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Study on the Effects of Government Fixed Asset Investment to Economic Growth in China: Based on a Co-Integration Model

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Abstract
China has achieved economic boom in the past 30 years, which was believed to be closely related to the central government's ability to regulate the entire economy. The aim of this paper is to examine the above conjecture by statistically evaluate whether and to what extent has the mostly used countermeasures by the Chinese government to regulate the economy—investment in fixed asset—achieved its fundamental goals of promoting sustained economic growth. Using a co-integration model, this paper proved that a 1% increase in government fiscal expenditure on fixed assets can cause a 0.68% increase in gross domestic product in the long run, anda subsequent error-correction model have demonstrated the short run impetus of fixed asset investment on economic growth is 0.058%.Based on our study, investment in fixed assets was the key factor in promoting economic growth in recent decades of China, which demonstrated its effectiveness as an instrument for economic regulation and control. We believe our work can prove the necessity of moderate governmental interventions on economic development thus providing implications for policy makers.

Keywords: evaluation, fixed asset investment, economic growth, policy making, macro-economic regulation

INTRODUCTION

Since implementing the reform and opening-up policies of the 1970s, China has achieved economic boom. Among all the factors that have contributed to China's economic success, the role of China's government can't be neglected, since it has much greater power to intervene in economic development than do the governments of most developed countries (Allen, Qian, & Qian, 2005; Montinola, Qian, & Weingast, 1995).During the past 30 years, many countermeasures have been implemented by the Chinese government to stimulate the economic development, among which we noticed a dramatic investment fever in fixed assets, especially in infrastructures buildings (Jun, 2003; Qin & Song, 2009). However, empirical evaluation of the effects of such investment by the government has been limited, regardless that some studies noted that China's regulatory countermeasures has fulfilled its role in promoting economic growth (Caichen & Liyuan, 2015; Jinquan & Bing, 2005; Jinquan, Zhong, & Yangchun, 2014). This paper attempts to address this gap by testing whether and to how much extent has fixed asset investment by the government promoted the economic development in China.

The rest of this paper is organized as follows: **Section 2** addresses variable selection and data. **Section 3** addresses econometric procedures. **Section 4** presents the main empirical results. **Section 5** states the main conclusions.

Variable Selection and Data

Since1978, the Chinese central government has undertaken numerous counter measures to regulate the economy. These regulatory practices can be divided into 7 periods, five of which are characterized by tightening practices whose purpose is to cool down the economy and two of which are expansionary practices that are used during recessions(Feng& Kong, 2009; Fung, Ho, & Zhu, 2000). During the whole process of China's efforts to regulate the economy, the mostly used countermeasures by China is to invest in infrastructure building to boost economic growth, in spite of some specific policies that aimed to regulate the overall stability of the economy such as direct political interventions on price levels and taxation adjustments(Zhang, 2017). In this paper we confined our topic on testing the specific function of real government fixed assets investment (FIX_real) in stimulating economic growth.

Quarterly data of government fixed assets investment and gross domestic product (GDP) was collected from the Database of National Bureau of Statistics of China for the period 1998-2014. The data were deflated based on the GDP deflator with 2000 as the base year to

eliminate the impact of price factors, and was then seasonally adjusted using the Census X12 seasonal adjustment procedure to eliminate seasonal factors. After the above two procedure we linearized the data using the logarithmic transformation to eliminate heteroscedasticity. A time frame is chosen because of the limited amount of high-quality data.

METHODOLOGY

To evaluate the exact effects of government's fixed asset investment to economic growth, we have employed a co-integration test to study the equilibrium relationship between it and China's past economic growth.

The co-integration test is a type of new model used for the analysis of non-stationary time series data;co-integration refers to the long-run equilibrium relations among non-stationary variables given that all the variables are integrated in the same order (Engle & Granger, 1987). Many test procedures for co-integration have been proposed, such as the Engle-Granger two-step technique and the Johansen-Juselius approach (Johansen & Juselius, 1990). In this study, we have two variables that could generate at most one co-integration equation; therefore, we employed the Engle-Granger two-step technique. The first step in the Engle-Granger two-step technique was fitting the long-run relationship in levels by Ordinary Least Squares. Then, the unit root test was applied to the resulting residual to judge the hypothesis of co-integration; if there is no co-integration relation between X_t and Y_{1t}, any linear combination of these two variables as well as their residual will be non-stationary. Therefore, the co-integration relationship between X_t and Y_t can be judged by performing a unit root test for their residual. After the co-integration relationship between studied variables is confirmed, an error correction model can be used to access the short-run adjustments toward the long-run equilibrium state, that is, to understand how economic activity was affected by changes in policy in a short period of time.

RESULTS AND DISCUSSION

Before co-integration estimation, the Augmented ADF unit roots test and Phillips-Perronunit roots test were applied to each variable'stime series at their levels (GDP_real, FIX_real) and to their respective differentiated series, which indicated that they were integrated in order one I(1). Then after estimating the co-integration equation, the unit root tests without trend were applied to the residuals of the estimated co-integration equation; the reported statistics in **Table 1** showed that the null hypothesis of a unit root was rejected, implying that the co-integration relationships did hold.

Table 1 The Estimation of Co-integration Equation.

Variable	t-statistic	$C_{0.01}$	$C_{0.05}$	$C_{0.1}$
Resid	-3.962**	-4.061	-3.427	-3.107

Note: The critical value ($c_{0.01}$,$c_{0.05}$,$c_{0.1}$) was calculated according to formula $C_P=\varphi_\infty+\varphi_1/T+\varphi_2/T^2$ proposed by Mackinnon(Mackinnon, 2010), where T is the sample size, *p* stands for *p*-value, φ_∞, φ_1 and φ_2 can be obtained from the critical value table for co-integration test.

* 10% significance level

** 5% significance level *** 1% significance level

Table 2 shows the estimation results for Eq (1), which stand for the co-integration equation for government fixed asset investment with real gross domestic product, from which the long-term equilibrium relationship between government's fixed asset investment and GDP can be assessed. As can be seen from Eq (1), a 1% increase in government fiscal expenditure on fixed assets can cause a 0.68% increase in gross domestic product, indicating that the stimulating effect of fixed asset investment from the government on economic growth is obvious. The co-integration equation not only revealed the extent to which fiscal expenditure on fixed assets can have an impact on economic growth but also that there was a long-run equilibrium relationship between them.

Table 2 Estimates coefficients of con-integration model and ECM model

Co-integrating Eq. (1)	Coefficient	Std. Error	t-statistic
FIX_real	0.683842***	0.010731	63.72338
C	4.985948***	0.091968	54.21373
R-squared	0.984006		
Adj. R-squared	0.983764		
S.E. equation	0.072245		
Sum sq. resid	0.344473		
F-statistic	4060.669		
Log likelihood	83.21059		
Mean dependent	10.81983		
S.D. dependent	0.566980		
Durbin-Watson stat	0.490558		
ECM Eq.(2)	**Coefficient**	**Std. Error**	**t-statistic**
C	0.016362***	0.003365	4.861944
∆GDP_real (-1)	0.283372**	0.115003	2.464032
∆FIX_real	0.057870***	0.015890	3.641850
Ecm (-1)	-0.062163***	0.017679	-3.516261
R-squared	0.346686		
Adj. R-squared	0.315074		
S.E. equation	0.008608		
Sum sq. resid	0.004595		
Log likelihood	222.2436		
F-statistic	10.96691		
Mean dependent	0.026357		
S.D. dependent	0.010402		
Durbin-Watson stat	2.103042		

Note: * 10% significance level

** 5% significance level *** 1% significance level

To assess the short-run dynamic equilibrium relationship between government fixed asset investment and economic growth, an error correction model was estimated, as shown in the bottom part of **Table 2**,we can see that the short-run elasticity coefficient for fixed asset investment from the government and GDP was 0.058, indicating that a 1% increase in fixed asset investment will generate a 0.058% impetus for GDP, which was much smaller than the elasticity coefficient of the above long-run co-integration equation; this implies that the government's fixed asset investment had a more significant effect on economic growth in the long run than in the short run.

CONCLUSIONS

In this paper, the positive role of government fixed asset investment in promoting economic growth was confirmed that the Chinese central government has successfully used such means to stimulate economic growth. We believed that this can provide important implications for policy makers. Generally, the role of investment in fixed assets by the central government can be reflected in two respects: First, it can promote consumption in a very short time by boosting domestic demand, and through the multiplier effect, it produces huge driving forces for economic growth. Conversely, fixed asset investment is one of the most effective means of capital accumulation and has a stronger effect on long-term economic development when put into actual use. Mankiw (2012) once noted that productivity is not only a source of economic growth but also a key factor that the government must consider when making economic policy. Physical capital investment is one of the decisive factors in productivity(Qian, 2000), and its role in long-term economic growth cannot be ignored. Based on our study, investment in fixed assets was the key factor in promoting economic growth in recent decades of China; therefore, investment in fixed assets can be an important government tool for economic regulation and control. The limitation of our work is its failure in exploring the effects of other major economic intervention instruments by the Chinese government, such as taxation and monetary policy. This will be a direction that we will pursue in our future study.

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