Strategic Research Area for Sustainable Development in East Asia
Research Center for Sustainable Development in East Asia
埼玉大学東アジアSD研究領域・東アジアSD研究センター

Discussion Paper series

SU-RCSDEA 2019-006

Economic Effects of Inward Foreign Direct Investment in Vietnamese Provinces

Hiroyuki Taguchi, Saitama University

Huyen Khanh Pham, Saitama University

Economic Effects of Inward Foreign Direct Investment in Vietnamese Provinces

Hiroyuki Taguchi, Saitama University
255 Shim o-Okubo, Sakura-ku, Saitama, Japan, 338-8570,
Tel: +81-48-858-3324, Fax: +81-48-858-3696, E-mail tagusaya0710@s3.wh.qit.ne.jp

Huyen Khanh Pham, Saitama University
255 Shim o-Okubo, Sakura-ku, Saitama, Japan, 338-8570,
Tel: +81-48-858-3324, Fax: +81-48-858-3696

Abstract

This article examines the effect of FDI on economic growth and domestic investment with a focus on Vietnamese provinces by conducting the Granger causality and impulse response tests under a vector auto-regression (VAR) estimation using panel data. The major research questions in this study are twofold: whether the inward FDI causes economic growth or economic growth induces the FDI, and whether the inward FDI crowds in or crowds out domestic investment. Since this study targets Vietnamese provinces, it explores reginal differences in the FDI effect by dividing Vietnamese provinces according to FDI-value intensity. The VAR estimation results showed two clear contrasts on FDI effects between the FDI-intensive region and the FDI-less-intensive one. One contrast was that FDI causes economic growth in the FDI-intensive region, whereas economic growth induces FDI in the FDI-less-intensive region. Another contrast was that FDI crowds in domestic investment in the FDI-intensive region, whereas FDI crowds out domestic investment in the FDI-less-intensive region. These contrasts suggest the existence of FDI's agglomeration effects.

Keyword: Inward foreign direct investment (FDI), Economic growth, Domestic investment, Crowd-in or -out effects, Vietnamese 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 31.5 trillion US dollars in 2017 by about 14 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 39.2 percent in 2017 in the world.[1]

Vietnamese economy, one of the emerging market economies in Asia, has also accepted inward FDI in a remarkable degree in accordance with its involvement in global value chains for the recent decades. As a matter of fact, its FDI (stock value) ratio to GDP rose up from 3.7 percent in 1990 to 57.9 percent in 2017. For the latecomer's economy like Vietnam, in particular, the acceptance FDI has been often considered to be one of the driving forces to boost economic growth and to accelerate its catch-up process toward such forerunner economies as Thailand and Malaysia.

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 in Solow (1956), 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 (e.g., Romer, 1990), 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 (e.g. Chen et al., 2017; Pilbeama and Oboleviciuteb, 2012). Another angle of dispute lies in the causality between FDI and growth (e.g. Hsiao and Hsiao, 2006). 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 favorable locations for their investment. Thus it raises endogeneity problems in a single-equation regression analysis. As for the targeted samples in empirical analyses, there have been limited studies to address the regional nexus between FDI and growth, while its

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

national-level relationship has been examined intensively.

This article examines the effect of FDI on economic growth and domestic investment with a focus on Vietnamese provinces by conducting the Granger causality and impulse response tests under a vector auto-regression (VAR) estimation. The major research questions in this study are twofold: whether the inward FDI causes economic growth or economic growth induces the FDI, and whether the inward FDI crowds in or crowds out domestic investment. Since this study targets Vietnamese provinces, it explores reginal differences in the FDI-growth effect and the FDI-domestic investment effect in Vietnam. This study first classifies Vietnamese provinces according to FDI-value intensity: FDI-intensive region and FDI-less-intensive region. The reason for this classification is that FDI intensity is considered to create agglomeration effects such as technological spillovers and forward- and backward- industrial linkage. Another classification is geographical one comprising three areas of Northern, Central and Southern Vietnam. As for an analytical methodology, this study adopts not a single-equation regression but a VAR model to avoid the endogeneity problem among economic variables of FDI, economic growth and domestic investment. 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 the FDI-growth effects in Vietnam, and clarifies the contributions of this study. Section 3 conducts a VAR estimation for examining the FDI effects with the descriptions of methodologies, data and estimation outcomes with its interpretations. The last section summarizes and concludes.

2. Literature Review and Contribution

This section reviews the literature related to FDI-growth effects in Vietnam. Most of the studies in this category provided evidence to support positive effects of FDI on economic growth. The studies could be classified by the examined samples into multinational, national and regional levels.

Regarding the multinational level including Vietnam, Vu et al. (2008) examined the impact of FDI on growth in China and Vietnam by using sectoral data for FDI inflows. Their results showed that the FDI has a statistically-significant positive effect on economic growth for the two economies, and that most of the beneficial impact was concentrated in the secondary industries.

As for the national level, Vu (2008) investigated the FDI contribution to growth in

Vietnam by using time-varying coefficients in an augmented production function and by letting the FDI indirectly affect GDP growth through labor productivity, and found that the FDI has significant and positive effect on labor productivity and economic growth in Vietnam, though the effect is not equally distributed among economic sectors. Anwar and Nguyen (2010a) examined the impact of FDI-generated spillovers on manufacturing sector growth in Vietnam by using panel data of manufacturing industries, and suggested that FDI-generated spillovers have made a significant contribution to manufacturing sector growth through vertical-backward linkages. Bhatt (2013) also studied the role of FDI to exports and GDP in Vietnam by using a VAR model, and identified a long run equilibrium relationship among exports, FDI and GDP through a cointegration test and a causality from FDI to exports through Granger test. Nguyen (2017) studied the short run and long run impact of FDI and export on economic growth in Vietnam using annual time series data by employing a autoregressive distributed-lagged model and error correction model, and showed that in the long run FDI has a significant positive impact on economic growth whereas it has not in the short run.

Looking at the regional-level analyses in Vietnam, Hoang et al. (2010) examined the effects of FDI on economic growth in Vietnam by using the panel data across 61 provinces, and showed that there is a strong and positive effect of FDI on economic growth as a channel of increasing the stock of capital. There have been also several studies focusing on the difference in the FDI effects across the regions. Anwar and Nguyen (2010b) investigated the linkage between FDI and economic growth by a simultaneous equations model using a panel dataset that covers 61 provinces of Vietnam, and identified the existence of a mutually reinforcing two-way linkage between FDI and economic growth. However, this study also revealed that the linkage is not applied to every region, and suggested that the economic impact of FDI would be larger if more resources were invested in education and training, financial market and in reducing the technology gap between the foreign and local firms. Anwar and Nguyen (2014) analyzed the impact of FDI-generated spillovers on total factor productivity (TFP) in eight regions of Vietnam, using a dataset that covers a large number of manufacturing firms, and found that the impact of FDI spillovers on TFP varies considerably across regions and that the strong impact through backward linkage exists only in Red River Delta, South Central Coast, South East and Mekong River Delta.

This study contributes to the literature reviewed above as follows. First, this study conducts a regional-level analysis that was relatively few in the literature, and explores reginal differences in FDI effects in Vietnam. Second, this study addresses directly the issue on the crowding-out or crowding-in effects of FDI on domestic investment, which

was not explicitly dealt with in the literature. These effects could be examined by incorporating a variable of domestic investment in the estimation model. Third, this study adopts not a single-equation regression but a VAR model to avoid the endogeneity problem. 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.

3. Empirics

This section conducts an empirical analysis, namely, a VAR model estimation for examining the FDI effects with the descriptions of methodologies, data and estimation outcomes with its interpretations.

3.1 Methodology: VAR Estimation

This subsection describes the methodology for the VAR model estimation. The basic assumption is based on an 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 Vietnam. The study thus focuses only on the real aspect of the economy, ignoring the financial variables.

Under this assumption, the following three variables are selected for the estimation: inward foreign direct investment (FDI) in terms of stock value (*fdi*), gross regional products (GRP) in each province (*grp*), and domestic investment in each province (*div*). The first two variables are used for examining the causality between FDI and economic growth. The variable of domestic investment is needed for identifying the crowding-in or crowding-out effects of FDI on domestic investment.

For the estimation, a single-equation regression would cause a estimation bias since all the variables above are endogenous ones. The study thus adopts a VAR model for letting the data determine the causality between targeted variables and for tracing out the dynamic responses of variables to exogenous shocks overtime. To be specific, the study conducts the tests of Granger causality and impulse response to the one-unit shock under the VAR model estimation on the bilateral combinations between FDI and GRP, and between FDI and domestic investment. Regarding the lag interval, the study takes one-year lag in the VAR model estimation.[2] Then the VAR estimation, by using Vietnamese

[2] This study estimates the bilateral combinations of variables and adopts one-year lag, due to the data constraint with the limited numbers of time-series observations, 2005-2016, as described later on.

provincial data, is conducted in terms of the nation-wide model, the regional model divided into two groups of FDI-intensive provinces and FDI-less-intensive provinces, and the geographical model comprising three areas of Northern, Central and Southern Vietnam.

3.2 Data Description

This subsection describes the data source and the sample data for the estimation use. All the data of the three variables for the estimation are retrieved from Statistical Yearbook of each province. For instance, the data for Ho Chi Minh City are taken by its statistical yearbook of each year as follows.[3] The FDI data are obtained by the item of "Accumulation of foreign direct investment projects licensed having effect (thousand US dollars)" as of the end of each year in the category of "IV. investment"; the GRP data are from the item of "Gross regional domestic product at current prices (billion dongs)" in the category of "III. National accounts and state budget"; and the data of domestic investment are calculated by subtracting the item of "Foreign invested sector" from the item of "Total investment at current prices (billion dongs)" in the category of "IV. investment". The "domestic investment" thus does not contain the FDI in this study. The GRP and domestic investment are converted into the values of US dollars by using the dongs-per-US dollar exchange rate, which are retrieved by the State Bank of Vietnam.[4]

The sample data is confined to the data availability of the provincial FDI data. Table 1 indicates that the FDI data are available in 34 provinces out of 63 provinces in 2016. The sum of GRPs of the 34 sample provinces accounts for 93.3 percent of nation-wide GDP in 2016.[5] The time-series sample of each province is available for the period between 2005 to 2016. For the VAR estimation of nation-wide model, the study constructs a panel data with 34 provinces for the period of 2000-2016. In the estimation of regional model, the 34 sample provinces are divided into two groups according to the FDI intensity in 2016. To be specific, the sample provinces are arranged in the sequence of the FDI US dollar value in 2016 from the top to the bottom. Then the first half group from the top (Ho Chi Minh City) to the 17th (Vinh Phuc) is called "FDI-intensive region" and the latter half group from the 18th (Da Nang) to the bottom (Dong Thap) is called "FDI- less-intensive region". For each region, the study constructs a panel data with 17 provinces

[3] See the website: http://www.pso.hochiminhcity.gov.vn/web/guest/nam-20161
[4] See the website: http://www.sbv.gov.vn
[5] The nation-wide GDP in 2016 is retrieved from the website of General Statistics Office of Vietnam: https://www.gso.gov.vn/default_en.aspx?tabid=775

for 2000-2016, respectively. Regarding the estimation of geographical model, as shown Table 1, the 34 sample provinces are simply divided into three areas: Northern, Central and Southern areas, which create panel data with 13, 10 and 11 provinces for 2000-2016, respectively.

Figure 1 displays the overview of the relationship between FDI and GRP on year-on-year rate base in the top 6 of FDI-intensive and FDI-less-intensive provinces. By rough observation, the FDI and GRP appears to synchronize in the FDI-intensive provinces rather than the FDI-less-intensive provinces. Their correlation should, however, be statistically tested by a more precise manner through the VAR estimation later on.

3.3 Data Property

Before conducting the VAR model estimation, the study investigates 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 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 2 reports the result of both unit root and co-integration tests for the variables used for each estimation model: the nation-wide model, the regional model with FDI intensity and the geographical model. For all the variables in each model, the unit root test identifies a unit root in their levels, but rejects it in their first differences at the conventional level of significance, thereby the variables following the case of $I(1)$. The co-integration test is, thus, conducted further on the combinations of variables in each model. The panel PP test and ADF test[6] (at least, either of tests) suggests that the level

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

series of a set of variables' data are co-integrated. The study thus utilizes the level data for each VAR model estimation.

3.4 Estimation Outcomes

Table 3, Table 4 and Figure 2 respectively report the estimation outcomes of VAR models, Granger causalities and impulse responses on the FDI effects on GRP and domestic investment based on Vietnamese provincial database. The outcomes are reported for the nation-wide model, the regional model divided into two groups of FDI-intensive provinces and FDI-less-intensive provinces, and the geographical model comprising three areas of Northern, Central and Southern Vietnam.

3.3.1 Nation-wide Model

Table 3-1 and Table 4-1 report the estimation outcomes of the nation-wide VAR model. Regarding the Granger causalities, the causality is identified from FDI to GRP but not from GRP to FDI in the combination between FDI and GRP. In the combination between FDI and domestic investment, the causality is confirmed from FDI to domestic investment. Both causalities from FDI to GRP and to domestic investment are significant at the conventional level (99 percent), and are supposed to be "positive" ones judging from the estimated VAR model in Table 3-1.

As for the impulse responses in Figure 2-1, GRP responds positively to the one-unit shock of FDI continuously from the beginning with 95 percent error band, whereas FDI does not significantly respond to the shock of GRP. In the combination between FDI and domestic investment, domestic investment responds positively to the shock of FDI continuously from the beginning with 95 percent error band.

3.3.2 Regional Model with FDI Intensity

Table 3-2, Table 4-2 and Figure 2-2 report the estimation results of the regional model estimation classified by the FDI intensity. Regarding the combination between FDI and GRP, the positive causality from FDI to GRP is verified in the FDI-intensive region at the significant level (95 percent) and in the FDI-less-intensive region at weakly significant level (90 percent). The positive causality from GRP to FDI is, on the other hand, identified in the FDI-less-intensive region at the significant level (95 percent) but not in the FDI-intensive region. Looking at the impulse responses between FDI and GRP in Figure 2-2,

GRP responds positively to the shock of FDI with 95 percent error band in the FDI-intensive region, whereas FDI responds positively to the shock of GRP in the FDI-less-intensive region. The response of FDI to the shock of GRP in the FDI-intensive region and the response of GRP to the shock of FDI in the FDI-less-intensive region are ambiguous, respectively.

In the combination domestic between FDI and domestic investment, the causality from FDI to domestic investment shows a clear contrast between the regions: the "positive" causality is identified in the FDI-intensive region at 95 percent level, whereas the "negative" causality is found in the FDI-less-intensive region at 99 percent level. The causality from domestic investment to FDI is, on the other hand, is confirmed as a positive one only in the FDI-less-intensive region at 99 percent level. As for the impulse responses between FDI and domestic investment in Figure 2-2, domestic investment responds to the shock of FDI with 95 percent error band, positively in the FDI-intensive region, but negatively in the FDI-less-intensive region. The positive response of FDI to the shock of domestic investment is found in the FDI-less-intensive region.

3.3.3 Geographical Model

Table 3-3, Table 4-3 and Figure 2-3 report the estimation results of the geographical model estimation. In the combination between FDI and GRP, it is only in the Northern area that the positive causality and impulse response from FDI to GRP are identified clearly at the conventional level of significance: at 99 percent in the causality and with 95 percent error band in the impulse response. Those effects are, on the other hand, insignificant or weak in the Central and Southern areas. As for the causalities and impulse responses from GRP to FDI, there are no significant effects in all the areas.

As for the relationship between FDI and domestic investment, it is also in the Northern area that the positive causality and impulse response from FDI to domestic investment are identified clearly at the conventional level of significance: at 99 percent in the causality and with 95 percent error band in the impulse response. Those effects are, however, insignificant in the Central and Southern areas. The causality and impulse response from domestic investment to FDI differ according to the areas: negative effects in the Northern area, positive effects in the Central area and insignificant effects in the Southern area.

3.5 Interpretations of Estimation Outcomes

This subsection interprets the estimation outcomes above by each model, from the viewpoints of the causalities between FDI and GRP and of FDI crowd-in or crowd-out effects on domestic investment.

In the nation-wide model covering all sample provinces, the estimation result simply suggests that FDI causes economic growth whereas economic growth does not induce FDI, and that FDI just crowds in domestic investment. Since the positive impulse response of GDR to the FDI shock is found to be not temporary but sustainable, the FDI effect seems to follow not the traditional neoclassical growth model but the new "endogenous" growth theory in which FDI is considered to have a permanent growth effect through technology transfer and spillover.

The regional model with FDI intensity, on the other hand, produces contrasting estimation results between the FDI-intensive region and the FDI-less-intensive one. One contrast is that FDI causes economic growth in the FDI-intensive region, whereas economic growth induces FDI in the FDI-less-intensive region. Another contrast is that FDI crowds in domestic investment in the FDI-intensive region, whereas FDI crowds out domestic investment in the FDI-less-intensive region. These contrasts imply the existence of FDI's agglomeration effects with technological spillovers and forward- and backward-industrial linkage. The FDI-intensive region with agglomeration effects makes FDI crowd in domestic investment, which also facilitates the region's economic growth. The FDI-less intensive region lacking in agglomeration effects, however, makes FDI crowd out domestic investment due to resource-scarcity, which does not necessarily lead to the region's economic growth. For this region, which is usually in premature development stage, it is the side of economic growth that could be a key factor to attract FDI.

The geographical model reflects mixed estimation results of different FDI effects from the FDI-intensive province and the FDI-less-intensive one, since each area contains both types of provinces. The Northern area shows the positive effects of FDI on economic growth and domestic investment, similar to those of the FDI-intensive region, since the area includes 9 FDI-intensive provinces out of 13 sample provinces. The Central and Southern areas, on the other hand, represent the insignificant or weak impact of FDI, since both areas includes the FDI-intensive province and the FDI-less-intensive one to a certain extent in each.

In sum, the VAR estimation outcomes identifies regional differences in the effects of FDI on GRP and domestic investment in Vietnam, and the differences come from the variance in the FDI intensity in each province. One contrast is that FDI causes economic growth in the FDI-intensive region, whereas economic growth induces FDI in the FDI-less-intensive region. Another contrast is that FDI crowds in domestic investment in the

FDI-intensive region, whereas FDI crowds out domestic investment in the FDI-less-intensive region. These contrasts suggest the existence of FDI's agglomeration effects.

4. Concluding Remarks

This article examined the effect of FDI on economic growth and domestic investment with a focus on Vietnamese provinces by conducting the Granger causality and impulse response tests under a vector auto-regression (VAR) estimation using panel data. The major research questions in this study were twofold: whether the inward FDI causes economic growth or economic growth induces the FDI, and whether the inward FDI crowds in or crowds out domestic investment. Since this study targeted Vietnamese provinces, it explored reginal differences in the FDI-growth effect and the FDI-domestic investment effect by dividing Vietnamese provinces according to FDI-value intensity: the FDI-intensive region and FDI-less-intensive region.

The VAR estimation results showed two clear contrasts on FDI effects between the FDI-intensive region and the FDI-less-intensive one. One contrast was that FDI causes economic growth in the FDI-intensive region, whereas economic growth induces FDI in the FDI-less-intensive region. Another contrast was that FDI crowds in domestic investment in the FDI-intensive region, whereas FDI crowds out domestic investment in the FDI-less-intensive region. These contrasts imply the existence of FDI's agglomeration effects with technological spillovers and forward- and backward-industrial linkage. The FDI-intensive region with agglomeration effects makes FDI crowd in domestic investment, which also facilitates the region's economic growth. The FDI-less intensive region lacking in agglomeration effects, however, makes FDI crowd out domestic investment due to resource-scarcity, which does not necessarily lead to the region's economic growth. For this region, which is usually in premature development stage, it is the side of economic growth that could be a key factor to attract FDI.

References

Anwar, S. and L.P. Nguyen (2010a), Absorptive capacity, foreign direct investment-linked spillovers and economic growth in Vietnam, in: *Asian Business & Management*, Vol. 9, No. 4, pp. 553-570.

Anwar, S. and L.P. Nguyen (2010b), Foreign direct investment and economic growth in Vietnam, in: *Asian Pacific Business Review*, Vol. 16, No. 1-2, pp. 183-202.

Anwar, S. and L.P. Nguyen (2014), Is foreign direct investment productive? A case study of the region of Vietnam, in: *Journal of Business Research*, Vol. 67, No. 7, pp. 1376-1387.

Bhatt, P.R. (2013), Causal Relationship between Exports, FDI and Income: The Case of Vietnam, in: *Applied Econometrics and International Development*, Vol. 13, No. 1, pp. 161-172.

Chen, G.S., Y. Yao and J. Malizard (2017), Does foreign direct investment crowd in or crowd out private domestic investment in China? The effect of entry mode, in: *Economic Modelling*, Vol. 61, pp. 409-419.

Hsiao, F.S.T. and M.C.W. Hsiao (2006), FDI, exports, and GDP in East and Southeast Asia – Panel data versus time-series causality analyses, in: *Journal of Asian Economics*, Vol. 17, pp. 1082-1106.

Hoang, T.T., P. Wiboonchutikula and B. Tubtimtong (2010), Does Foreign Direct Investment Promote Economic Growth in Vietnam?, in: *ASEAN Economic Bulletin*, Vol. 27, No. 3, pp. 295-311.

Levin, A., C.F. Lin and C. Chu (2002), Unit root tests in panel data: Asymptotic and finite-sample properties, in: *Journal of Econometrics*, Vol. 108, pp. 1–24.

Nguyen, N.T.K. (2017), The Long Run and Short Run Impacts of Foreign Direct Investment and Export on Economic Growth of Vietnam, in: *Asian Economic and Financial Review*, Vol. 7, No. 5, pp. 519-527.

Pedroni, P. (2004), Panel Cointegration; Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis, in: *Econometric Theory*, Vol. 20, pp. 597–625.

Pilbeama, K. and N. Oboleviciuteb (2012), Does Foreign Direct Investment Crowd In or Crowd Out Domestic Investment? Evidence from the European Union, in: *The Journal of Economic Asymmetries*, Vol. 9, No. 1, pp. 89-104.

Romer, P.M. (1990), Endogenous Technological Change, in: *The Journal of Political Economy*, Vol. 98, No. 5, pp. S71-S102.

Solow, R.M. (1956), A Contribution to the Theory of Economic Growth, in: *The Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94.

Vu, T.B. (2008), Foreign direct investment and endogenous growth in Vietnam, in: *Applied Economics*, Vol. 40, No. 9, pp. 1165-1173.

Vu, T.B., B. Gangnes and I. Noy (2008), Is Foreign direct investment good for growth? Evidence from sectoral analysis of China and Vietnam, in: *Journal of the Asia Pacific Economy*, Vil. 13, No. 4, pp. 542-562.

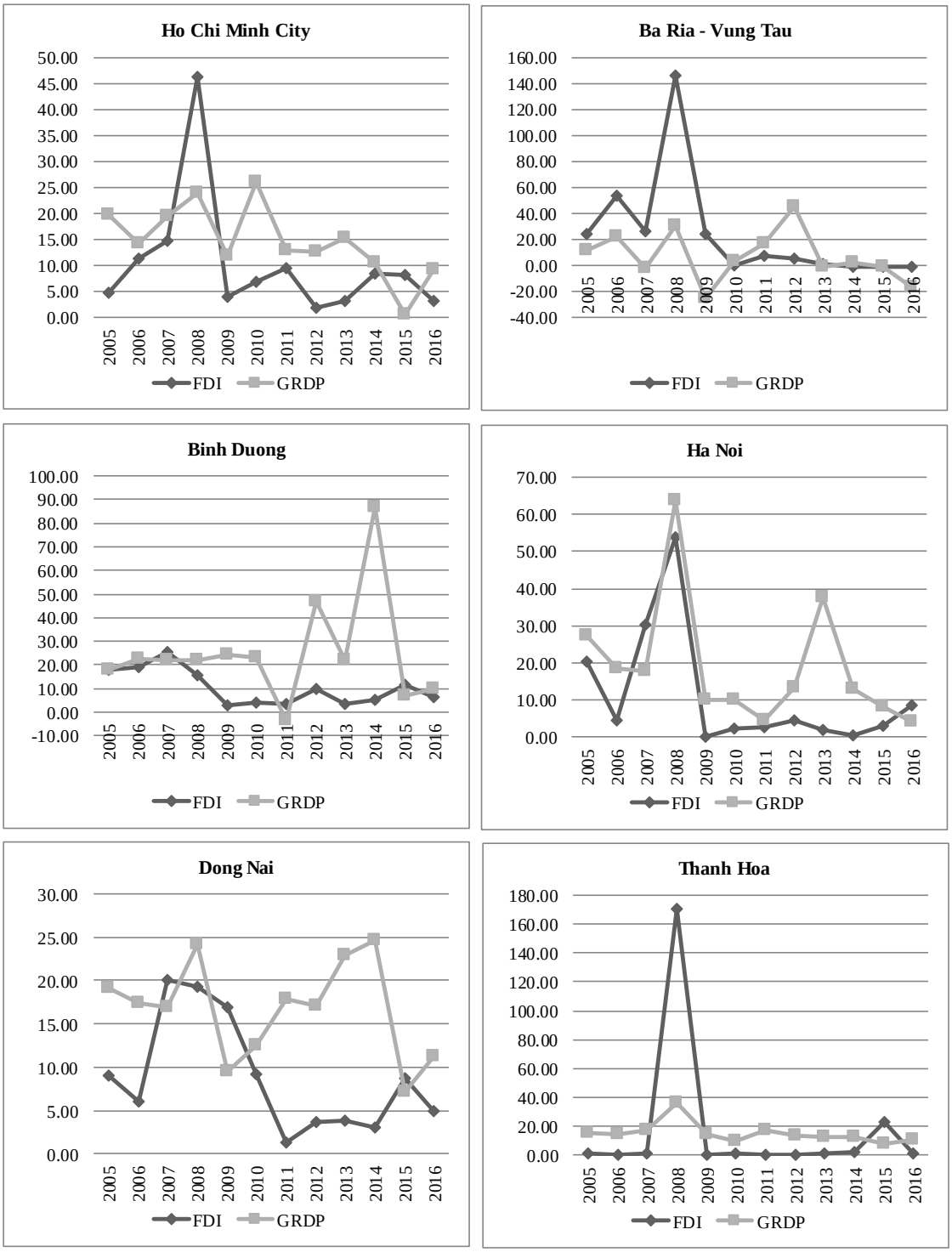
Table 1 Availability of FDI Data

Area	*Province*	*FDI value in 2016 million US dollars*	*FDI intensity*	*FDI Ranking*
Northern	Lao Cai	383	*less intensive*	30
	Bac Giang	3,301	*intensive*	16
	Lang Son	313	*less intensive*	32
	Quang Ninh	5,823	*intensive*	11
	Thai Nguyen	7,278	*intensive*	9
	Bac Ninh	12,315	*intensive*	7
	Ha Nam	2,091	*less intensive*	21
	Ha Noi	24,298	*intensive*	4
	Hai Duong	6,736	*intensive*	10
	Hai Phong	12,165	*intensive*	8
	Hung Yen	3,615	*intensive*	15
	Nam Dinh	923	*less intensive*	27
	Vinh Phuc	3,254	*intensive*	17
	FDI data are not available in the folloing provinces: Dien Bien, Hoa Binh, Lai Chau, Son La, Yen Bai, Bac Kan, Cao Bang, Ha Giang, Phu Tho, Tuyen Quang, Ninh Binh and Thai Binh			
Central	Nghe An	1,778	*less intensive*	25
	Thanh Hoa	12,911	*intensive*	6
	Thua Thien - Hue	2,919	*less intensive*	20
	Binh Dinh	2,041	*less intensive*	22
	Binh Thuan	3,687	*intensive*	14
	Da Nang	3,223	*less intensive*	18
	Phu Yen	4,809	*intensive*	13
	Quang Nam	1,996	*less intensive*	23
	Quang Ngai	1,108	*less intensive*	26
	Lam Dong	518	*less intensive*	29
	FDI data are not available in the folloing provinces: Ha Tinh, Quang Binh, Quang Tri, Khanh Hoa, Ninh Thuan, Dac Lac, Dak Nong, Gia Lai and Kon Tum			
Southern	Ba Ria - Vung Tau	26,680	*intensive*	2
	Binh Duong	25,466	*intensive*	3
	Dong Nai	23,192	*intensive*	5
	Ho Chi Minh City	41,170	*intensive*	1
	An Giang	215	*less intensive*	33
	Can Tho	644	*less intensive*	28
	Dong Thap	100	*less intensive*	34
	Long An	4,813	*intensive*	12
	Tien Giang	1,912	*less intensive*	24
	Tra Vinh	2,967	*less intensive*	19
	Vinh Long	371	*less intensive*	31
	FDI data are not available in the folloing provinces: Binh Phuoc, Tay Nimh, Ben Tre, Bac Lieu, Ca Mau, Hau Giang, Kien Giang and Soc Trang			
	Number	34 / 63		
	Coverage in GDP (%)	93.3		

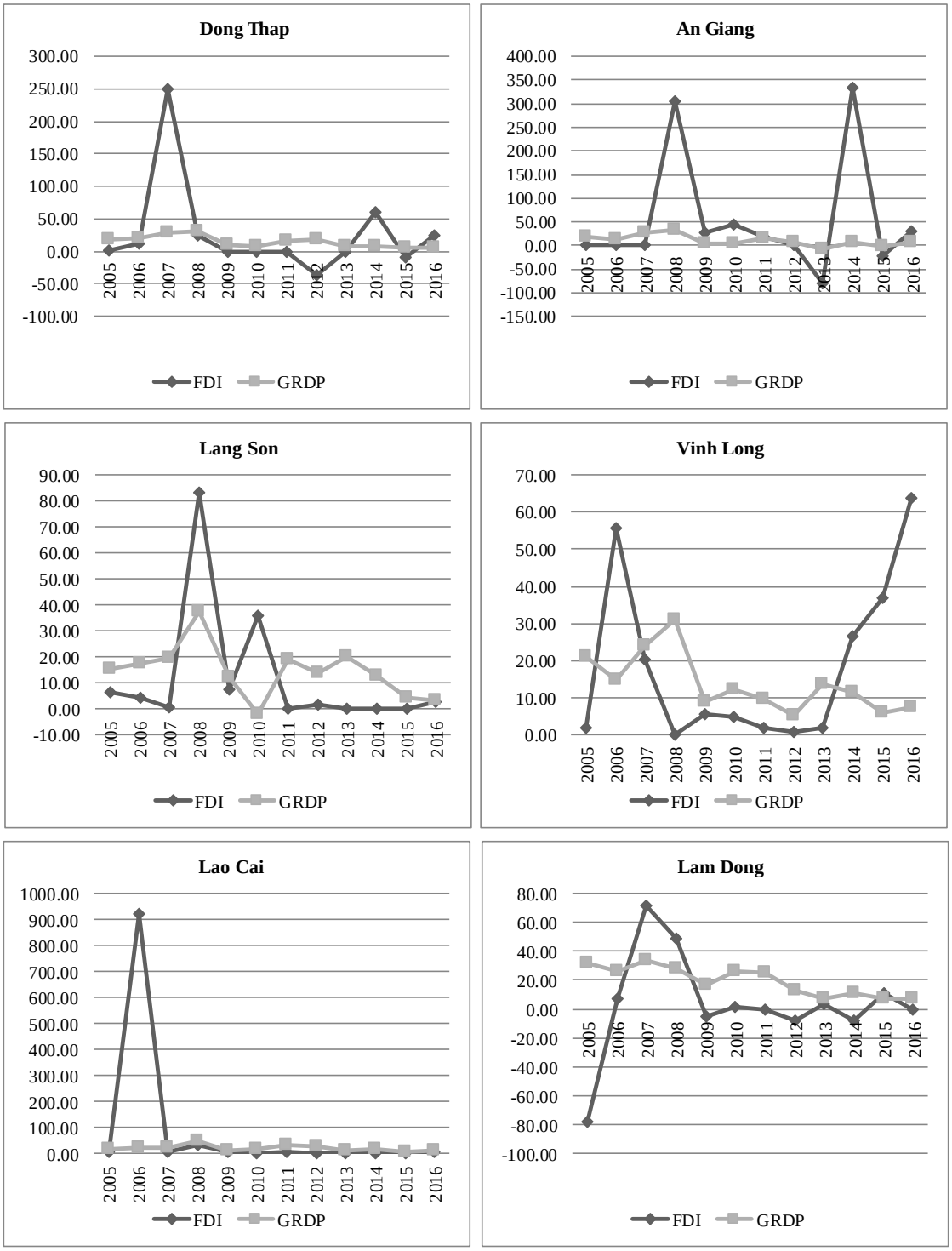
Sources: Statistical Yearbook of each province

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

[Top 6 of FDI-Intensive Provinces]



[Top 6 of FDI-Less Intensive Provinces]



Sources: Statistical Yearbook of each province

Table 2 Unit Root and Co-integration Test

	Unit Root Test (Levin, Lin & Chu Test)		Cointegration Test	
	Level	First Difference	Panel PP	Panel ADF
[Nation-wide Model]				
fdi	7.59	-10.09 ***	-2.14 **	-3.80 ***
grp	17.34	-5.27 ***		
fdi	7.59	-10.09 ***	-2.41 ***	-3.74 ***
div	9.92	-10.58 ***		
[Regional Model: FDI Intensive Region]				
fdi	4.85	-8.97 ***	-2.50 ***	-3.50 ***
grp	12.84	-4.12 ***		
fdi	4.85	-8.97 ***	-1.07	-2.03 **
div	4.77	-6.48 ***		
[Regional Model: FDI Less-Intensive Region]				
fdi	6.68	-5.43 ***	-0.34	-1.55 *
grp	11.74	-3.33 ***		
fdi	6.68	-5.43 ***	-2.25 **	-3.15 ***
div	9.15	-8.52 ***		
[Geographical Model: Northern Region]				
fdi	8.90	-5.78 ***	-2.42 ***	-3.92 ***
grp	15.37	-3.13 ***		
fdi	8.90	-5.78 ***	0.53	-1.30 *
div	5.47	-5.20 ***		
[Geographical Model: Central Region]				
fdi	0.58	-8.07 ***	-0.56	-2.43 ***
grp	8.57	-1.34 *		
fdi	0.58	-8.07 ***	-2.40 ***	-2.87 ***
div	8.56	-3.19 ***		
[Geographical Model: Southern Region]				
fdi	2.20	-4.41 ***	-0.42	-2.25 **
grp	5.97	-5.53 ***		
fdi	2.20	-4.41 ***	-2.35 ***	-3.44 ***
div	2.24	-10.90 ***		

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

Table 3 Estimated VAR Model

Table 3-1 Nation-wide Model

fdi & grp	*fdi*	*grp*
fdi -1	1.052 ***	0.026 ***
	[77.473]	[3.506]
grp -1	0.027	1.071 ***
	[1.423]	[101.236]
adj. R^2	0.980	0.988
fdi & div	*fdi*	*div*
fdi -1	1.062 ***	0.009 ***
	[104.883]	[2.880]
div -1	0.036	1.045 ***
	[0.868]	[77.769]
adj. R^2	0.980	0.966

Table 3-2 Regional Model with FDI Intensity

[FDI-intensive Region]

fdi & grp	*fdi*	*grp*
fdi -1	1.054 ***	0.027 **
	[54.435]	[2.499]
grp -1	0.025	1.069 ***
	[0.927]	[68.289]
adj. R^2	0.974	0.988
fdi & div	*fdi*	*div*
fdi -1	1.066 ***	0.010 **
	[76.075]	[2.252]
div -1	0.021	1.041 ***
	[0.357]	[53.970]
adj. R^2	0.974	0.965

[FDI-less-intensive Region]

fdi & grp	*fdi*	*grp*
fdi -1	0.965 ***	0.023 *
	[30.039]	[1.847]
grp -1	0.057 **	1.085 ***
	[2.341]	[112.857]
adj. R^2	0.830	0.965
fdi & div	*fdi*	*div*
fdi -1	0.893 ***	-0.024 **
	[27.129]	[-2.609]
div -1	0.318 ***	1.114 ***
	[5.218]	[65.314]
adj. R^2	0.843	0.916

Table 3-3 Geographical Model

[Northern Area]

fdi & grp	*fdi*	*grp*
fdi -1	1.133 ***	0.096 ***
	[29.802]	[4.455]
grp -1	-0.064	1.008 ***
	[-1.372]	[37.565]
adj. R^2	0.974	0.988
fdi & div	*fdi*	*div*
fdi -1	1.158 ***	0.086 ***
	[37.735]	[4.707]
div -1	-0.192 ***	0.863 ***
	[-2.623]	[19.629]
adj. R^2	0.975	0.952

[Central Area]

fdi & grp	*fdi*	*grp*
fdi -1	0.988 ***	0.004
	[26.216]	[0.975]
grp -1	0.115	1.107 ***
	[1.503]	[117.047]
adj. R^2	0.884	0.985
fdi & div	*fdi*	*div*
fdi -1	0.964 ***	0.004
	[26.175]	[1.062]
div -1	0.400 **	1.089 ***
	[2.432]	[57.573]
adj. R^2	0.887	0.951

[Southern Area]

fdi & grp	*fdi*	*grp*
fdi -1	1.054 ***	0.023 *
	[55.794]	[1.887]
grp -1	0.025	1.068 ***
	[0.922]	[60.279]
adj. R^2	0.985	0.988
fdi & div	*fdi*	*div*
fdi -1	1.059 ***	0.000
	[69.830]	[0.335]
div -1	0.070	1.095 ***
	[0.836]	[93.502]
adj. R^2	0.984	0.992

Note: ***, **, * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.
The t-statistic is in parentheses [ ].
Sources: Author's estimation based on Statistical Yearbook of each province

Table 4 Granger Causalities

Table 4-1 Nation-wide Model

Null Hypothesis	Lags	Chi-sq
fdi does not Granger Cause *grp*	1	12.29 ***
grp does not Granger Cause *fdi*	1	2.02
fdi does not Granger Cause *div*	1	8.29 ***
div does not Granger Cause *fdi*	1	0.75

Table 4-2 Regional Model with FDI Intensity

[FDI-intensive Region]

Null Hypothesis	Lags	Chi-sq
fdi does not Granger Cause *grp*	1	6.24 **
grp does not Granger Cause *fdi*	1	0.86
fdi does not Granger Cause *div*	1	5.07 **
div does not Granger Cause *fdi*	1	0.12

[FDI-less-intensive Region]

Null Hypothesis	Lags	Chi-sq
fdi does not Granger Cause *grp*	1	3.41 *
grp does not Granger Cause *fdi*	1	5.48 **
fdi does not Granger Cause *div*	1	6.81 *** (negative)
div does not Granger Cause *fdi*	1	27.23 ***

Table 4-3 Geographical Model

[Northern Area]

Null Hypothesis	Lags	Chi-sq
fdi does not Granger Cause *grp*	1	19.85 ***
grp does not Granger Cause *fdi*	1	1.88 (negative)
fdi does not Granger Cause *div*	1	22.15 ***
div does not Granger Cause *fdi*	1	6.88 *** (negative)

[Central Area]

Null Hypothesis	Lags	Chi-sq
fdi does not Granger Cause *grp*	1	2.26
grp does not Granger Cause *fdi*	1	0.91
fdi does not Granger Cause *div*	1	1.12
div does not Granger Cause *fdi*	1	5.91 **

[Southern Area]

Null Hypothesis	Lags	Chi-sq
fdi does not Granger Cause *grp*	1	3.56 *
grp does not Granger Cause *fdi*	1	0.85
fdi does not Granger Cause *div*	1	0.11
div does not Granger Cause *fdi*	1	0.70

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

Figure 2 Impulse Responses

Figure 2-1 Nation-wide Model

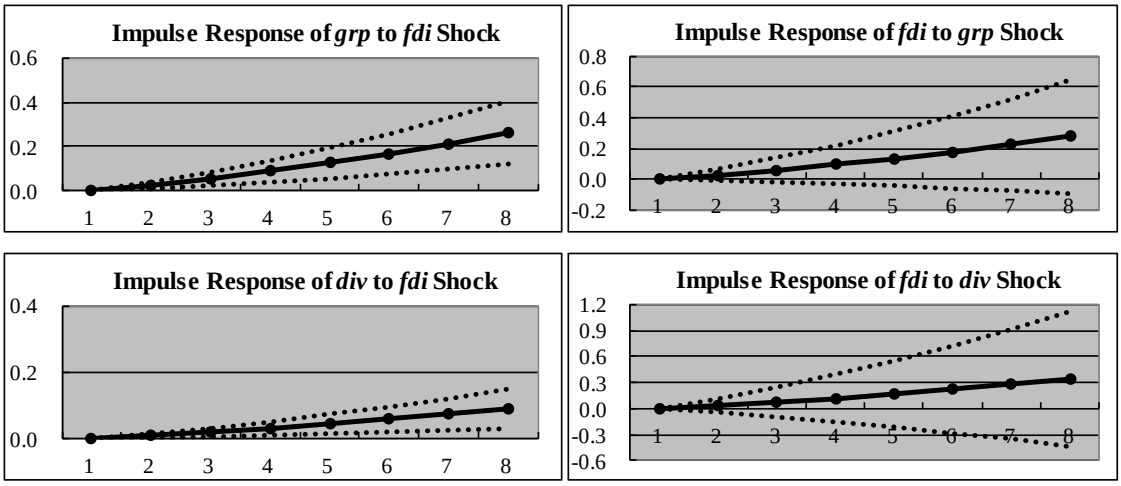
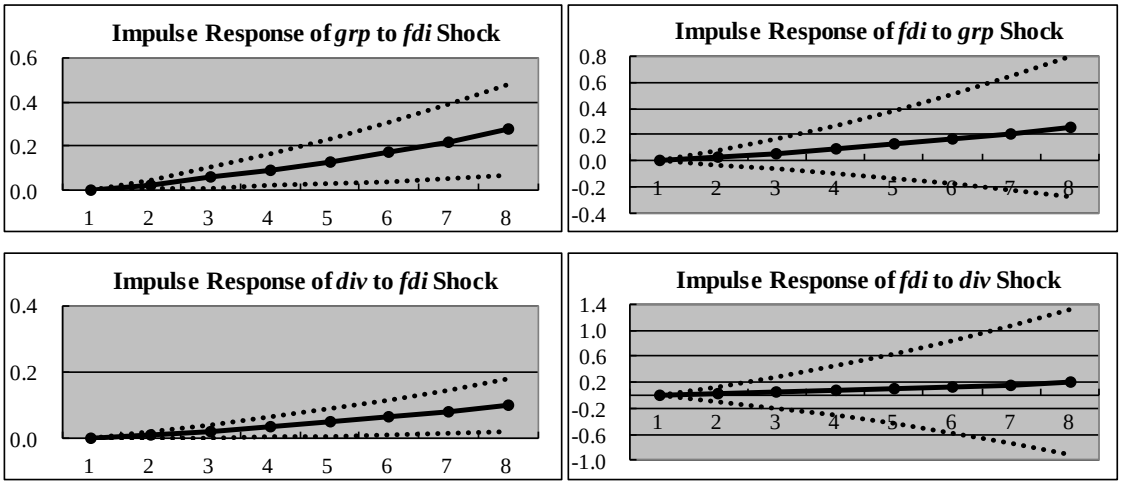


Figure 2-2 Regional Model with FDI Intensity

[FDI-intensive Region]



[FDI-less-intensive Region]

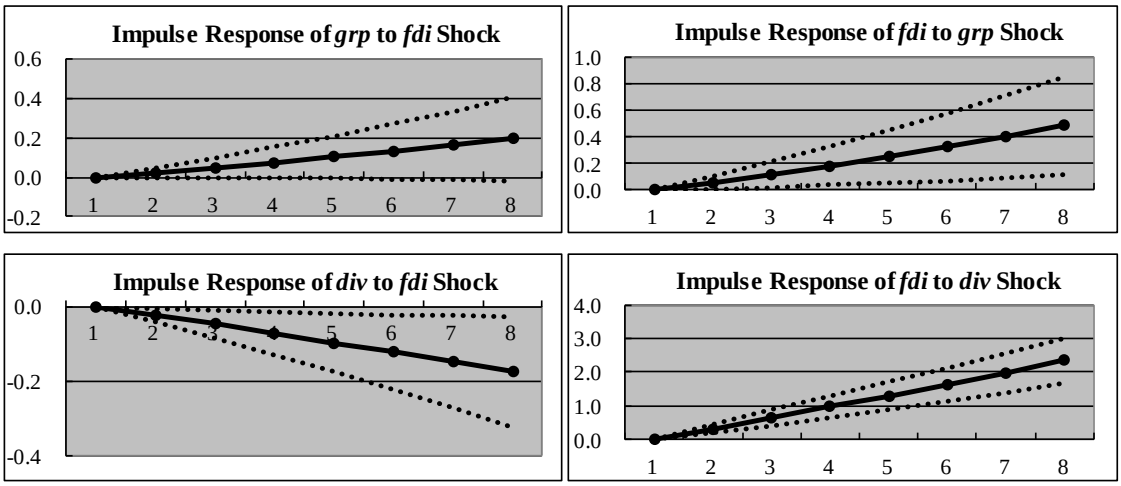
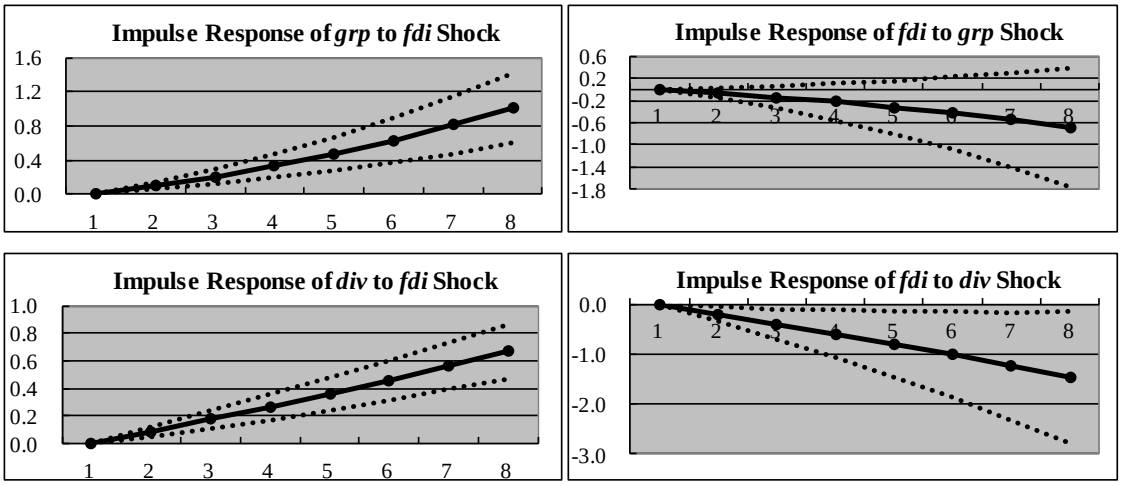
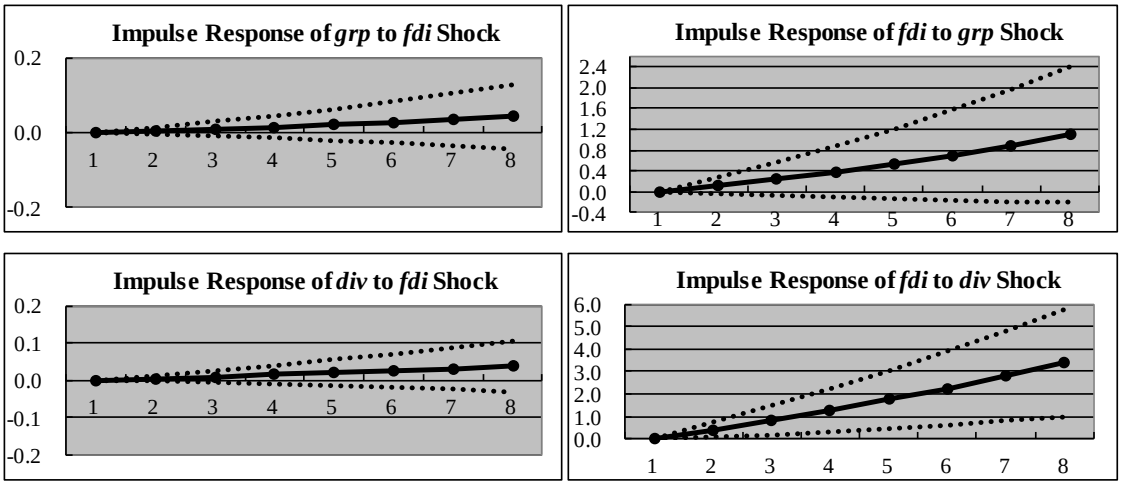


Figure 2-3 Geographical Model

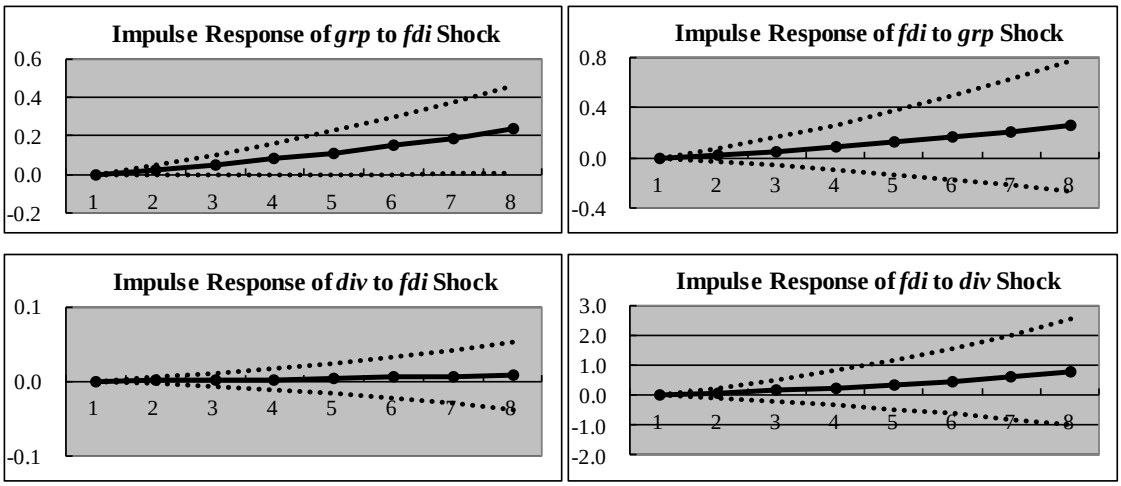
[Northern Area]



[Central Area]



[Southern Area]



Note: 1) The shock is defined as one unit 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