labour, capital, and technology in the growth process. The standard aggregate production function can be written as:

$$Y_{it} = f(L_{it}, K_{it}, A_{it}) \quad (1)$$

where Y is output, L is labour, K is capital, and A is an index of technology. In this case, the subscript *i* indicates the relevant country, region, or sector and *t* represents the relevant time intervals. In order to apply this model in empirical work, it is necessary to be more specific about the functional form and the nature in particular of the technology factor, given that technology ultimately determines the productivity of the labour and capital inputs.

The original representation of the neo-classical growth model developed by Solow (1957) utilizes a Cobb-Douglas production function and regards technology as an exogenous factor that can be estimated as a residual term after accounting for the impact of the L and K inputs. The Solow model assumes that long-run economic growth is generated by capital accumulation and population growth, but exogenous technological progress is the key factor that generates improvements in factor productivity and prosperity. In contrast, post-Keynesian models have emphasised the role of saving and investment in the growth process, because they not only raise

the capital stock but also act as the channel through which technological progress and increased dynamism are spread to the economy (Kaldor, 1957; Kaldor and Mirlees, 1962). The neoclassical approach has also been extended by incorporating human capital into the production function. More recently, drawing on the insights of both the neo-classical and Keynesian approaches, the analysis of the growth process has emphasised the need to develop endogenous production models, which incorporate plausible explanations of the behaviour of the technology factor that generates higher factor productivity (Romer, 1986; Lucas, 1988; Frankel ad Romer, 1999). The endogenous growth models emphasise the role of research and development (R&D), human capital accumulation and externalities in the growth process and incorporate the possibility that the investments in human capital and technology reduce the diminishing return to capital accumulation and generate higher economic growth in the long-run (Romer, 1986; Frankel ad Romer, 1999). The endogenous models also suggest that institutional factors, such as government policy on regional investment, may have strong effects on regional growth (Martin and Sunley, 1998). They also admit the possibility that capital and labour tend to migrate to and thus create even higher growth in the prosperous regions, leading to increased divergence in growth patterns and permanent inter-regional disparities in development (Bertola, 1993; Barro and Sala-I-Martin, 1991). The endogenous growth theory thus has important regional implications, extending the debate on whether and to what extent economic growth is spatially localized and the "processes of cumulative causation in regional development" (Martin and Sunley, 1998, p211).

We follow the approach of the endogenous growth models by incorporating an explicit analysis to identify the determinants of and variations in rural industry regional economic

growth. The specific form of equation (1) used to estimate the determinants of the sector growth can be expressed as:

$$Y_{it} = \alpha + \beta X_{it} + \eta_i + \mu_t + \varepsilon_{it}, \qquad (i = 1, \ldots, N; t = 1, \ldots, T) \qquad (2)$$

Where Y_{it} is the dependent variable, measured (alternatively) as output growth and export growth in province *i* and year *t*. X is a vector of independent explanatory variables in province i and year t, η_i and μ_t denote provincial specific fixed and time effects, and ε_{it} is the error term.

4. Methodology

4.1 Variables

4.1.1 Dependent variables

The dependent variable Y is measured by two economic growth indicators and we investigate whether the same or different factors determine output growth and export growth in rural industry. This approach, which is one of the empirical novelties of the study, allows a more robust and comprehensive analysis of the regional development process, by presenting a comparison of different measures.

4.1.2 Predictors

Following the characterisation of the production function, and the spirit of the endogenous growth literature, the predictors are categorised as factors related to the physical capital-input and human capital-input. The physical capital-input variables include domestic capital investment and inward FDI. The human capital-input variables are labour productivity and human capital.

Physical capital-input factors

Domestic capital investment (the ratio of domestic capital investment to gross output). This factor is included because capital investment typically increases productive capacity by

raising both the domestic stock of capital and its productivity. New capital investment is often associated with the latest technologies and can not only increase production capacity but also raise the capital-labour ratio and labour productivity (Zheng, et al 2017). We expect that the domestic capital investment variable would have a positive impact on sectoral output /export growth.

FDI (the ratio of inward FDI to gross output). FDI is usually regarded as a major driver of growth in developing countries, boosting growth through both increased capital and productivity enhancement, arising from technology transfers and spillovers related to managerial skills transfer and human capital augmentation. It is argued that FDI firms have higher capital intensity and labour productivity, and pay higher wages than local domestic firms (Girma, et al. 2001; Driffield and Girma, 2003). We expect that FDI variable would have a positive impact on sectoral output /export growth.

Human capital-input factors

Labour productivity (the ratio of gross output to the number of employees). Labour productivity is an important factor in determining of economic output and the long-run growth trend. As measured by output per employee, higher labour productivity generally implies higher growth in output as well as a higher output level. We use labour productivity rather than total factor productivity (TFP) to distinguish the labour contribution to growth from the capital-related contribution. We would expect the labour productivity variable to have a positive impact on sectoral output /export growth.

Human capital (the ratio of the number of employees with higher education to the total number of employees). Research shows that human capital is one of the most important determinants of labour productivity. Labour skills and labour quality can be effectively

associated with employees' education level. We would expect human capital variable to have a positive impact on sectoral output /export growth.

4.1.3 Controls

Alongside the physical and human capital input predictors, several control variables are also included. The control variables are: sectoral-related factors, represented by firm size, an agglomeration effect, and labour cost to reflect rural industry characteristics; a locational-related factor, represented as an Eastern location dummy to reflect provincial economic and geographic location effects; and an institutional-related factor, represented as a privatisation time dummy to capture the impact of this important institutional change.

Sectoral-related factors

Firm size (the ratio of gross output to number of rural enterprises). The logic behind the incorporation of this factor is that increases in firm size often allow economies of scale to be achieved, helping to reduce unit costs and therefore raise output growth (Fu and Balasubramanyam, 2003). It is expected that the relationship between firm size and output/export growth would be positive

Agglomeration (the ratio of the number of rural enterprises in the province to the provincial land squares). Agglomeration effects arise from industrial geographical concentration because industrial clusters can reduce costs (e.g. transportation costs) and promote a more efficient use of inputs, boosting total factor productivity and outputs. The expectation is for a positive relationship between agglomeration and output/export growth.

Labour cost (the ratio of total real wages to the number of employees). The labour cost variable can have either a negative or a positive effect on output/export growth, depending on

whether a higher labour cost is associated with a higher or lower labour productivity. Hence, the relationship is ambiguous between labour cost and output/export growth.

Locational- related factor

Provincial proximity to local and foreign markets, economic development zones, transportation facilities, and business network may have significant impacts on sectoral growth. We include a locational dummy variable to control for provincial economic and geophysical location. It is expected that the provinces close to the Eastern coast with well-established transportation and business network will exhibit a positive effect on regional output/export growth.

Institutional-related factor

Institutional factor may affect regional economic development. There were some major institutional changes in the rural TVE sector in mid-1990s and most collective-owned TVEs were privatised during the ownership reforms of 1996-2001 in rural industry. We include a time dummy variable to capture the impact of privatisation reforms in 1996-2001 on regional output/export growth.

4.2 Data

The data is collected from various issues of *China Township Village Enterprise Statistical Yearbooks*, which is widely used by scholars for China's rural TVE industry related research. A balanced provincial panel dataset, pooled time-series and cross-section data, is employed over 23 years crossing 29 provinces. The time-series of the panel dataset covers the period 1992-2014 in which the rural industry has experienced significant development with important transformative changes related to population movement, employment, and industrial restructuring (Liu, et al, 2011; Long and Woods, 2011). The start year (1992) of this study is the

year in which the Chinese government launched its deeper economic reforms and further opening-up policies following the country leader Deng's Southern China Tour in 1992. The study covers all major institutional change periods, including the rural industry taxation reform and the ownership reforms of 1996-2001. As discussed above, most of the collective-owned TVEs gradually became privatised during this institutional restructuring period, aiming to gain efficiency improvements in a more liberalised market regime (Ito, 2010). The cross-section of the panel dataset includes 29 provinces (autonomous regions and central municipalities). In order to keep consistency, the data for Chongqing are included into Sicuan province from 1997 onwards because Chongqing became a central municipality in 1996. Tibet is excluded from the sample due to data availability. We first examine the general determinants of economic growth (in terms of both output growth and export growth) covering the whole sample of the total 29 provinces. In order to detect regional variation, we then divide the total 29 provinces into three regions according to their geographic locations as the Eastern (12 provinces), Central (9 provinces), and Western (8 provinces) regions. This division enables us to investigate the regional determinants of sectoral economic growth for each region and to compare variations in the determinants across the three regions. There are several advantages in using panel data compared to either a time-series or a cross-section approach (Hsiao, 2003). Panel data analysis controls for individual heterogeneity and the impact of omitted variables, and there is therefore less risk of obtaining biased results. Because panel data contains more degree of freedom and more sample variability, it allows more accurate inference of model parameters and less collinearity among the variables. Panel data has a greater capacity for capturing the complexity and dynamics of the model and thereby improves the efficiency of the econometric estimates (Hsiao, 2003).

4.3 Models

Following the endogenous growth model approach, we incorporate independent variables (X) including the predictors (domestic capital investment, FDI, labour productivity, and human capital), and controls (firm size, agglomeration, labour cost, privatization dummy, and location dummy) to detect the key determinants of the rural industrial output and export growth. In order to detect the dynamic divergence/convergence in the rural regional economic development trajectories, we transform equation (2) into a dynamic panel model by including a one-year lagged dependent variable Y_{it-1} in equation (3). This enables us to capture the adjustment process in rural regional economic growth.

$$Y_{it} = \alpha Y_{it-1} + \beta' \chi_{it} + \eta_i + \mu_t + \varepsilon_{it} \quad (3)$$

We employ the generalize method of moments (GMM) estimator for the panel data analysis (Blundell and Bond, 1998). Relying primarily on internal instruments, the GMM can deal with potential problems such as endogeneity, autocorrelation, individual specific heteroscedasticity, and omitted variable bias (Blundell and Bond, 1998). The GMM estimator combines equations in first difference with equation in levels, using lagged internal instruments in difference equations (Blundell and Bond, 1998). The consistency of the GMM estimators depends on whether lagged values of the explanatory variables are valid instruments in the output or/and export growth regression. The Hansen over identifying restriction test and the second order serial correlation Arellano-Bond (2) test are conducted to evaluate the validity of the instruments and the robustness of GMM estimation (Arellano and Bond, 1991). The test results (reported in Table 2 and 3) confirm there are no serious problems of endogeneity or autocorrelation within the estimation.

5. Findings and discussion

5.1 Regional disparity in output and export

Table 1 reports the rural industrial sector regional output and export (in total volume and percentage) of the three regions, respectively. The table shows a significant regional disparity in terms of both the sectoral gross output and export. During the last three decades, the proportion of gross output generated in the Eastern region has increased from 69% in 1994 to 71% in 2004, and 76% in 2014, while the central region experienced a decrease from 24% in 1994 to 20% in 2004, and further down to 16% in 2014. Gross output in the Western region was less than 10% of the total throughout the period. In the case of export, there is an even greater skewness in regional disparities. More than 90% of total exports over the period came from the Eastern region, less than 8% from the Central region, and only 2% from the Western region. Table 2 and 3 reveals the results from the GMM panel data analysis on whether and to what extent these disparities are caused by the variations in regional and sectoral characteristics.

(Insert Table 1 about here)

5.2 Results for output growth

Table 2 shows the output growth results for the whole country (all 29 provinces) and the three regions, respectively. The whole country results reveal that the dynamic variable of lagged output growth is insignificant, indicating there exists neither divergence nor convergence in regional output growth trajectory in general. The two physical capital-input variables, domestic capital investment and inward FDI both have a significant ($p<0.01$) positive impact on output growth. This suggests that they are both important in promoting output growth as expected. However, according to their magnitude of the coefficients, their relative importance to the output growth is different. A 1% increases in domestic capital investment leads to 0.56% increase, while 1% increases in FDI leads to 0.37% increase in output growth. The results indicate that

domestic investment is more important than FDI in promoting rural industrial output growth. Between the two human capital-input variables, labour productivity variable is insignificant ($p>0.10$) though with the expected positive sign, while human capital is significant ($p<0.01$) but with unexpected negative sign. The results may imply that labour productivity is not important for the sectoral output growth, and increases in numbers of employees with higher education may lead to increases in labour costs, therefore, reduce output growth. Given that the vast majority of rural enterprises are SMEs in the manufacturing sector, they generally use less advanced or very basic technology for labour-intensive processing or assembly production (Fu and Balasubramanyam, 2003; Putterman, 1997). They tend to rely mostly on unskilled cheap labour rather than a well-educated work force with higher education qualifications (Fu and Balasubramanyam, 2003). SMEs in developing countries face multiple challenges and constrains, such as "lack of economic scope, limited access to capital and technology, poor managerial skill, lack of training opportunities", they tend to hire unskilled and illiterate labour from "the bottom of the labour force" (Maksimov, et al., 2017, p245). The unexpected findings may also imply the sector's low value-added industrial structure (such as food processing), deterring the sector's further growth (Fu and Balasubramanyam, 2003; Shen and Tsai, 2016). With respect to the control variables, firm size and agglomeration are both positive and significant, indicating they are both important in increasing output growth. In contrast, the variable of labour cost has a negative impact on output growth. Increasing in labour costs will reduce output growth, vice versa, decreasing in labour costs will increase output growth. The results for the two locational and institutional dummy variables suggest that the privatisation reforms and the proximity to the coast have no impact on output growth.

(Insert Table 2 about here)

The results for the three regions show a certain degree of regional variation. The variable of lagged output growth is significant in the Eastern region but insignificant in the Central and Western regions, indicating a strong self-reinforcing effect in the Eastern region with an even faster output growth than other regions. The two physical-input variables, domestic capital investment and inward FDI, appear to be significant in all regions, indicating they are both important for regional output growth in the regions. But the differences in magnitude of the coefficients suggest that domestic capital investment has more output growth impact than FDI. This finding is applicable to all regions in general. Given that historically domestic capital investment is heavily concentrated in the Eastern region, it can be argued that domestic capital investment is the most important determinant and the major cause of the regional output growth disparity between the three regions. Moreover, comparing the magnitude of the coefficients of domestic capital investment variable among the three regions, the Western region has the highest coefficient, indicating that the Western region will achieve the highest output growth with the same amount domestic capital investment among all regions. This may due to the fact that the Western region lacks of capital investment historically and any new investment will lead to a higher margin in output growth.

The variable of firm size is positively significant associated to regional output growth in all the three regions, indicating that firm size is an important factor for output growth. The agglomeration effect is significant and important only in the Central and Western regions, but not in the Eastern region. This may suggest that the relatively crowded industrial development zones in the Eastern region are unlikely to make any further positive agglomeration effect in raising output growth in the region. However, more rural industrial activities with enlarged firm size would result in a positive agglomeration effect in the Central and Western regions.

5.2 Results for export growth

Table 3 shows the export growth results for all 29 provinces as the whole and the three regions, respectively. For the whole samples with 29 provinces, the dynamic lagged export growth is significant at a high level of 1% ($p<0.01$), indicating a strong self-reinforcing effect and divergence in provincial export growth. The two physical capital-input variables are both positive and significantly associated with the sectoral export growth at a high level of 1% ($p<0.01$). This suggests that domestic capital investment and FDI both are the important determinants for promoting export. Interestingly, their relative importance varies and FDI turns to be more important than domestic capital investment. A 1% increase in FDI will result in 0.21%, while domestic investment will result in only 0.08% increases in export growth. This finding may reveal that the rural industrial export is mainly driven by FDI firms because they are more export-oriented attracted by the government promoting export policy and contribute more to export growth than their local counterparts. However, the results for the two human capital-input variables are unexpected, labour productivity is significant but with a wrong negative sign while human capital is insignificant. The results suggest that human capital with higher education is not important while labour productivity will reversely affect export growth. The findings may reflect a fact that the sector absorbs large unskilled surplus labour without necessarily requiring labour efficiency (Zheng, et al. 2017; Fu and Balasubramanyam, 2003). The findings may also be associated with the characteristics of the sectoral export products, which do not require high labour productivity or a highly-educated labour force, rather, they mainly rely on labour-intensive processing with low technologies and low labour productivity. With respect to the controls, the labour cost variable, however, is positively associated with export growth. The finding may reflect that export-oriented firms may have a relative higher

wage level compared to that of non-export-oriented ones as the higher profits generated from exports enable them to pay higher wages, which in turn promote export growth via an efficiency wage effect. Given that the vast majority FDI firms are export-oriented, this may account in part for the fact that FDI firms' wage levels are normally higher than those of domestic firms (Girma, et al. 2001; Driffield and Girma, 2003). As such, FDI may contribute to a more unequal income distribution between workers employed by domestic and foreign firms in a developing country (Figini and Gorg, 2011). Firm size and agglomeration are both positively and significantly associated with export growth, indicating large in firm size and agglomeration effect are important to raise export growth. The locational effect variable appears to be significant at a high level of 1%, suggest that provinces located close to the coast with well-established nationally and internationally transportation and business network have significant impact on export growth. It may also reflect the impact of the government preferential policy attracting export-oriented FDI firms into the Eastern coast to promote country's export-led growth.

(Insert Table 3 about here)

With respect to the three regions, the dynamic lagged export growth is significant at a high level of 1% across all the three regions, suggesting a strong self-reinforcing effect and divergence in export growth trajectory. The region with high export growth continues to grow even faster, while the regions with low export growth grow even slower, further accelerating the regional export growth disparity between the three regions. FDI and domestic capital investment are both positive and significant in all regions, indicating they are both important for export growth in general, with FDI having more positive impact than domestic capital investment on raising export growth in particular. The finding reflects the fact that the sector has attracted a bulk of export-oriented FDI, especially into the Eastern region, leading to a high export growth

in the region (Fu and Balasubramanyam, 2003). It can thus be argued that inward FDI is the most important determinant and the major cause of the regional disparity in terms of export growth between the three regions. The finding supports the argument that FDI is likely to increase inequality in developing countries (Figini and Gorg, 2011; Wu and Hsu, 2012). However, the two human capital-input variables, while human capital remains insignificant labour productivity has a negative impact on export growth in the Central and Western regions. The findings may suggest that human capital with higher education is not important and any increase in labour productivity might well have a negative impact on exports from the two regions. It may imply the nature of exporting products from the regions mainly relying on low technology for labour-intensive processing. In contrast, both firm size and agglomeration effect are positive and significantly important in the Central and Western regions but not in the Eastern region. The implication is that enlarged firm size and more concentrated industrial zones would promote regional export growth in the Central and Western regions.

5.3 Comparison between output and export growth

Comparing the results for the output growth and export growth, there is a strong self-reinforcing effect in export growth across all provinces in all the three regions, while the self-reinforcing effect in output growth only exists in the Easter region. The difference suggests a stronger regional divergence development trajectory in export growth than that in output growth. In other words, the regional economic development disparity has been continuously increased in export growth much greater than that in output growth among the three regions. It also appears that the two economic indicators are determined by different sets of factors. Some factors are important for increasing output growth while others are more important for raising export growth. Domestic capital investment is more important than FDI for output growth, while latter

is more important than former for export growth. The locational effect is more important for export growth than for output growth. Similarly, some factors are important for some regions but not necessarily for others. For example, firm size plays important roles in stimulating output growth in all three regions but has positive impact on export growth only in Central and Western regions. Labour cost seems to be an important factor in promoting export growth in the Eastern and Western regions, but does not act to raise output growth in the same regions. Agglomeration effect is important for raising both output and export growth in Central and Western regions but not in the Eastern region. These findings reveal a significant degree of variation in the determinants of regional output and export growth. The findings also suggest that the determinants of economic development are contextual subject to the indictors and regions in concern. The importance of the factors may differ across the regions and thus need to be taken into account when assessing the causes of disparity and the policies that might encourage regional convergence.

6. Conclusions and policy implications

This study has employed a dynamic panel data analysis to investigate variations in the determinants of rural industry regional economic development disparities. Using a comparative approach that employs two indicators of economic growth, the study reveals significant regional variations across the three regions in the determinants between rural industrial output growth and export growth. There exists a strong divergence in export growth across all three regions, indicating an accelerating regional export disparity between the three regions. A strong self-reinforcing effect in output growth exists in the Eastern region, with faster growth than in the other regions. Domestic capital investment and FDI are both important causes of rural regional disparities. Domestic capital investment is identified as the most important reason for disparities

in regional rural output growth, while FDI is the main reason for regional export growth disparity. Our findings also indicate that the relative importance of the determinants varies between different economic indicators and across regions, and thus we argue that the formulation of policies to promote specific economic goals should take explicit account of the regional context in which the policies operate.

Our findings provide important policy implications. In order to reduce regional rural economic development disparity among the three regions, the Chinese government should promote rural industrial output and export growth by increasing domestic capital investment and promoting inward FDI in both the Central and Western regions. The government should promote more capital invest especially in the poorest Western region, in which a high marginal output growth can be yielded to catch up with other regions. In order to enhance export growth in the two inland regions, the rural industrial sector should attract more export-oriented FDI to promote export-led growth. Higher output and export growth would also be encouraged by enlarged firm size and the development of more industrial zones to achieve agglomeration effects in the two remote regions. By encouraging the development of rural industry, these policies will play an important role in reducing poverty as well as regional disparities in rural China.

References

Andersson, F. Edgerton, D. and Opper, S. (2013). A matter of time: revisiting growth convergence in China. *World Development,* 45, 239-251

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equation. Review of Economic Studies, 58, 277-297

Barro, R. and Sala-I-Martin, X. (1991). Convergence across states and regions. *Brookings Papers on Economic Activity,* 1991(1), 107-182

Benjamin, D. Brandt, L. Giles, J. and Wang, S. (2008). Income inequality during China's economic transition. in Brandt, L and Rawski, T.G. edited book, *China's Great Economic Transformation,* Cambridge University Press

Bertola, G. (1993). Models of economic integration and localized growth. In *Adjustment and growth in the European Mowtay Union,* ed. F. Torres and F. Giavazzi, 159-79. Cambridge: Cambridge University Press.

Blundell, R., Bond, S., 1998. Initial condition and moment restriction in dynamic panel data models. J. Econ. 87 (1), 115–143.

Borts, G. H., and Stein, J. L. (1964). *Economic growth in a free market.* New York: Columbia University Press.

Driffield, N. and Girma, S. (2003). Regional foreign direct investment and wage spillovers: plant level evidence from the UK electronics industry. *Oxford Bulletin of economics and Statistics*, 65(4), 453-474

Figini, P. and Gorg, H. (2011). Does foreign direct investment affect wage inequality? An empirical investigation. *The World Economy*, 34(9), 1455-1475

Frankel, J. A. and Romer, D. (1999). Does Trade Cause Growth? *American Economic Review*, 89, 379-399

Fu, X. and Balasubramanyam, V. N. (2003). Township and village enterprises in China. *Journal of Development Studies*, 39(4), 37-46

Girma, S. Greenaway, D. and Wakelin, K. (2001). Who benefits from foreign direct investment in the UK? *Scottish Journal of Political Economy*, 48(2), 119-133

Gravier-Rymazewska, J. Tyrowicz, J. and Kochanowicz, J. (2010). Intra-provincial inequalities and economic growth in China. *Economic System*, 34, 237-258

Hsiao, C. (2003). Analysis of Panel Data, Vol. 34 of Econometric Society monographs. Cambridge University Press, Cambridge, 2nd ed.

Ito, J. (2010). Inter-regional difference of agricultural productivity in China: distinction between biochemical and machinery technology. *China Economic Review*, 21, 394-410

Kaldor, N. (1957). A Model of Economic Growth, *Economic Journal*, 67, 328, 591-624

Kaldor, N. (1981). The role of increasing returns, technical progress and cumulative causation in the theory of international trade and economic growth. *Econornie Appliquee*, 34(4), 593-617

Kaldor, N. and Mirlees, J. A. (1962). New Model of Economic Growth, *Review of Economic Studies*, 29(3), 174-192

Li, Y. Long, H. and Liu, Y. (2015). Spatio-temporal pattern of China's rural development: a rurality index perspective. *Journal of Rural Studies*, 38, 12-25

Li, Y. and Wei, D. (2010). The spatial-temporal hierarchy of regional inequality of China. *Applied Geography*, 30, 303-316

Liu, H. (2006). Changing regional rural inequality in China 1980-2002. *Area*, 38, 377-389

Liu, S. Xie, F. Zhang, H. and Guo, S. (2014). Influences on rural migrant workers' selection of employment location in the mountainous and upland areas of Sichuan, China. *Journal of Rural Studies*, 33, 71-81

Liu, X. Wang, X. Whally, J. and Xin, X. (2011). Technological change and China's regional disparities – a calibrated equilibrium analysis. *Economic Modelling*, 28, 582-588

Liu, Y. Lu, S. and Chen, Y. (2013). Spatio-temporal change of urban-rural equalised development patterns in China and its driving factors. *Journal of Rural Studies*, 32, 320-330

Liu, Y. Liu, J. and Zhou, Y. (2017). Spatio-temporal patterns of rural poverty in China and targeted poverty alleviation strategies. *Journal of Rural Studies*, 52, 66-75

Liu, Z. Liu, S. Jin, H. and Qi, W. (2017). Rural population change in China: Spatial differences, driving forces and policy implications. *Journal of Rural Studies*, 51, 189-197

Long, H. and Woods, M. (2011). Rural restructuring under globalisation in Eastern coastal China: What can be learned from Wales? *Journal of Rural and Community Development*, 6(1), 70-94

Long, H. Zou, J. and Liu, Y. (2009). Differentiation of rural development driven by industrialisation and urbanisation in Eastern coastal China. *Habitat International*, 33, 454-462

Long, H. Zou, J. Pykett, J. and Li, Y. (2011). Analysis of rural transformation development in China since the turn of the new millennium. *Applied Geography*, 31, 1094-1105

Lucas, R. E. (1988). On the Mechanics of Economic Development, *Journal of Monetary Economics*, 22, 3-42

Maksimov, V. Wang, S. and Luo, Y. (2017). Reducing poverty in the least developed countries: the role of small and medium enterprises. *Journal of World Business*, 52, 244-257

Martin, R. and Sunley, P. (1998). Slow convergence? The new endogenous growth theory and regional development. *Economic Geography*, 74(3), 201-227

Mukherjee, A. and Zhang, X. (2007). Rural industrialisation in China and India: Role of policies and institutions. *World Development*, 35(10), 1621-1634

Putterman, L. (1997). On the past and future of China's township and village-owned enterprises. *World Development*, 25(10), 1639-1655

Quah, D. (1996). Empirics for economic growth and convergence. *European Economic Review* 40, 1353-1375

Rodriguez-Pose, A. and Hardy, D. (2015). Addressing poverty and inequality in the rural economy from a global perspective. *Applied Geography*, 61, 11-23

Rogers, S. (2014). Betting on the strong: local government resource allocation in China's poverty counties. *Journal of Rural Studies*, 36, 197-206

Romer, P. (1986). Increasing Returns and Long Run Growth, *Journal of Political* Economy, 94, 1002-1037

Rozelle, S. (1994). Rural industrialization and increasing inequality: emerging patterns in China's reforming economy. *Journal of Comparative Economics*, 19, 362-391

Shen, X. and Tsai, K. (2016). Institutional adaptability in China: local developmental models under changing economic conditions. *World Development*, 87, 107-127

Solow, R. M. (1957). Technical Change and the Aggregate Production Function, *Review of Economics and Statistics*, 39, 312-320

Tong, C. (1999). Production efficiency and its spatial disparity across China's TVEs a stochastic production frontier approach. *Journal of Asian Economics*, 10, 415-430

Wang, Y. Liu, Y. Li, Y. and Li, T. (2016). The spatio-temporal patterns of urban-rural development transformation in China since 1990. *Habitat International*, 53, 178-187

Ward, P. (2016). Transient poverty, poverty dynamics, and vulnerability to poverty: an empirical analysis using a balanced panel from rural China. *World Development*, 78, 541-553

Wildau, G. and Mitchell, T. (2016). China Income Inequality among the World's Worst, F*inancial Times*, 14 January 2016

Wu, J. and Hsu, C. (2012). Foreign direct investment and income inequality: Does the relationship vary with absorptive capacity? *Economic Modelling*, 29, 2183-2189

Zheng, L. Batuo, M. and Shepherd, D. (2017). The Impact of Regional and Institutional Factors on Labour productive Growth – Evidence from the Township and Village Enterprise sector in China, *World Development*, 96, 591-598

Table 1 Regional disparity in rural industrial sector's gross output and export

Unit: 10,000 yuan

	Gross output						Export					
	1994	%	2004	%	2014	%	1994	%	2004	%	2014	%
Eastern	313106703	69	1350363121	71	4910079340	76	36808861	91	172615138	94	422409064	93
Central	107837709	24	393324310	20	1047497061	16	2857404	7	8075406	4	23706914	5
Western	32840465	7	168297422	9	506780401	8	655104	2	2730485	2	8850839	2
Total	**453784877**	**100**	**1911984853**	**100**	**6464356802**	**100**	**40321369**	**100**	**183421029**	**100**	**454966817**	**100**

Source: calculated from the China's TVE yearbooks

Table 2 Results for rural industry output growth

	Whole Country	Eastern	Central	Western
Lagged gross output_1	0.08(0.07)	0.21(0.08)**	0.16(0.14)	0.11(0.15)
Domestic capital investment	0.56(0.13)***	0.35(0.12)**	0.35(0.16)*	0.84(0.38)*
Inward FDI	0.37(0.11)***	0.20(0.08)**	0.12(0.04)**	0.19(0.09)*
Labour productivity	0.47 (0.43)	0.20(0.23)	0.19(0.58)	0.52(0.58)
Human capital	-0.44(0.10)***	-0.11(0.09)	-0.34(0.14)**	-0.42(0.19)*
Labour cost	-0.14(0.04)***	-0.49(0.14)***	-0.47(0.25)*	-0.98(0.39)**
Firm Size	0.87(0.26)***	0.68(0.20)***	0.50(0.25)**	0.38(0.21)*
Agglomeration effect	0.25(0.12)**	0.04(0.11)	0.16(0.14)*	0.14(0.12)*
Privatization effect	0.32(0.25)	0.23(0.62)	0.14(0.22)	0.28(0.20)
Locational effect	0.08(0.40)			
Constant	-10.2(2.08)***	-4.3(1.1)***	-1.5(1.5)	6.1(2.2)**
Observation	530	228	178	124
Arellano-Bond (2) test	0.523	0.258	0.781	0.974
Hansen test	0.983	0.985	0.998	0.986

Notes: standard error in parentheses; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.

Table 3 Results for rural industry export growth

	Whole country	Eastern	Central	Western
Lagged Export_1	0.59(0.07)***	0.46(0.10)***	0.48(0.07)***	0.64(0.16)***
Domestic capital investment	0.08(0.02)***	0.13(0.04)**	0.10(0.03)**	0.07(0.03)**
Inward FDI	0.21(0.02)***	0.17(0.04)***	0.14(0.08)*	0.29(0.12)**
Labour productivity	-0.51(0.23)**	-0.15(0.10)	-0.44(0.17)**	-0.67(0.29)**
Human capital	-0.05(0.04)	-0.09(0.06)	-0.03(0.05)	-0.10(0.09)
Labour cost	0.24(0.06)***	0.21(0.08)**	0.02(0.08)	0.44(0.14)**
Firm Size	0.22(0.04)***	0.08(0.12)	0.36(0.13)**	0.27(0.12)*
Agglomeration effect	0.08(0.03)**	0.16(0.13)	0.25(0.05)***	0.14(0.05)**
Privatization effect	0.04(0.09)	0.02(0.11)	0.08(0.33)	0.27(0.29)
Locational effect	0.42(0.13)***			
Constant	-0.76(0.31)**	0.98(0.42)**	-2.1(0.49)***	-0.15(1.2)
Observation	601	264	197	140
Arellano-Bond (2) test	0.154	0.624	0.377	0.992
Hansen test	0.604	0.998	0.985	0.990

Notes: standard error in parentheses; *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.