The effect of inward foreign direct investment on economic growth: The case of Chinese provinces

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Abstract

This article examines the effect of inward foreign direct investment (FDI) on economic growth with a focus on Chinese provinces by conducting the Granger causality and impulse response tests in a vector auto-regression (VAR) estimation. The study contributes to the reviewed literature by examining the FDI effect in such comprehensive ways as demand-side and supply-side models, and by clearing the endogeneity problem of targeted variables under a VAR framework. The main findings of this study were as follows. First, the positive effect of FDI on economic growth in Chinese provinces was confirmed by all the model estimations: statistical, demand-side and supply-side models. Second, from the regional perspectives, the positive effect of FDI on economic growth was found in the eastern region, but not in the non-eastern region. Third, no crowding-out effect of FDI on domestic capital formation was identified both in demand-side and supply side analyses.

Keyword: Inward foreign direct investment (FDI), Economic growth, Chinese provinces, Vector auto-regression estimation, Granger causality and Impulse responses.

JEL Classification Codes: F21; O47; O53

1. Introduction

Inward foreign direct investment (FDI) is a major source of capital inflows and has boosted its presence in the world economy during the recent decades. The stock value of FDI in the world increased from 2.2 trillion US dollars in 1990 to 25.0 trillion US dollars in 2015 by about 11 times, whereas the world GDP grew by only three times during the same period. As a result, the FDI ratio relative to GDP rose from 9.6 percent in 1990 to 34.6 percent in 2015 in the world. Even in China, a large economy, the ratio went up from 5.2 percent in 1990 to 10.9 percent in 2015.[1] Although the argument that FDI has a positive effect on economic growth in the host country is generally accepted, there have still been critical discussions on the FDI impacts in the theoretical and empirical aspects.

From the theoretical perspective, if we follow the traditional neoclassical growth model, FDI merely increases the investment rate, resulting in a transitional growth in per capita income under the assumption that technological progress is exogenous. Under the new "endogenous" growth theory in which technological progress is endogenous, however, FDI is considered to have a permanent growth effect through technology transfer and spillover.

From the empirical perspective, while most of studies supported positive effects of FDI on growth, some studies found that FDI had no significant effect on growth and even crowded out domestic capital accumulation and innovation. Another angle of dispute lies in the causality between FDI and growth. Whereas some evidence showed the positive causality from FDI to growth, the other pointed out that FDI could be attracted to growing economies and markets since foreign investors tended to choose these attractive locations for their investment. Thus it raises endogeneity problems in a single-equation regression analysis. As for the sampled targets, there have been limited studies to address the regional nexus between FDI and growth, while their national-level relationship has been examined intensively.

This article examines the effect of FDI on economic growth with a focus on Chinese provinces by conducting the Granger causality and impulse response tests in a vector auto-regression (VAR) estimation. The contributions of this study are as follows. First, this study targets regional economies focusing on Chinese provinces, while most of previous studies sampled national economies. Second, this study investigates the FDI effects on GDP not only in their bilateral relationship but also in the models of demand and supply sides. The previous studies concentrated only on either supply-side effect of

[1] The data is based on UNCTAD STAT: http://unctadstat.unctad.org/EN/Index.html

FDI, e.g., on innovation, or demand-side effect, e.g., on domestic investment. This study, however, addresses comprehensive effects of FDI containing both-side aspects. Third, as an analytical methodology, this study adopts not a single-equation regression but a VAR model to avoid the endogeneity problem on FDI and GDP. The VAR estimation lets the data determine the causality between targeted variables, and makes it possible to trace out the dynamic responses of variables to exogenous shocks overtime.

The rest of the paper is structured as follows. Section 2 describes the literature review with a focus on statistical approach, supply-side analysis and demand side-analysis related to FDI effects in China, and clarifies the contributions of this study. Section 3 first presents an analytical framework to examine the FDI effects on economic growth: bilateral statistical model, demand-side model and supply-side model, and then conducts a VAR estimation on the FDI effects with the descriptions of methodologies, data and estimation outcomes with its interpretation. The last section summarizes and concludes.

2. Literature Review and Contribution

This section reviews the literature related to FDI effects in China by classifying the studies into the following three categories: statistical approach, supply-side analysis and demand side-analysis.

The statistical approach is simply to put the relationship between FDI and GDP (and some other related variable) in econometric tests. Most of the studies in this category provided evidence to support positive effects of FDI on GDP (economic growth). The studies in this category could be further classified by the examined samples into multinational, national and regional levels.

Regarding the multinational level including China, Hsiao and Hsiao (2006) examined the causality among FDI, GDP and exports by panel-data VAR estimation for eight east and south-east Asian countries including China during the period from 1986 to 2004. They found unidirectional positive effects of FDI on GDP directly and also indirectly through exports through their estimation. Farshid et al. (2009) investigated the FDI and trade impacts on economic growth for five East Asian countries (China, Korea, Malaysia, Philippines and Thailand) for 1980-2006 by using augmented production function growth model with panel data. The study identified positive impacts of FDI on economic growth in China, Korea and Thailand.

As for national level, Liu et al. (2002) verified the long-run causal links among FDI, trade and economic growth in China through co-integration analysis using nation-wide aggregate data for the period from the first quarter of 1981 to the fourth quarter of 1997.

Liu (2009) also investigated the FDI impact on economic growth for 1983-2005 at national level through ordinary econometric analyses, and found that the FDI impact was descending since 1994 though the impact was still positive. Agya and wunuji (2014) examined the causal effect of FDI on economic growth of China by the primary, secondary and tertiary sectors for 1995-2010. Their Granger causality tests indicated that FDI caused economic growth in secondary industry, whereas it did not in primary and tertiary industries.

Looking at regional-level analyses in China, Zhang (2001) assessed the FDI contribution on economic growth for 1986-1997, using cross-section and panel data at the province level of China. The estimate suggested that FDI promoted economic growth and the FDI's positive impacts were larger in the coastal provinces than the inland ones in the 1990s. Wei (2002) examined the FDI effect on regional economic growth in China by employing time-pooling and cross-section data between 1985 and 1999, and found that FDI inflows contributed to approximately ninety percent of the gap in economic growth rates between eastern developed regions and western undeveloped ones in China.

The second category is the supply-side analyses to focus FDI effects on supply-side variables such as technological spillover, innovation and institutional quality. The estimation outcomes in this category seem to be rather inconclusive in that some studies pointed out negative crowding effects while the others supported positive effects. Liu (2002) investigated whether FDI generated externalities in the form of technological transfer by using data on 29 manufacturing industries over the period from 1993 to 1998 in the Shenzhen Special Economic Zone of China. The study found that FDI had large and significant spillover effects in that it raised both the level and growth rate of productivity of manufacturing industries. Chen (2007) also analyzed the relationship between FDI and regional innovation through a cross-section estimation using data of each province in China retrieved from statistical yearbooks in 2004 and 2005. Its finding was, however, that the entry of FDI had no use for enhancing indigenous innovation capability, implying that inward FDI might have the crowding-out effect on domestic innovation activity. Regarding the institutional impact of FDI, Long et al. (2015) provided empirical evidence that the presence of FDI positively affected the institutional quality of the host regions in China through the cross-section estimation using firm-level survey data as of year 2004.

The third category is the demand-side approach to contain demand items, in particular, domestic investment in the analyses. The critical question is whether FDI crowds in or crowds out domestic investment. Xu and Wang (2007) tested the FDI effect on domestic capital formation, exports, imports and GDP growth in China through

econometric estimations using a data set covering the 1980-1999 period. The key finding was that the inflow of FDI stimulated domestic investment as well as exports and imports. Chen et al. (2017) also examined the relationship between FDI and domestic investment in China using quarterly data spanning from the first quarter of 1994 to the fourth quarter of 2014. They considered the entry mode chosen by foreign investors and found that the FDI in the mode of foreign-funded enterprise crowded domestic investment out while the FDI with equity joint venture crowded it in. Thus empirical evidence on this point has not always been settled down yet.

The literature reviewed above is summarized in Table 1. There were relatively fewer studies that focused on regional economies as a research target and that adopted the sophisticated methodologies such as VAR estimation as an analytical framework. In addition, there was no study that addressed FDI effects from comprehensive perspectives containing supply and demand sides. This study contributes to enriching the evidence on FDI effects in the following ways. First, this study investigates the FDI effects on GDP not only in their bilateral statistical relationship but also in the models of demand and supply sides. Second, this study targets regional economies focusing on Chinese provinces. Third, this study adopts not a single-equation regression but a VAR model to avoid the endogeneity problems on FDI and GDP and to enable us to trace out the dynamic responses of variables to the FDI shocks overtime.

3. Empirics

This section conducts empirical analysis. We first present an analytical framework to examine the FDI effects on economic growth: bilateral statistical model, demand-side model and supply-side model, and then conduct a VAR estimation on the FDI effects with the descriptions of methodologies, data and estimation outcomes with their interpretations.

3.1 Analytical Frameworks

This subsection presents the analytical framework to examine the FDI effects on economic growth. For simplicity, we assume equilibrium in monetary and external sectors at the national level so that interest rate and exchange rate can be given. This assumption would be justified since this study's analysis targets regional economies in China. We thus focus only on the real aspect of the economy, ignoring the financial variables.

Under this assumption, three kinds of models: bilateral statistical model, demand-side model and supply-side model, are presented as follows.

$$F_1(fdi, grp) = 0 \quad (1)$$

$$F_2(fdi, grp, fce, gcf, ext) = 0 \quad (2)$$

$$F_3(fdi, grp, gcf, emp) = 0 \quad (3)$$

where *fdi*, *grp*, *fce*, *gcf*, *ext* and *emp* are inward foreign direct investment (FDI), gross regional products (GRP), consumption, domestic investment, exports, and number of employees, respectively. Equation (1) is the model to simply put the bilateral relationship between FDI and GRP in a statistical test; Equation (2) is the demand-side model in which major demand variables, consumption, domestic investment and exports, are inserted; and Equation (3) is the supply-side model where the variables related to production factors, capital (domestic investment) and labor (number of employees) are contained.

When it comes to the empirical examination of the equations above, a single-equation regression causes a estimation bias since all the variables specified in the equations above are endogenous ones. Thus we adopt a VAR model and conduct the tests of Granger causality and impulse response under the model to examine the FDI effect on GRP.

A VAR model equation for estimation is specified in the following way.

$$y_{it} = \mu + V y_{it-1} + \varepsilon_{it} \quad (4)$$

where y_{it} is a column vector of the endogenous variables with province *i* and year *t*, i.e., $y_{it} = (fdi_{it}\ grp_{it})'$ for estimating the bilateral statistical model in (1), $y_{it} = (fdi_{it}\ grp_{it}\ fce_{it}\ gcf_{it}\ ext_{it})'$ for the demand-side model in (2), and $(fdi_{it}\ grp_{it}\ gcf_{it}\ emp_{it})'$ for the supply-side model in (3); μ is a constant vector; V is a coefficient matrix; y_{it-1} is a vector of the lagged endogenous variables; and ε_{it} is a vector of the random error terms in the system. Regarding the lag interval, we take one-year lag under the limited numbers of time-series observations, 2001-2015. For the bilateral statistical model, its estimation is conducted by two groups of provinces: those that belong to the eastern region in China and the others, as well as by total provinces. Based on the VAR model estimation, we examine the Granger causality and impulse response from FDI to GRP in each of model estimation.

3.2 Data Description

We first clarify the data sources and series for the estimation use. The FDI data are retrieved from Statistical Yearbook of each province. For instance, the FDI data in Beijing

city are taken by the item of "Actual Use of Foreign Direct Investment (10,000 US dollars)" in the category of "15-1 Foreign Economic Relations and Trade" from Beijing Statistical Yearbook 2016.[2] All the other data come from National Bureau of Statistics of China (NBS)[3]: GRP, consumption and domestic investment are from "Gross Reginal Product (100 million yuan)", "Final Consumption Expenditure (100 million yuan)" and "Gross Capital Formation (100 million yuan), respectively, in the "National Accounts" category, all of which are converted into the values of US dollars by using "The Exchange Rate Between RMB and USD"; exports are from "Total Value of Exports of operating units (1,000 US dollars)" in the "Foreign Trade and Economic Cooperation" category; and number of employees is from "Number of Engaged Persons in Private Enterprises (10,000 persons)" in the "Employment and Wages" category.

Regarding the data availability, we have to follow the constraint of the regional FDI data in which the data can be obtained only in 22 out of 31 provinces (10 out of 11 provinces in the eastern region and 12 out of 20 provinces in the non-eastern region[4]) for 2001-2015 as shown in Table 2. The sum of GRPs of the 22 sample provinces accounts for 85 percent of nation-wide GDP in 2013. For the subsequent VAR estimation, then, we construct a panel data with 22 provinces for the period of 2001-2015 for each model. Figure 1 displays the overview of the relationship between FDI and GRP on year-on-year rate base in the selected provinces. It appears by rough observation that the FDI and GRP synchronize in the eastern region more clearly than they do in the non-eastern region. Their correlation should, however, be statistically tested by a more precise manner, the VAR estimation.

Before conducting the VAR model estimation, we investigate the stationary property of each variable's data by employing a panel unit root test, and if needed, a panel co-integration test for a set of variables' data. The unit root test is conducted on the null hypothesis that a level and/or a first difference of the individual data have a unit root. In case that the unit root test tells us that each variable's data are not stationary in the level, but stationary in the first-difference, a set of variables' data corresponds to the case of $I(1)$, and then can be further examined by a co-integration test for the "level" data. If a set of variables' data are identified to have a co-integration, the use of the "level" data is justified for a VAR model estimation. For a panel unit root test, we adopt the Levin, Lin and Chu unit root test (developed by Levin et al., 2002), which assumes that the

[2] See the website: http://www.bjstats.gov.cn/nj/main/2016-tjnj/zk/indexeh.htm
[3] See the website: http://data.stats.gov.cn/english/
[4] The classification between the eastern and non-eastern regions is based on the NBS criteria. The NBS divides the mainland into eastern, western and intermediate zones. The non-eastern region of this study corresponds to the sum of western and intermediate zones in the NBS.

parameters of the series lagged are common across cross sections. We specify the test equation by containing individual intercept and adopting automatic lag length selection. For a panel co-integration test, we conduct the Pedroni residual co-integration test (developed by Pedroni, 2004) by including individual intercept and adopting automatic lag length selection in the test equation.

Table 3 reports the result of both unit root and co-integration tests for the variables used for each estimation model: bilateral statistical model (and divided into the models for the eastern and non-eastern regions), demand-side model and supply-side model. For all the variables in each model, the unit root test identified a unit root in their levels, but rejected it in their first differences at the conventional level of significance, thereby the variables following the case of $I(1)$. The co-integration test was, thus, conducted further on the combinations of variables in each model. The panel PP test and ADF test[5] (at least, either of tests) suggested that the level series of a set of variables' data were co-integrated. We thus utilize the level data for each VAR model estimation.

3.3 Estimation Outcomes and Interpretations

Table 4, Table 5 and Figure 2 respectively report the estimation outcomes of VAR models, Granger causalities and impulse responses on bilateral statistical model, demand-side model and supply-side model for examining the FDI effects on GRP in China. We describe the outcomes by each estimated model one by one.

3.3.1 Bilateral Statistical Model

The estimation outcomes of the bilateral statistical models are as follows. The outcomes are reported for the models of the eastern and non-eastern regions as well as the nation-wide model. Regarding the Granger causalities in the nation-wide model shown at the top of Table 5, the causality was identified not from GRP to FDI but from FDI to GRP in the nation-wide model. The causality from FDI to GRP was significant at the conventional (99 percent) level, and was supposed to be a "positive" one judging from the estimated VAR model in Table 4. When we look at the regional models at the second and third rows of Table 5, however, the causality from FDI to GRP was verified not in the non-eastern region but in the eastern region. The causality from FDI to GRP in the eastern

[5] Regarding the panel PP and ADF tests under the Pedroni residual co-integration test, see EViews 9 Users Guide II (pp. 952-958).

region was also positively significant at the 99 percent level. When we see the outcomes of the impulse responses in Figure 2, GRP responded positively to the shock of FDI within a 95 percent error band from the beginning of the shock in the nation-wide model and eastern-region model, while the response was ambiguous in the non-eastern model.

The following points should be noted as the implications of the estimation outcomes above. First, the outcomes showed not bilateral causalities but an unilateral causality from FDI to GRP. Although there was the argument that FDI could be attracted to growing economies and markets, the causality in Chinese provinces was found to be not the case. Second, it was in the eastern region that the causality from FDI to GRP was identified. This finding is consistent with the previous studies, e.g., Zhang (2001). The reason for this outcomes might come from the difference in the FDI contribution to regional economies. In fact, the last column of Table 2 indicates that the FDI-GRP ratio at its peak year during the samples reaches 4-20 percent in the eastern region except the Hebei province, whereas the ratio stays at 0-6 percent in the non-eastern.

3.3.2 Demand-Side Model

The estimation outcomes of the demand-side model are as follows. When we see the outcome of Granger causalities at the fourth row of Table 5 and in the estimated model in Table 4, the positive causality was verified not from GRP to FDI but from FDI to GRP at the significant level in the same way as the nation-wide bilateral statistical model. As for the causalities from FDI to the other demand items, the positive causalities at the significant level were found from FDI to consumption and exports, while the causality from FDI to domestic investment was positive but insignificant. The impulse response test in Figure 2 indicated that GRP responded positively to the shock of FDI within a 95 percent error band from the beginning of the shock just like the nation-wide bilateral statistical model.

The results above told us as their implications that the FDI had a positive effect on GRP in Chinese provinces from the demand-side perspective, and that the FDI also have favorable effects on major demand items such as consumption and exports as well as the total GRP. It should be noted that the FDI had no negative effect on domestic investment. It provided the evidence that the FDI had no crowding-out effect on domestic capital formation from the demand side on the critical debate on whether the FDI crowds in or crowds out domestic investment.

3.3.3 Supply-Side Model

The last estimation outcomes are those of the supply-side model. The Granger causality test at the fifth row of Table 5 and the estimated model in Table 4 indicated the positive causality from FDI to GRP, but not from GRP to FDI, just like precious models. As for the causalities from FDI to the other supply items, the positive causality was found from FDI to domestic investment, but not to number of employees. The impulse response test in Figure 2 showed that GRP responded positively to the shock of FDI similarly as in the previous models. The results above suggested that the FDI had a positive effect on GRP in Chinese provinces also from the supply-side perspective. In addition, the supply-side model provided noteworthy evidence that the FDI had even a positive effect on domestic investment

4. Concluding Remarks

This article examined the effect of FDI on economic growth with a focus on Chinese provinces by conducting the Granger causality and impulse response tests in a VAR estimation. The study contributed to the related literature by examining the FDI effect in such comprehensive ways as demand-side and supply-side models, and by clearing the endogeneity problem under a VAR framework. The main findings of this study were as follows. First, the positive effect of FDI on economic growth in Chinese provinces was confirmed by all the model estimations: statistical, demand-side and supply-side models. The opposite effect of economic growth on FDI was, on the other hand, insignificant in all the models. Second, from the regional perspectives, the positive effect of FDI on economic growth was found in the eastern region, but not in the non-eastern region, probably due to the differences in the FDI share relative to gross regional products. Third, no crowding-out effect of FDI on domestic capital formation was identified both in demand-side and supply side analyses.

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Table 1 Summary of Literature Review

Studies	Perspective on FDI effects	Methodorogy	Samples
[Statistical Approach]			
Hsiao & Hsiao (2006)	GDP & Export: Positive	VAR (Panel & Time Series)	Multi-national, 1986-2004
Farshid et al. (2009)	GDP: Positive	Normal Regression (Panel)	Multi-national, 1980-2006
Liu et al. (2002)	GDP & Trade: Positive	Cointegration (Time Series)	National 1981q1-1997q4
Liu (2009)	GDP: Positive but Desending	Normal Regression (Time Series)	Naional 1983-2005
Agya & Wunuji (2014)	GDP (secondary ind.) Positive	VAR-Granger C. (Time Series)	National 1995-2010
Zhang (2001)	GDP: Positive	Normal Regression (Panel & Cross Section)	Regional, 1986-1997
Wei (2002)	GDP: Positive	Normal Regression (Panel & Cross Section)	Regional, 1985-1999
[Supply-side Analysis]			
Liu (2002)	Technology Spillover: Positive	Normal Regression (Panel)	Regional (Shenzhen), Manufacturing, 1993-1998
Chen (2007)	Innovation: Crowd-out	Normal Regression (Cross Section)	Reginal, 2004, 2005
Long et al. (2015)	Institutional Quality: Positive	Normal Regression (Cross Section)	Regional, 2004
[Demand-side Analysis]			
Xu and Wang (2007)	Domestic capital, Trade & GDP: Positive	Normal Regression (Time Series)	National, 1980-1999
Chen et al. (2017)	Domestic investment: Crowd-in and -out	Normal Regression (Time Series)	National, 1994q1-2014q4

Sources: Author's description

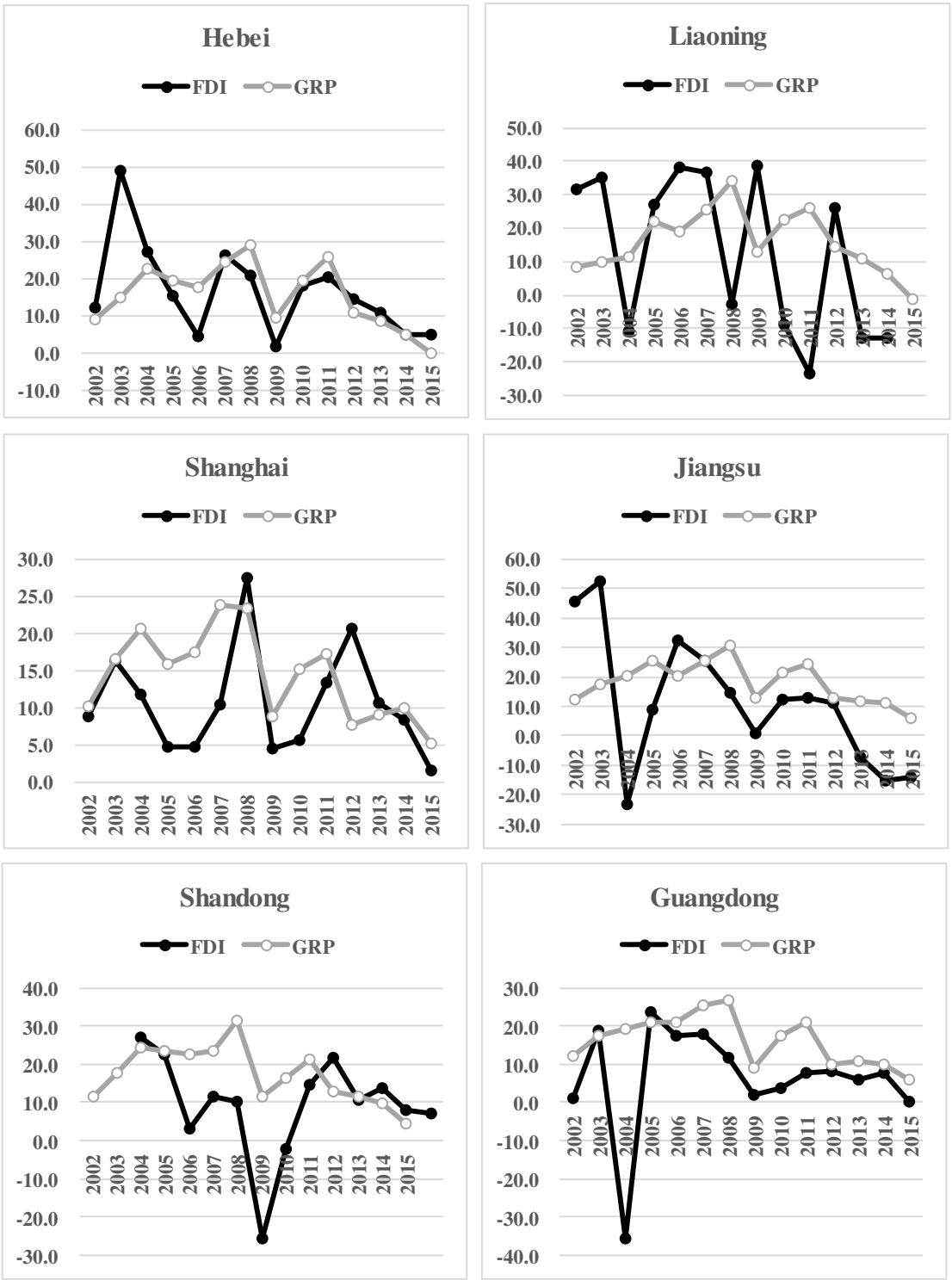
Table 2 Availability of FDI Data

Region	*Province*	*Availability of fdi data*	*fdi-grp ratio*
Eastern Region	Beijing	○	4.5 (2006)
	Tianjin	○	20.2 (2003)
	Hebei	○	1.9 (2005)
	Liaoning	○	14.2 (2007)
	Shanghai	○	7.3 (2002)
	Jiangsu	○	10.5 (2003)
	Zhejiang	○	4.7 (2005)
	Shandong	○	4.9 (2003)
	Guangdong	○	8.9 (2001)
	Hainan	○	6.9 (2003)
	Fujian		
Non-Eastern Region	Shanxi	○	1.7 (2007)
	Inner Mongolia	○	2.8 (2006)
	Jilin	○	3.2 (2009)
	Anhui	○	3.9 (2015)
	Jiangxi	○	4.9 (2005)
	Hubei	○	3.0 (2004)
	Hunan	○	2.7 (2006)
	Chongqing	○	6.8 (2011)
	Sichuan	○	2.9 (2011)
	Gansu	○	0.5 (2001)
	Ningxia	○	1.9 (2005)
	Xinjiang	○	0.4 (2013)
	Heilongjiang		
	Henan		
	Guangxi		
	Guizhou		
	Yunnan		
	Tibet		
	Shaanxi		
	Qinghai		
	Number	22 / 31	
	Coverage in GDP (%)	85.0	

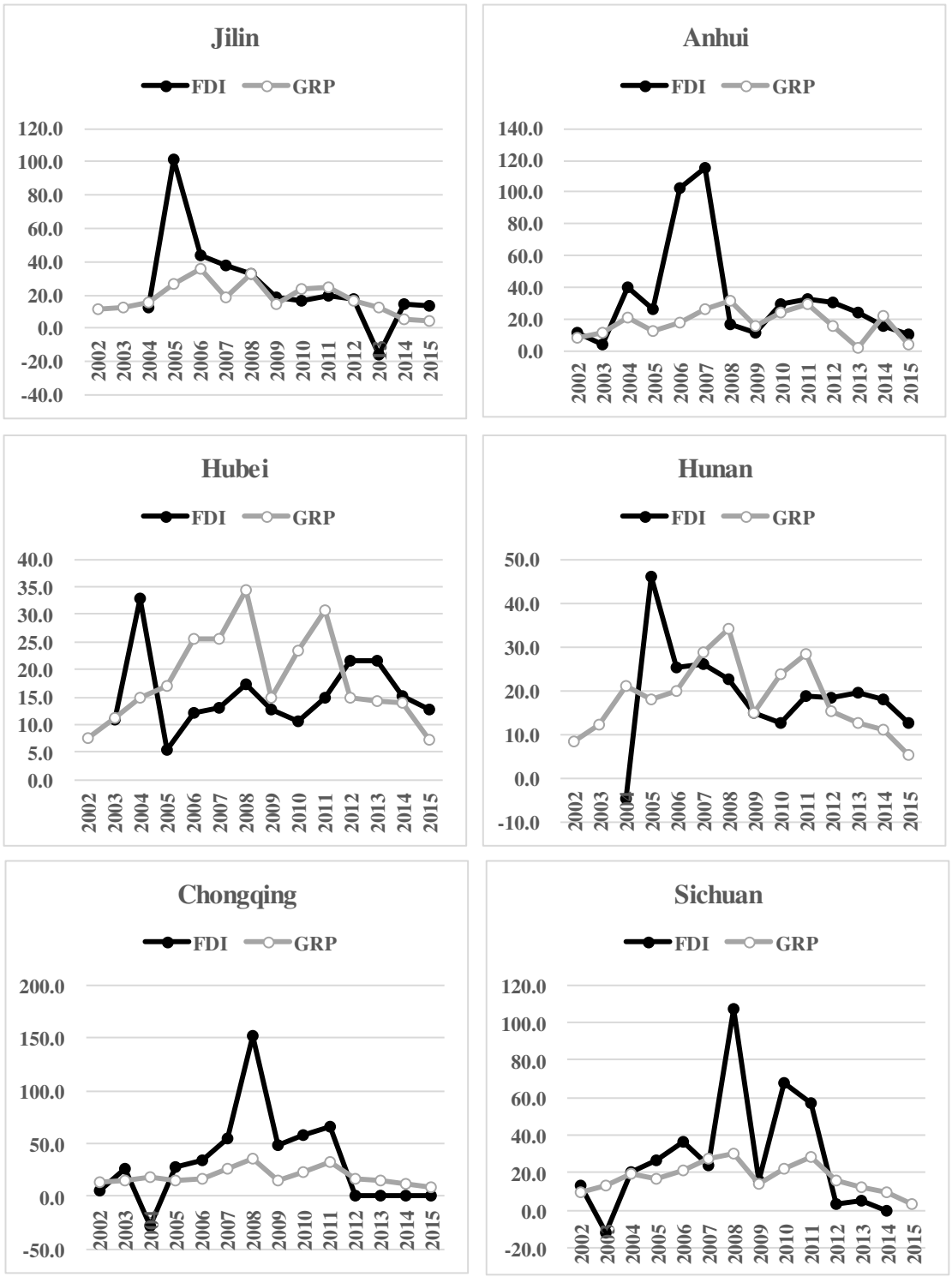
Sources: Statistical Yearbook of each province

Figure 1 Relationship between FDI and GRP (Year-on-Year rate, %)

[Eastern Region]



[Non-Eastern Region]



Sources: Statistical Yearbook of each province and NBS

Table 3 Unit Root and Co-integration Test

	Unit Root Test (Levin, Lin & Chu Test)		Cointegration Test	
	Level	First Difference	Panel PP	Panel ADF
[Bilateral Model]				
fdi	8.03	-6.44 ***	-3.30 ***	-4.85 ***
grp	7.78	-4.16 ***		
[Bilateral Model_Eastern Region]				
fdi	1.18	-7.57 ***	-3.60 ***	-3.89 ***
grp	6.22	-3.02 ***		
[Bilateral Model_Non-Eastern Region]				
fdi	8.45	-2.26 **	-0.44	-2.34 ***
grp	4.74	-2.50 ***		
[Demand Model]				
fdi	8.03	-6.44 ***		
grp	7.78	-4.16 ***		
fce	14.31	-1.96 **	-4.71 ***	-4.10 ***
gcf	-0.01	-2.31 **		
ext	1.08	-9.44 ***		
[Supply Model]				
fdi	8.03	-6.44 ***		
grp	7.78	-4.16 ***	-5.18 ***	-5.38 ***
gcf	-0.01	-2.31 **		
emp	12.76	-1.28 *		

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: Author's estimation based on Statistical Yearbook of each province and NBS

Table 4 Estimated VAR Model

[Bilateral Model]

	fdi	*grp*
fdi -1	1.005 ***	1.181 ***
	[48.573]	[5.026]
grp -1	0.000	1.067 ***
	[0.249]	[132.698]
C	576.084 ***	8,971.230 ***
	[4.542]	[6.230]
adj. R^2	0.957	0.994

[Bilateral Model: Eastern Region]

	fdi	*grp*
fdi -1	0.985 ***	1.275 ***
	[31.004]	[3.857]
grp -1	-0.000	1.063 ***
	[-0.021]	[100.545]
C	940.773 ***	9,135.68 ***
	[3.328]	[3.108]
adj. R^2	0.939	0.994

[Bilateral Model: Non-Eastern Region]

	fdi	*grp*
fdi -1	1.065 ***	0.073
	[33.146]	[0.120]
grp -1	0.001	1.103 ***
	[1.083]	[60.828]
C	196.063 **	7,556.304 ***
	[2.361]	[4.764]
adj. R^2	0.966	0.989

[Demand Model]

	fdi	*grp*	*fce*	*gcf*	*ext*
fdi -1	0.996 ***	0.878 ***	0.413 ***	0.184	0.410 **
	[43.632]	[3.542]	[4.005]	[1.141]	[2.043]
grp -1	0.002	1.389 ***	0.161 ***	0.235 ***	0.074
	[0.297]	[17.988]	[5.035]	[4.698]	[1.194]
fce -1	-0.000	-0.511 ***	0.859 ***	-0.380 ***	-0.184 **
	[-0.020]	[-5.144]	[20.774]	[-5.874]	[-2.290]
gcf -1	-0.004	-0.191 **	-0.115 ***	0.933 ***	-0.038
	[-0.577]	[-2.494]	[-3.620]	[18.661]	[-0.620]
ext -1	0.000	0.023	0.001	0.011	1.090 ***
	[0.362]	[0.928]	[0.102]	[0.679]	[52.196]
C	634.193 ***	12,788.55 ***	4,263.734 ***	9,709.769 ***	5,073.166 ***
	[146.514]	[8.040]	[6.443]	[9.388]	[3.936]
adj. R^2	0.957	0.994	0.995	0.990	0.986

[Supply Model]

	fdi	*grp*	*gcf*	*emp*
fdi -1	0.974 ***	0.832 ***	0.502 ***	0.002
	[38.373]	[2.883]	[2.628]	[0.333]
grp -1	0.000	1.045 ***	0.010	0.001 ***
	[0.209]	[37.166]	[0.549]	[3.022]
gcf -1	-0.002	0.017	1.056 ***	-0.003 ***
	[-0.645]	[0.368]	[34.232]	[-2.782]
emp -1	0.126 *	1.620 **	-0.657	1.075 ***
	[1.777]	[2.005]	[-1.229]	[56.881]
C	568.622 ***	8,460.400 ***	7,362.619 ***	60.464 *
	[4.274]	[5.589]	[7.353]	[1.706]
adj. R^2	0.958	0.994	0.989	0.988

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
Sources: Author's estimation based on Statistical Yearbook of each province and NBS

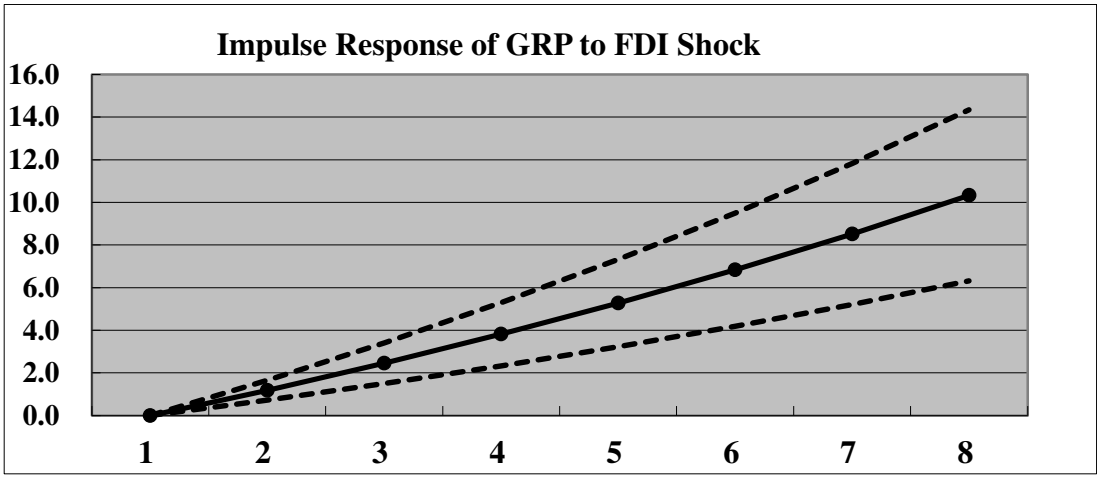
Table 5 Granger Causalities

Null Hypothesis	Lags	Chi-sq
[Bilateral Model]		
fdi does not Granger Cause *grp*	1	25.26 ***
grp does not Granger Cause *fdi*	1	0.06
[Bilateral Model_Eastern Region]		
fdi does not Granger Cause *grp*	1	14.88 ***
grp does not Granger Cause *fdi*	1	0.00
[Bilateral Model_Non-Eastern Region]		
fdi does not Granger Cause *grp*	1	0.01
grp does not Granger Cause *fdi*	1	1.17
[Demand Model]		
fdi does not Granger Cause *grp*	1	12.55 ***
grp does not Granger Cause *fdi*	1	0.08
fdi does not Granger Cause *fce*	1	16.04 ***
fdi does not Granger Cause *gcf*	1	1.30
fdi does not Granger Cause *ext*	1	4.17 **
[Supply Model]		
fdi does not Granger Cause *grp*	1	8.31 ***
grp does not Granger Cause *fdi*	1	0.04
fdi does not Granger Cause *gcf*	1	6.90 ***
fdi does not Granger Cause *emp*	1	0.11

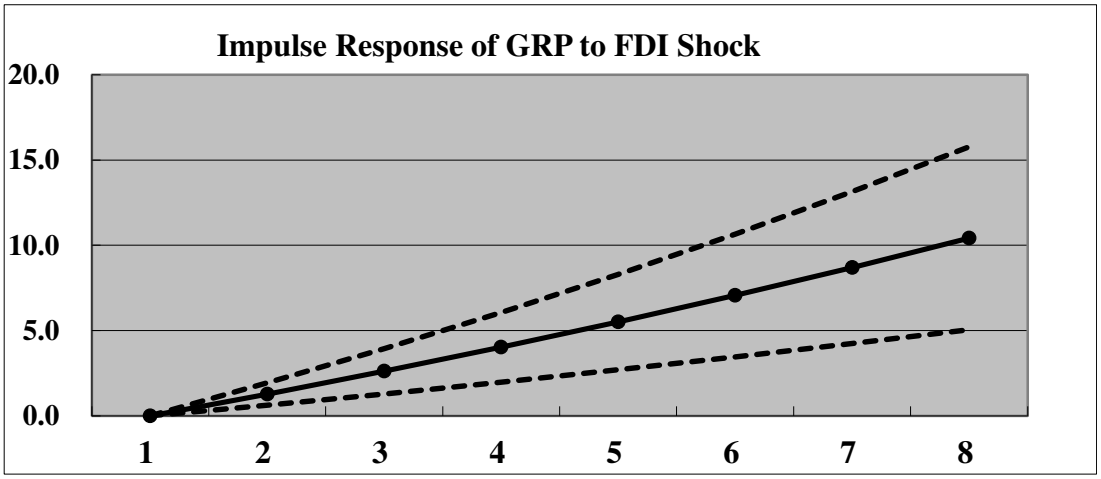
Note: ***, ** denote the rejection of null hypothesis at the 99% and 95% level of significance.
Sources: Author's estimation based on Statistical Yearbook of each province and NBS

Figure 2 Impulse Responses

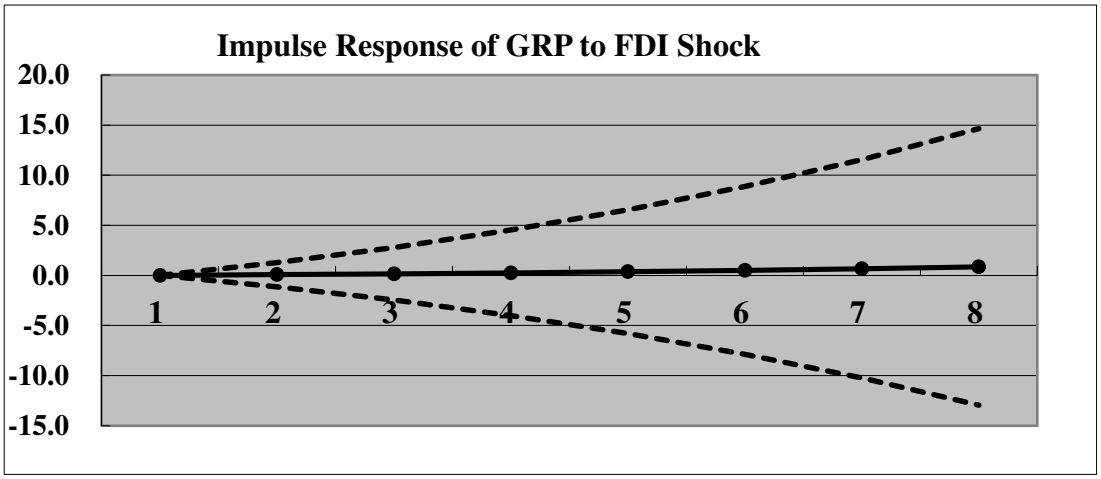
[Bilateral Model]



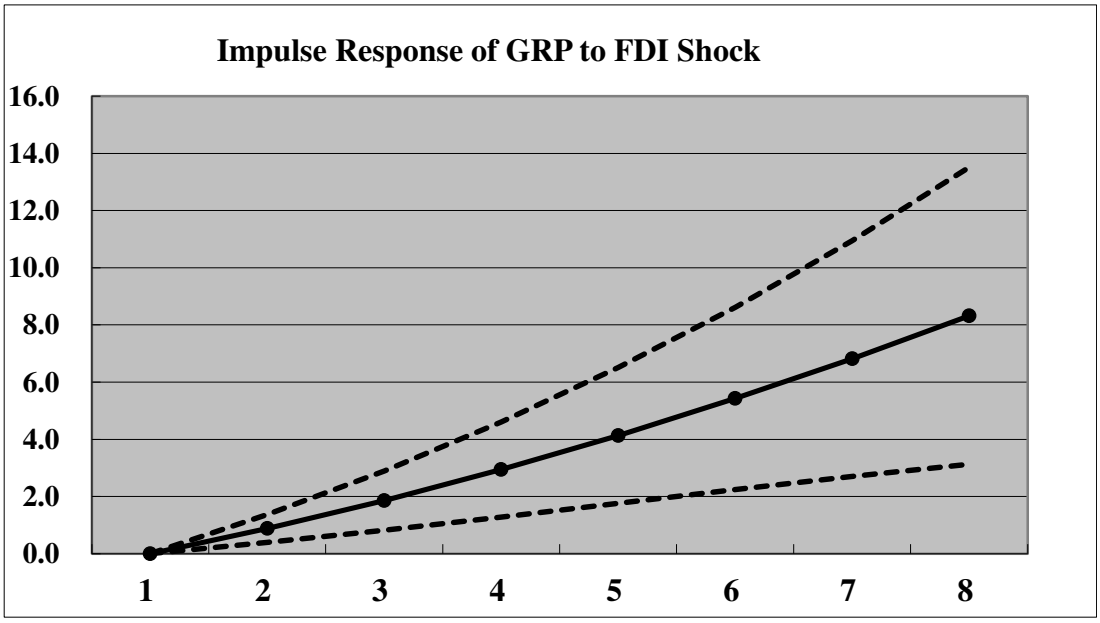
[Bilateral Model: Eastern Region]



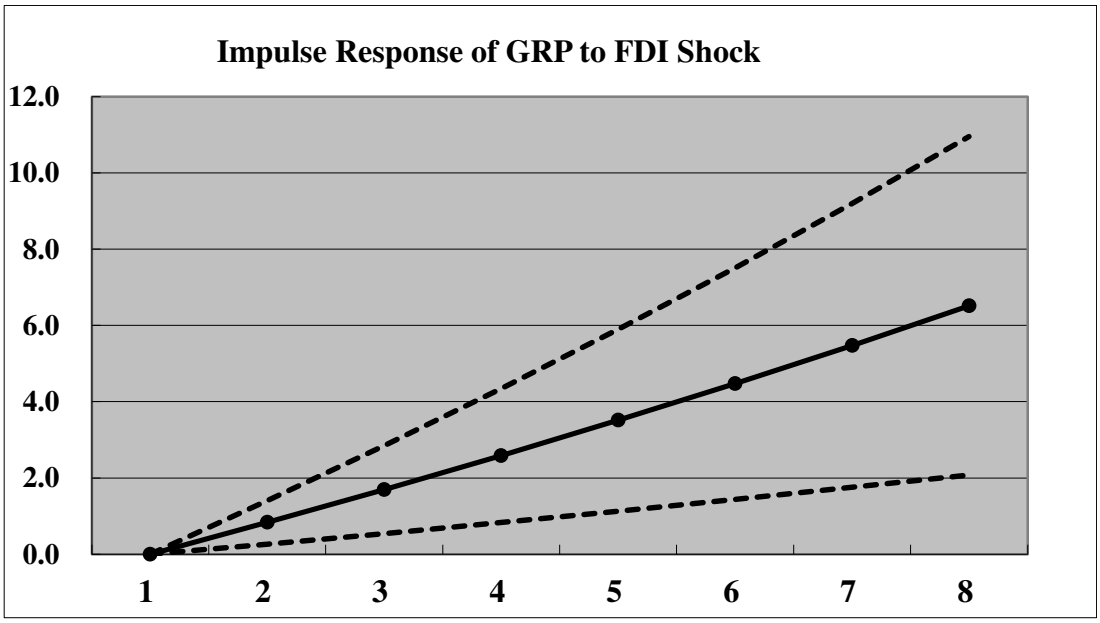
[Bilateral Model: Non-Eastern Region]



[Demand Model]



[Supply Model]



Note:
1) The shock is defined as one unit FDI innovation.
2) The dotted lines denote a 95 percent error band over 8-year horizons.
Sources: Author's estimation based on Statistical Yearbook of each province and NBS