Received: 1 September 2011 | Accepted: 1 December 2018

DOI: 10.1111/dpr.12420

ARTICLE

The impact of unequal regional distribution of fiscal resources on China's post-reform economic growth

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Funding information
Ministry of Science and Technology Taiwan (MOST 105-2410-H-004-014)

Abstract

Motivation: The relationship between unequal fiscal resources among regions and China's economic growth remains unclear due to its possibly different short- and long-run directions. This study considers the role of unequal fiscal resources among regions in China's economic growth.

Purpose: The article develops an empirical model to investigate the effect of unequal regional distribution of fiscal resources on China's economic growth in the short and long run in the post-reform period.

Approach and Methods: A time-series data during the 1979–2010 period is used, adopting the Autoregressive Distributed Lag (ARDL) approach plus co-integration with two indicators of inequality, the GINI coefficient (GINI) and coefficient of variance (CV), calculated from different components of provincial fiscal revenue. Six model specifications of the ARDL plus co-integration equation are estimated.

Findings: The primary finding is that, in the short run, China's regional fiscal distribution inequality has a negative one-year lagged effect on its economic growth as the fiscal subsidy from central government is considered. However, the long-run equilibrium relationship between fiscal inequality and economic growth in China is positive during the research period.

Policy Implications: As China is pursuing sustainable economic growth and trying ultimately to achieve equal regional development, this study thus suggests that China should continue to support the principle of 'let some people grow rich first', perhaps implying that some regions should have more fiscal resources to develop successfully first. This will eventually benefit the country's overall economic development.

KEYWORDS

ARDL with co-integration, China, economic growth, fiscal inequality

1 | INTRODUCTION

Since China's economic reforms started at the end of the 1970s, China's phenomenal economic growth has attracted worldwide attention. The issue of how a huge economy has grown so rapidly interests economists, who are also keen to find the key factors that have contributed to it. Many scholars have suggested that fiscal decentralization has been one of China's most important areas of reform and has

contributed to its economic growth since 1978 (Ma, 1997; Knight & Shi, 1999; Lin & Liu, 2000; Qiao, Martinez-Vazquez, & Xu, 2008).[1]

China's fiscal decentralization was shaped by the two major fiscal reforms. The first started in 1985 and became known as the 'Fiscal Responsibility System (FRS)'; the second started in 1994 and was termed the 'Tax Sharing System (TSS)'. The major goals of the TSS were to increase both the share of government revenues in the gross domestic product (GDP) and the share of central government revenue in the total budgetary revenue.[2]

Since the TSS provided better incentives for local governments through separate tax administrations, and through the removal of the de facto ceiling imposed by the FRS on the increase in local tax revenues,[3] this might have aggravated the unequal distribution of fiscal resources among regions in China. Two indicators, the Gini coefficient (*GINI1*) and the coefficient of variance (*CV1*), representing the level of unequal regional distribution of fiscal resources (the regional sources of fiscal revenue) in China, and China's economic growth rate from 1979 to 2010, are shown in Figure 1.[4] The time trend of *GINI1* is found to be similar to that of *CV1*. Both indicators started with the highest value during the research period, implying that the central government allowed some regions to have abundant fiscal resources, on the principle of 'let some people grow rich first'.

Figure 1 shows that in 1985, when the FRS was implemented, the *GINI1* and *CV1* started to follow a downward trend; that is to say, the FRS mitigated the unequal distribution of fiscal resources among regions, but started a fall in economic growth. Unlike the FRS, after the TSS was implemented in 1994, both the *GINI1* and *CV1* follow an upward trend. In other words, the TSS aggravated the unequal distribution of fiscal resources among regions, and also caused economic growth to fall in the short run. From 1999 to 2007, all three variables exhibited a similar upward pattern, and a downward trend from 2007.

The relationship between the unequal fiscal resources among regions and China's economic growth remains unclear, possibly because of taking different directions in the short and long run. Some studies have explained a negative impact of unequal fiscal resources among regions on China's economic growth in the short run because a high level of fiscal inequality causes severe conflict between regions that are highly developed and those that are not (Hu, 2008) and creates inefficiency and social instability (Chen & Zhang, 2008). However, the 'flying geese' theory originally proposed by Akamatsu (1961, 1962) (explained below) might anticipate a positive long-run equilibrium relationship between fiscal inequality and economic growth in China. The ultimate goal of 'let some people grow rich first', a crucial policy proposed by Deng Xiaoping in 1985,[5] is to bring about the improvement of the whole coun-

[1]Ma (1997) thought that fiscal decentralization was one of China's most important areas of reform and had contributed to economic growth since 1978. Knight and Shi (1999) pointed out that important issues of government decentralization, involving serious principal-agent problems have to be solved in discussing China's economic growth, because China's provinces average 40 million people, making each province equivalent to a country's population in other parts of the world. Lin and Liu (2000) also considered an important reform —fiscal decentralization — to be a key factor contributing to such rapid economic development. Qiao, Martinez-Vazquez, and Xu (2008) indicated that fiscal decentralization was one of the most important policy undertakings of the Government of China during the last two decades of economic reform from planned socialism.

[2]As pointed out by Qiao, Martinez-Vazquez, and Xu (2008), the key measures in the TSS included the introduction of a value added tax (VAT) as the major revenue source and the setting up of uniform tax-sharing rates for major taxes including VAT.

[3]The uniform tax-sharing rates suggested by the TSS replaced the previous fixed-amount remittance scheme adopted in the FRS.

[4]Due the lack of data, Tibet is excluded as *GINI1* and *CV1* are calculated.

[5]This central idea is proposed as Deng Xiaoping met a senior US business delegation organized by US Time Inc. on 23 October 1985.

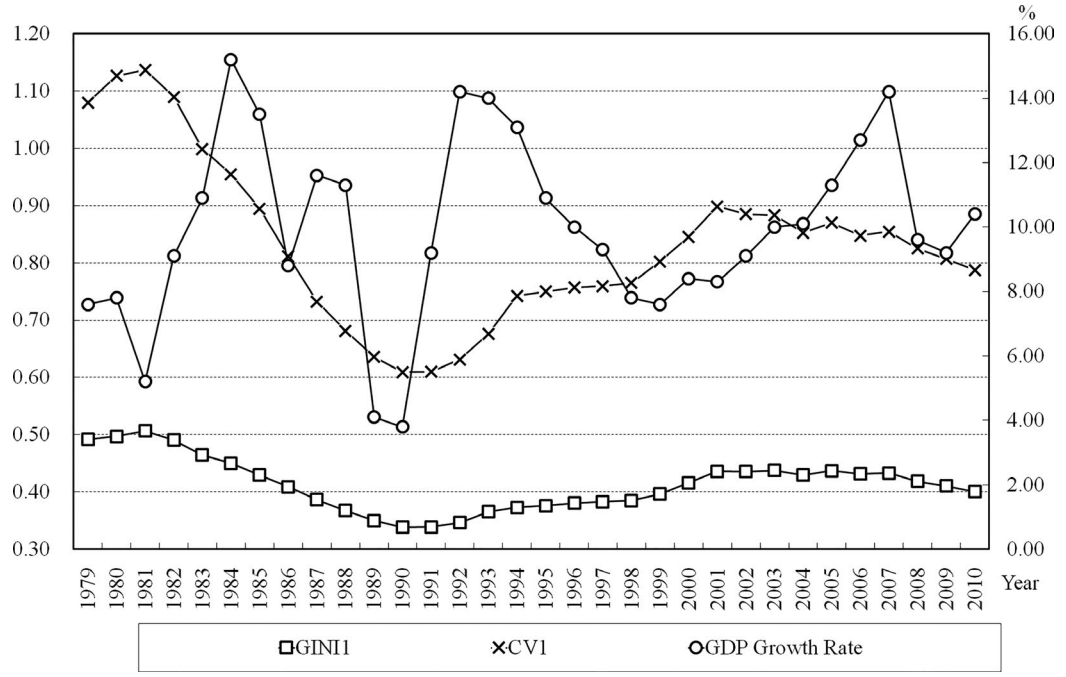

FIGURE 1 Fiscal inequality and economic growth rate in China
Sources: Various years of *China Statistical Yearbook* and *Financial Yearbook of China*

try. To some extent, this policy resembles the 'flying geese' theory. Fiscal inequality favouring the coastal region makes it grow rich first and then play a leadership role. The leading goose will have positive spillover effect on the following geese, eventually fostering nationwide economic development.

This article considers the role of the inequality of fiscal resources among regions in China's economic growth. The article aims to establish an empirical model to explore this issue, and to examine this relationship in both the short and the long run, keeping other variables constant.

The remainder of this article proceeds as follows. Section 2 reviews the relevant literature followed by a description of the empirical models and data adopted in Section 3. Section 4 analyses the empirical results and Section 5 provides conclusions and some policy implications.

2 | LITERATURE REVIEW

The study focuses on the impact of unequal regional distribution of fiscal resources on China's economic growth, an issue that has been generally neglected. The influence of income distribution among the population on a nation's economy may be regarded as being analogous to that of fiscal resources distributed among its regions on the national economy. A literature review on the impact of income inequality on economic growth might provide some insights into the main subject of investigation.

Alesina and Rodrick (1994) showed that income inequality has a negative impact on economic growth,[6] while Persson and Tabellini (1994) found that it is only in democratic countries that income

[6]Alesina and Rodrick (1994) used 70 countries (developed and developing), over the 1960–1985 period to conduct an empirical study.

inequality impedes economic growth. Under a dictatorship, the economic impact of income inequality becomes insignificant.[7] Unlike Persson and Tabellini (1994), Clarke (1995) found that income inequality has a negative impact on economic growth both in democratic and non-democratic countries.[8] Li and Zou (1998) developed a theoretical model to find that income inequality has a positive impact on economic growth if government spending is on consumption, but a negative impact when the emphasis is on production. They also found empirically that income inequality can benefit economic growth.[9] Barro (1999) examined 100 countries from 1960 to 1990, finding that income inequality has no significant influence on economic growth. However, as the sample is categorized into two groups — rich and poor— income inequality will hurt economic growth in poor countries, but will enhance it in rich countries.

With regard to the relationship between income inequality and economic growth, Lundberg and Squire (2003) also used data for 38 countries from 1960 to 1990 and found that income inequality contributes to economic growth, but that economic growth will aggravate income inequality. In the case of China, Huang, Kao, and Chiang (2004) adopted yearly time-series data from 1978 to 2002 to conclude that the country's economic growth will increase the degree of income inequality, but that its effect on China's economic growth is insignificant.

As for the influence of fiscal resource inequality on China's economic growth, Hu (2008) indicated that a severe fiscal inequality will cause large regional discrepancies in economic and social development and further aggravate the conflict between highly and less-developed regions. This will harm a nation's economy. Chen and Zhang (2008) also asserted that the regional inequality of fiscal resource distribution could damage China's economic growth because of inefficiency and social instability. According to the law of diminishing marginal productivity, transferring fiscal resources from regions with more to those with less will improve a nation's productivity and efficiency, implying that mitigating this inequality could benefit China's economic growth. It is also proposed that regions with fewer fiscal resources will be prone to low cohesion. Therefore, greater regional inequality in the distribution of fiscal resources will lead to low social cohesion, and might damage China's economic growth in the short run.

The long-run equilibrium relationship between fiscal inequality and economic growth in China has yet to be discussed, however. The final goal of 'let some people grow rich first' proposed by Deng Xiaoping in 1985, a fundamental policy of the Government of China (GoC), is to improve the whole country. To some extent, this policy is in the spirit of the flying geese theory (Akamatsu, 1961, 1962). Ozawa (2011) indicated that the third flying geese pattern, the alignment of nations along the different stages of development, has become most popularized and widely accepted among those scholars and journalists who refer to the flying geese theory of economic development. One economy, like the first goose in a V-shaped formation, can lead other economies towards industrialization, passing older technologies down to the followers as its own incomes rise and it moves on to newer technologies. In China, fiscal inequality favouring the coastal region makes that region grow rich first and then play the role of the first goose. The existence of the flying geese phenomenon in China has been proved by Qu, Cai, and Zhang (2012). According to Ozawa (2011),

[7]Persson and Tabellini (1994) used 56 countries from 1960 to 1985 to investigate this issue. They also indicated that democratic countries will respond more strongly to income inequality, such as by raising tax rates, to mitigate it, although these policies will also damage a country's economic growth.

[8]Clarke (1995) studied 82 countries over the 1970–1985 period to explore this issue and indicated that dictatorships are also concerned about social turmoil caused by income inequality and adopt various policies to mitigateit.

[9]Li and Zou (1998) looked at 112 countries during the 1947–1994 period together with fixed- and random-effects models to examine this issue.

the development of the lead goose will have positive spillover effects to the other geese, eventually fostering the economic development of the country as a whole. If this is the case, the long-run equilibrium relationship between fiscal inequality and economic growth in China might be positive.

Since the influence of an unequal distribution of fiscal resources among regions on China's economic growth has not been explored and might be different in the short and long run according to the flying geese analogy, this article presents an empirical model to explore this issue.

3 | EMPIRICAL MODELS AND VARIABLES

3.1 | Empirical Model

Due to the possibility of bi-directional causality between an unequal regional distribution of fiscal revenue and economic growth, we use the Granger causality approach. However, since the time-series data used in this study are insufficient to estimate a VAR (vector autoregressive model),[10] the Autoregressive Distributed Lag (ARDL) approach plus co-integration as proposed by Pesaran and Shin (1998) Pesaran, Shin, and Smith (2001) is applied. This methodology has been used by Karfakis (2002), Sezgin and Yildirim (2002), Fatai, Oxley, and Scrimgeour (2003), Yildirim and Sezgin (2003), Huang and Kao (2005) among others.

As pointed out by Karfakis (2002) and Fatai et al. (2003), the primary advantage of the ARDL approach to co-integration as constructed by Pesaran and Shin (1998) and Pesaran et al. (2001) is that it can be applied regardless of the stationary properties of the variables in the sample. It also avoids the pre-test problems associated with the unit-root and standard co-integration analysis, while also allowing for inferences on long-run estimates, which are not possible under alternative co-integration procedures.[11]

The first stage of the process involves establishing the existence of a long-run relationship between the variables. This is tested by computing the *F*-statistic when testing the joint significance of the lagged levels of series in the Error Correction (EC) form of the underlying ARDL model, which is shown as follows:

$$\Delta Y_t = \theta_0 + \sum_{i=0}^{k_1} \tau_i \Delta X_{t-i} + \sum_{i=1}^{k_2} \varphi_i \Delta Y_{t-i} + \delta_1 Y_{t-1} + \delta_2 X_{t-1} + \varepsilon_t \quad (1)$$

The null hypothesis of the non-existence of a long-run relationship that will be tested is that the lagged levels of Y_t and X_t are jointly insignificant; that is, H_0: $\delta_1 = \delta_2 = 0$ in Equation (1).[12]

The second stage is that if the null hypothesis of no long-run relationship is rejected, then the ARDL approach can be estimated using the differences in the variables and the lagged long-run solution, and either a long-run or short-run EC model version will be constructed. The study seeks to examine how the regional inequality in the distribution of fiscal resources affects China's economic

[11] However, as argued by Fatai et al. (2003), the possible disadvantage of the ARDL is the low number of degrees of freedom when estimating a regression with a small sample size.

[12] The tests are distributed according to a non-standard F-statistic, irrespective of whether the explanatory variables are stationary or non-stationary. The critical value bounds for these tests are computed by Pesaran et al. (2001).

[10] A VAR model also allows us to identify the long-run and short-run dynamics of the unequal distribution of fiscal revenue among regions and economic growth. However, when the number of variables in the system is large, a VAR model is hard to implement due to taking into consideration the degrees of freedom.

growth. This study selects several determinants of economic growth based on the literature, and therefore the regression constructed according to the ARDL approach to co-integration can be shown as follows:

$$\begin{aligned}\Delta LGDP_t = \alpha_0 &+ \sum_{i=1}^{k_1} \beta_i \Delta LGDP_{t-i} + \sum_{i=0}^{k_2} \lambda_i \Delta LINEQ_{t-i} + \sum_{i=0}^{k_3} \theta_1 \Delta LK_{t-i} + \sum_{i=0}^{k_4} \varphi_i \Delta LLAB_{t-i} \\ &+ \sum_{i=0}^{k_5} \tau_i \Delta LEN_{t-i} + \sum_{i=0}^{k_6} \gamma_i \Delta LOPEN_{t-i} + \delta_1 LGDP_{t-1} + \delta_2 LINEQ_{t-1} + \delta_3 LK_{t-1} \\ &+ \delta_4 LAB_{t-1} + \delta_5 LEN_{t-1} + \delta_6 LOPEN_{t-1} + \varepsilon_t \end{aligned} \tag{2}$$

The terms $\Delta LGDP$, $\Delta LINEQ$, ΔLK, $\Delta LLAB$, ΔLEN, and $\Delta LOPEN$ in Equation (2) denote the differences in the logarithm of real per capita GDP,[13] the inequality of fiscal resources distribution among regions in China, real accumulated capital, labour, energy consumption, and the total value of trade, respectively. In addition, α_0 is a constant term, t denotes year, and the lagged levels of all variables comprise the co-integration term (ECM) representing the long-term stable relation, and ε_t is the error term.

In order to improve the reliability of this study, *INEQ* is defined by two indicators: the GINI coefficient (*GINIj*) and coefficient of variance (*CVj*), where j=1, 2, 3. These two indicators are calculated from different components of provincial fiscal revenue. Models 1 and 2 use *GINI1* and *CV1* representing *INEQ*, respectively, calculated by own sources of fiscal revenue.[14] *GINI2* and *CV2* in Models 3 and 4, respectively, are calculated by own sources of fiscal revenue and extra-budgetary fiscal revenue. In Models 5 and 6, *GINI3* and *CV3* are calculated by sum of own sources of fiscal revenue, extra-budgetary fiscal revenue, and fiscal subsidies from the central government.[15] The higher the values of *GINIs* and *CVs*, the greater the degree of inequality of fiscal resource distribution among regions in China should be.

After rejecting the null hypothesis of the non-existence of a long-run relationship, the third stage determines the speed of adjustment of the economic growth to equilibrium by estimating the ARDL form of Equation (2), where the optimal lag lengths, k_1, k_2, k_3, k_4, k_5, and k_6 are selected by using two standard criteria: AIC (Akaike Information Criterion) and SBC (Schwarz's Bayesian Criterion).

3.2 | Data and Descriptions of Variables

Since the main focus is on the impact of the inequality of fiscal distribution among regions on China's economic growth, the research period extends from 1979 to 2010, i.e. the 32-year post-reform period. The annual time series of each variable, the dependent variable, real per capita GDP, and independent variables, labour, energy consumption, and the total value of trade, are obtained from various years of the *China Statistical Yearbook* compiled by National Bureau of Statistics of China (1980–2011). Real accumulated capital is from obtained Hsueh and Li (1999) and various years of the *China Statistical*

[13]Liang and Teng (2006) also adopted real per capita GDP as the indicator of economic growth.

[14]Tibet is not included, as all indicators of inequality in terms of fiscal distribution among regions are calculated due to the negative value of its own sources of fiscal revenue prior to 1989. Therefore, 30 out of 31 regions are used to calculate three indicators of the inequality of fiscal resources distribution among regions in China during the 1979 to 2010 period.

[15]While the regions' own sources of fiscal revenue are available from 1979 to 2010, the extra-budgetary fiscal revenue and fiscal subsidies from the central government are available only from 1986 to 2010 and 1995 to 2010, respectively. In this study, we treat unavailable data as zero, while all indicators of inequality are calculated.

Yearbook. Finally, all variables used for calculating various indicators of *INEQ* are obtained from various years of the *Financial Yearbook of China* compiled by China Financial Magazine (1980–2011) and the *China Compendium of Statistics 1949-2008* compiled by National Economy General Statistics Division of National Bureau of Statistics of China (2010). Since Chongqing was made a municipality separate from Sichuan Province in 1997, its administrative divisions have been changed.[16] Therefore, Chongqing's pre-1997 data are obtained from various issues of the *Chongqing Statistical Yearbook* compiled by Chongqing Statistics Bureau (1980–1998) and the *Sichuan Statistical Yearbook* compiled by Statistical Bureau of Sichuan (1980–1998).[17] Finally, all value variables, namely, per capita GDP, capital, and total trade, are deflated by the Consumer Price Index (CPI) at the base year of 1979 in order to control for inflation.[18] Descriptions and statistics of the variables are presented in Table 1.

The primary independent variable in this study is the inequality of fiscal resources distribution among regions in China, *INEQ*. As discussed earlier, this could harm China's economy in the short run because it could cause a large difference of economic and social development among regions and further aggravate conflicts between regions with high and low development (Hu, 2008), lead to low social cohesion and damage China's economic growth (Chen & Zhang, 2008). The policy of 'let some people grow rich first', in the spirit of the flying geese theory, implies a positive long-run equilibrium relationship between fiscal inequality and economic growth. As stated above, fiscal inequality favouring the coastal region enables it to grow rich first and play the lead goose, with positive spillover effect on the other geese, eventually to benefit the country's overall economic development. This study suggests that the inequality of fiscal resource distribution among regions could negatively affect China's economic growth in the short run, but have a positive long-run equilibrium relation with China's economic growth.

The method used to calculate real accumulated capital is based on the standard perpetual inventory approach provided by Wang and Yao (2003), Yao (2006), Liang and Teng (2006). This approach is described as follows:

$$K_t = (1-\delta)\,K_{t-1} + \frac{I_t}{P^k} \tag{3}$$

In Equation (3), K_t is the real accumulated capital; I_t is the gross nominal investment, P^k is the price index of I_t,[19] t denotes time and δ is the rate of depreciation.[20] According to studies in the literature, such as Chow and Li (2002), Yao (2006), and Liang and Teng (2006), the real accumulated capital is always concluded to be a stimulating factor to a nation's economic growth. It is anticipated that the real accumulated capital to exert a positive impact on China's economic growth.

[16]The new administrative divisions include Chongqing, Wanxian, Fuling, and Qianjiang.

[17]Some new administrative divisions' data could be obtained from the *Chongqing Statistical Yearbook* and *Sichuan Statistical Yearbook* after the 1997 issues. If such data could not be obtained from the later issues, we use the new administrative divisions.

[18]Due to the lack of a GDP deflator in China, this study uses the CPI instead of the GDP deflator to deflate the nominal value of variables. Keidel (2001) also indicated that using nominal GDP and the real economic growth rate to calculate China's GDP deflator could be incorrect.

[19]P^k is provided by the *China Statistical Yearbook* only from 1991. From 1979 to 1990, the value of P^k is calculated by Hsueh and Li (1999). Wang and Yao (2003) and Liang and Teng (2006) also adopted the P^k provided by Hsueh and Li (1999) to calculate K_t.

[20]However, the correct values of K_0 and δ are unknown. One assumption suggested by Yao (2006) is that K_0 is twice as much as GDP in year 0. The other assumption suggested by Perkins (1988), Wang and Yao (2003) and Liang and Teng (2006) is that the rate of depreciation is 5%. This study adopts these two assumptions to solve the aforementioned problems.

TABLE 1 Description and statistics of variables

	Descriptions	Mean	S.D.	Expected Sign
1. Dependent Variable				
GDP	Real per capita GDP in China (Unit: RMB)	1753.953	1453.636	
2. Independent Variables of Fiscal Inequality among Regions (*INEQ*)				
A. Fiscal Revenue=Own Sources of Fiscal Revenue				
GINI1	Gini coefficient	0.413	0.046	?
CV1	Coefficient of variance	0.831	0.143	?
B. Fiscal Revenue=A+ Extra-Budgetary Fiscal Revenue				
GINI2	Gini coefficient	0.404	0.051	?
CV2	Coefficient of variance	0.797	0.160	?
C. Fiscal Revenue=B+Fiscal Subsidy from Central Government				
GINI3	Gini coefficient	0.366	0.062	?
CV3	Coefficient of variance	0.713	0.183	?
3. Other Independent Variables				
K	Accumulated real value of capital in each year (Unit: 100 million)	66409.868	71827.313	+
LAB	Labour population (Unit: 10,000 people)	63398.906	11875.142	-
EN	Standard coal consumption in each year (Unit: 10,000 tons)	143489.469	78407.044	?
OPEN	Real total trade value in each year (Unit: 100 million RMB)	10237.489	11841.816	+

Sources: Various years of the *China Statistical Yearbook*, *Financial Yearbook of China*, *Chongqing Statistical Yearbook*, *Sichuan Statistical Yearbook*, the *China Compendium of Statistics 1949-2008*, and Hsueh and Li (1999).

Regarding the influence of the labour force on economic growth, Baumol (1967) indicated that excess labour supply will increase the fiscal burden on local governments to provide public goods. A redundant labour force might also cause social turmoil, further damaging a nation's economic growth. China, the world's most populous nation, still has a huge rural and urban labour force. Given an excess labour supply in China, this study suggests that the labour force has a negative influence on China's economic growth.

Some studies, such as Shan and Sun (1998) and Yuan, Kang, Zhao, and Hu (2008), have concluded that energy consumption has a positive influence on China's economic growth, but Soytas and Sari (2006) have suggested that it makes an insignificant contribution to China's economic growth. Therefore, the sign of the coefficient of energy consumption is uncertain.

Finally, international trade as a proxy for the degree of openness might contribute to China's economic growth. Feder (1983) indicated that exports allow for competition in international markets, further improving a nation's efficiency of resource allocation, and that imports can bring in higher technology from more advanced countries. Easterly and Rebelo (1993), Barro (1996), and Harrison (1996) also found that trade could improve the technology of production and accumulation of knowledge, and ultimately increase a nation's production. In addition, Young (1991) and Stokey (1991) pointed out that a higher degree of openness could have a stronger spillover effect of knowledge, and stimulate the economy. Zhang and Zou (1998), Jin and Zou (2005), and Liang and Teng (2006) also agreed on the positive impact of openness on economic growth. Therefore, this study expects trade to have a positive effect on China's economic growth.

4 | EMPIRICAL RESULTS

The six specifications of ARDL+Cointegration are estimated and shown in Table 2. The existence of a long-run relationship among *LGDP*, *LINEQ*, *LK*, *LLAB*, *LEN*, and *LOPEN* in Equation (2) is initially examined by computing the *F*-statistic. After estimating Equation (2) for six models, the calculated *F* value of the long-run significance test is *F*-Statistic for a null hypothesis of all values of δ_1 to δ_6 in Equation (2) equal to zero whose critical value is *F* (6, *n*-k), where *n*=number of observations and *k*=number of independent variables in each model. According to Table 2, the null hypothesis of no long-run relationship between these six variables can be rejected at the 5% level and supports the existence of a long-run relationship between them in six specifications.

4.1 | The Short-Run EC Estimation and Long-Run Analysis

After supporting the existence of a long-run relationship among these four variables, the short-run EC estimates are shown in Table 2, and show that the ARDL (k_1, k_2, k_3, k_4, k_5, k_6) model for each specification is determined according to both the AIC and SBC.[21] According to Table 2, the effects of the inequality of fiscal resource distribution among regions (*INEQ*) on China's economic growth differ markedly across different ingredients of fiscal resources and lags. The significantly positive coefficients of $LINEQ_t$ exists in Models 1 and 3 with the Gini coefficient under consideration of own sources of fiscal revenue and extra-budgetary fiscal revenue only. However, after taking fiscal subsidy from central government into consideration as measuring the Gini coefficient and coefficient of variance, the significantly negative coefficients of $LINEQ_{t-1}$ in Models 4, 5, and 6 imply a one-year lagged negative impact of unequal regional distribution of fiscal resources on China's economic growth no matter which indicator of inequality is adopted. That is to say, as the degree of the inequality of fiscal resource distribution among regions increases, it harms China's economic growth in the following year. This conclusion is reasonable in line with the earlier discussion. The negative impact of inequality of fiscal resource distribution among regions on China's economic growth in the short run comes from social conflict, social instability, and inefficiency, as pointed out by Hu (2008), Chen and Zhang (2008).

China's economic growth is affected by its own one-year lag. The coefficient of $\Delta LGDP_{t-1}$ is significantly positive in all model specifications. In addition, the coefficients of ΔLK_t are significantly positive in all specifications, implying an immediately positive effect of real accumulated capital on China's economic growth, but which becomes negative one year later. The coefficients of ΔLK_{t-1} are significantly negative in Models 3, 4, and 6 as more financial resources are considered. This result suggests that real accumulated capital could stimulate the economy contemporaneously but damage it one year later.

With regard to the labour force, none of the coefficients of $\Delta LLAB_t$ and $\Delta LLAB_{t-1}$ is statistically significant. This implies that the labour force plays no role in China's economy. All coefficients of ΔLEN_t are statistically insignificant, but the coefficients of ΔLEN_{t-1} in Models 1, 5, and 6 are all significantly negative. This study finds that energy consumption has a negative influence on China's economic growth one year later, due to over-consumption. Moreover, as all coefficients of $\Delta LOPEN_t$ are significantly positive, this study finds that trade has an immediately positive effect on China's economic growth. However, the coefficients of $\Delta LOPEN_{t-1}$ are significantly negative in Models 2 and 5, implying that an increase in trade will lead to low economic growth one year later.

[21] Estimated results of different model specifications based on either AIC or SBC are quite similar.

TABLE 2 Error correction model for China's economic growth

Variables	Model 1 *INEQ =GINI1*	Model 2 *INEQ =CV1*	Model 3 *INEQ =GINI2*	Model 4 *INEQ =CV2*	Model 5 *INEQ =GINI3*	Model 6 *INEQ =CV3*
Constant	−0.027 (−1.300)	−0.004 (−0.182)	−0.021 (−0.922)	−0.002 (−0.071)	−0.019 (−0.974)	−0.007 (−0.343)
TREND	−0.001 (−0.670)	0.000 (0.208)	−0.001 (−1.178)	0.000 (0.335)	0.001 (1.458)	0.001 (1.057)
$\Delta LGDP_{t-1}$	0.700*** (2.970)	0.932*** (4.109)	0.614*** (3.374)	0.856*** (4.189)	0.968*** (5.587)	0.914*** (5.026)
$\Delta LINEQ_t$	0.502** (2.435)	0.021 (0.161)	0.453*** (3.254)	0.155 (1.695)	0.125 (1.115)	0.079 (0.941)
$\Delta LINEQ_{t-1}$	−0.289 (−1.314)		−0.211 (−1.616)	−0.168* (−2.030)	−0.367*** (−3.377)	−0.251*** (−3.222)
ΔLK_t	0.548** (2.379)	0.504** (2.373)	0.855*** (3.841)	0.642*** (2.988)	0.434** (2.546)	0.440** (2.502)
ΔLK_{t-1}		−0.401 (−1.571)	−0.524** (−2.223)	−0.514** (−2.432)		−0.340* (−1.800)
ΔLK_{t-2}			0.329 (1.438)			
$\Delta LLAB_t$	−0.069 (−0.251)	0.062 (0.252)	−0.302 (−1.245)	−0.053 (−0.226)	0.028 (0.146)	−0.085 (−0.395)
$\Delta LLAB_{t-1}$						−0.173 (−1.065)
ΔLEN_t	0.080 (0.358)	0.066 (0.308)	−0.272 (−1.703)	−0.036 (−0.203)	−0.020 (−0.133)	−0.065 (−0.418)
ΔLEN_{t-1}	−0.397* (−1.894)	−0.298 (−1.666)		−0.265 (−1.540)	−0.338** (−2.316)	−0.371** (−2.411)
$\Delta LOPEN_t$	0.170*** (3.835)	0.126*** (3.302)	0.192*** (4.683)	0.137*** (3.846)	0.152*** (4.959)	0.163*** (4.787)
$\Delta LOPEN_{t-1}$	−0.054 (−1.208)	−0.078* (−1.799)		−0.057 (−1.386)	−0.065* (−1.779)	−0.049 (−1.231)
$\Delta LOPEN_{t-2}$	0.054 (1.256)					
ECM (-1)	−0.847*** (−4.455)	−0.854*** (−4.399)	−0.825*** (−4.498)	−0.804*** (−4.450)	−0.981*** (−6.206)	−1.012*** (−5.823)
Obs.	29	30	29	30	30	30
Adj. R^2	0.739	0.738	0.778	0.775	0.838	0.825
F-Stat. for EC	3.643**	4.023**	5.065***	4.416**	3.070**	3.055**
F-Stat.	7.595***	8.430***	9.919***	9.324***	13.479***	11.489***

Notes: *, **, and *** indicate that the coefficient differs statistically from zero at the 10%, 5%, and 1% significance levels, respectively.

Numbers in parentheses are *t*-values.

Estimated results in Models 1–4 and 6 are corrected for autocorrelation by Newey and West (1987).

Finally, the estimated ECM coefficients are all statistically significant at the 1% level in six model specifications, suggesting the joint significance of the long-run coefficients. Moreover, the ECM coefficient, which ranges from -1.012 to -0.804, reflects a rapid degree of convergence. That is to say,

once the economy is exposed to a shock, it will take a short time (approximately 12–15 months) to return to equilibrium.

The estimated long-run coefficients are shown in Table 3. Unlike the short-run conclusion, the estimated coefficient of *INEQ* is significantly positive at the 10% significance level in Model 2 and at the 5% significance level in Models 5 and 6 as extra-budgetary fiscal revenue and fiscal subsidy from central government are considered in *GINI3* and *CV3*, implying a positive long-run equilibrium relationship between the inequality of regional fiscal resource distribution and China's economic growth. This result is held, considering fiscal subsidy from central government and is reasonable based on the policy of 'let some people grow rich first' and the flying geese theory discussed above. The fiscal inequality that favours the coastal region enables it to grow rich first and then play the role of the lead goose, with positive spillover effects on the following geese, eventually to foster the nation's economic development.

With respect to other variables, the long-run solutions of the estimated ARDL model are consistent with our expectations. The coefficients of *LK*, and *LOPEN* are significantly positive in all specifications. All estimated coefficients of *LK* and *LOPEN* are statistically significant at the 1% level in all models, which means that the long-run positive relationships between real accumulated capital and economic growth and between trade and economic growth are highly statistically significant. Furthermore, the coefficients of *LLAB* are significantly negative in all specifications, indicating a negative long-run relationship between the labour force and economic growth. Finally, in China there is no long-run relationship between energy consumption and economic growth.

4.2 | The Robustness of the Empirical Model

In order to confirm the robustness of all model specifications presented above, several diagnostic tests were conducted with respect to the residuals for the econometric issues of serial correlation (SC), heteroscedasticity (HE), and normality (NO). This study uses the Serial Correlation LM Test to examine the null hypothesis that there is no serial correlation of residuals up to lag order q in the short- and long-run equations, where q is a pre-specified integer.[22] For testing the null hypothesis of homoscedasticity, the ARCH LM Test proposed by Engle (1982) is adopted.[23] A standard method for a normality test, the Jarque-Bera statistic, is employed.[24] Finally, in order to test for model misspecification (MS), the Regression Specification Error Test (RESET) proposed by Ramsey (1969) is applied.[25]

The estimated statistics are presented in Table 4, where it is found that all model specifications of the ARDL equation satisfy all econometric criteria, except for the Serial Correlation LM Test. That is, there is an absence of heteroscedasticity, and normality, and it is unable to detect any model

[22]The test belongs to the class of asymptotic (large sample) tests known as Lagrange multiplier (LM) tests. For a further discussion on this method, please refer to Godfrey (1988).

[23]The ARCH LM Test is a Lagrange multiplier (LM) test for autoregressive conditional heteroscedasticity (ARCH) in the residuals.

[24]As mentioned in Greene (2000), the Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference in terms of the skewness and kurtosis of the series from the normal distribution. Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed as ^{2} with two degrees of freedom.

[25]RESET is a general test for the following types of specification errors: 1. Omitted variables: the empirical model does not include all relevant independent variables. 2. Incorrect functional form: some or all of the dependent and/or independent variables are transformed into logs, powers, reciprocals, or in some other way. 3. Correlation between independent variable(s) and , which may be caused by the measurement error in the independent variable, simultaneous equation considerations, combinations of the lagged dependent variable values and serially-correlated disturbances.

TABLE 3 Estimated long-run coefficients

Dependent Variable: *LGDP*						
Variables	**Model 1** ***INEQ =GINI1***	**Model 2** ***INEQ =CV1***	**Model 3** ***INEQ =GINI2***	**Model 4** ***INEQ =CV2***	**Model 5** ***INEQ =GINI3***	**Model 6** ***INEQ =CV3***
C	2.735 (1.149)	2.429 (1.053)	3.397 (1.517)	3.317 (1.465)	3.130 (1.650)	2.875 (1.403)
LINEQ	0.155 (1.625)	0.113* (1.891)	0.120 (1.422)	0.078 (1.438)	0.250** (2.300)	0.139** (2.085)
LK	0.548*** (8.676)	0.536*** (8.507)	0.555*** (8.701)	0.556*** (8.843)	0.572*** (11.203)	0.562*** (10.401)
LLAB	−0.371** (−2.338)	−0.366** (−2.504)	−0.412** (−2.739)	−0.413** (−2.767)	−0.351** (−2.596)	−0.359** (−2.554)
LEN	0.122 (0.804)	0.144 (0.958)	0.086 (0.588)	0.084 (0.579)	0.034 (0.275)	0.060 (0.468)
LOPEN	0.168*** (3.595)	0.169*** (3.773)	0.181*** (4.058)	0.182*** (4.085)	0.201*** (4.951)	0.194*** (4.682)
Obs.	32	32	32	32	32	32
Adj.R^2	0.998	0.998	0.998	0.998	0.998	0.998

Notes: *, **, and *** indicate that the coefficient differs statistically from zero at the 10%, 5%, and 1% significance levels, respectively.
Numbers in parentheses are *t*-values.

mis-specification except for Model 4. In addition, there is a serial correlation of residuals in all short-run model specifications except for Model 5, as shown in Table 4. We therefore find that the heteroscedasticity and autocorrelation consistent estimator proposed by Newey and West (1987) is used to correct the econometric problem raised by serial correlation in five model specifications in Table 2.

After correcting for the serial correlation, all these results indicate that the model of the ARDL approach to co-integration adopted in this study is thus well specified, so the estimation results from the empirical model are also quite robust except for Model 4.

5 | CONCLUDING REMARKS

The article examined an important but neglected issue regarding the economic role of the inequality of fiscal resource distribution among regions in China. Using official time-series data from 1979 to 2010 and six model specifications of the ARDL plus co-integration equation, the main finding is that such inequality should have a negative one-year lagged impact on China's economic growth in the short run. That is to say, as inequality of fiscal resources distribution among regions increases, it will hurt China's economic growth in the following year due to social conflict, social instability, and inefficiency, as pointed out by Hu (2008) and Chen and Zhang (2008). However, a positive long-run equilibrium relationship between the inequality of fiscal resources distribution among regions and China's economic growth is found to be due to the important policy of 'let some people grow rich first' and the implications of the flying geese theory.

TABLE 4 Diagnostic tests

Models	Serial Correlation LM Test H_0: There is no serial correlation in the residuals up to order q.	ARCH-LM Test for Homoskedasticity H_0: There is no auto- regressive conditional hetero- skedasticity in the residuals up to order q.	Normality Test (Jarque-Bera Stat.) H_0: Normal distribution	RESET Test (F-Stat.) H_0: Absence of model misspeci-fication
Model 1: *INEQ=Gini1*	$\chi^2(q=3) = 8.040^{**}$ $\chi^2(q=6) = 9.092$	$\chi^2(q=3) = 1.310$ $\chi^2(q=6) = 9.636$	0.180	1.187
Model 2: *INEQ=CV1*	$\chi^2(q=3) = 16.663^{***}$ $\chi^2(q=6) = 17.676^{***}$	$\chi^2(q=3) = 6.020$ $\chi^2(q=6) = 9.541$	1.211	0.832
Model 3: *INEQ=Gini2*	$\chi^2(q=3) = 9.699^{**}$ $\chi^2(q=6) = 10.201$	$\chi^2(q=3) = 0.586$ $\chi^2(q=6) = 4.547$	3.380	1.984
Model 4: *INEQ=CV2*	$\chi^2(q=3) = 6.413^{*}$ $\chi^2(q=6) = 8.025$	$\chi^2(q=3) = 1.159$ $\chi^2(q=6) = 3.436$	5.288*	4.470**
Model 5: *INEQ=Gini3*	$\chi^2(q=3) = 2.053$ $\chi^2(q=6) = 6.591$	$\chi^2(q=3) = 1.766$ $\chi^2(q=6) = 2.317$	3.351	1.962
Model 6: *INEQ=CV3*	$\chi^2(q=3) = 3.211$ $\chi^2(q=6) = 13.620^{**}$	$\chi^2(q=3) = 1.551$ $\chi^2(q=6) = 2.289$	3.296	2.713

Note: *, **, and *** indicate that the null hypothesis is rejected at the 10%, 5%, and 1% significance levels, respectively.

In addition, China's economic growth is affected by its own one-year lag. Moreover, there is an immediate positive effect of real accumulated capital on China's economic growth, which becomes negative one year later. This is also true for the effects of trade on China's economy. This study also finds that energy consumption has a negative influence on China's economic growth one year later, and concludes that once the economy is exposed to a shock, it will take a short time (approximately 12–15 months) to return to equilibrium.

The study finds a positive long-run relationship between real accumulated capital and economic growth and between trade and economic growth. Nevertheless, there is a negative long-run relationship between the labour force and economic growth. Finally, there is no long-run relationship between energy consumption and economic growth in China.

Although fiscal inequality will cause short-run disadvantages, this study further suggests that the GoC should not worry about it for two reasons. First, if this positive long-run equilibrium relation can be maintained, then fiscal inequality will be a positive force for China's economic growth in the long run. Second, capital investment is a bigger driver of China's economic growth in both the short and the long run. An increase in GoC capital investment can eliminate the negative impact of fiscal inequality on China's economic growth in the short run.

According to the finding of a positive long-run equilibrium relationship between fiscal inequality and economic growth in China during the research period, one can say that, at least during the research period, fiscal inequality had a long-run contribution to China's economic growth and that the final goal of the policy of 'let some people grow rich first' was fulfilled. As China is pursuing sustainable economic growth and ultimately aims to achieve equal development across the country, this study thus suggests that the GoC continue to pursue the principle of 'let some people grow rich first' — or, in this case, let some regions' economies develop successfully first, and have more fiscal resources in order

to do so. Even if this policy damages China's economic growth in the short run, according to the 'flying geese' theory, the advanced region serving as the lead goose will have a positive spillover effect on less developed region—the follower geese—eventually benefiting the economic development of the country as a whole in the long run.

ACKNOWLEDGEMENTS

The authors acknowledge the financial support provided for this research by the Ministry of Science and Technology, Taiwan (MOST 105-2410-H-004-014). The authors would like to thank paper discussant, Tao-Tony Fang (Professor of Economics at York University and the University of Toronto), Jack W. Hou (Professor of Economics at California State University, Long Beach and Coeditor of *Contemporary Economic Policy*), and all participants of the 2010 Western Economics Association International (WEAI), Hilton Hotel, Portland, OR, 29 June–3 July 2010, for their helpful comments during the preparation of this paper. The authors also deeply appreciate Dr Tsun-Feng Chang's and Mr Yu-Chih Wei's efforts in data collection, primarily statistical processing, and offering some opinions. All views and errors are solely those of the authors.

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How to cite this article: Huang J-T, Chang M-L. The impact of unequal regional distribution of fiscal resources on China's post-reform economic growth. *Dev Policy Rev*. 2020;38:226–241. https://doi.org/10.1111/dpr.12420