



WORKING PAPER SERIES

CAN VIETNAM'S ECONOMIC GROWTH BE EXPLAINED BY
INVESTMENT OR EXPORT: A VAR ANALYSIS

Pham Mai Anh

Working Paper 0815
<http://www.vdf.org.vn/workingpapers/vdfwp0815>

VIETNAM DEVELOPMENT FORUM
November 2008

The views expressed herein are those of the author(s) and do not necessarily reflect the views of the Vietnam Development Forum.

© 2008 by Pham Mai Anh. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

Can Vietnam's Economic Growth be Explained by Investment or Export: A VAR Analysis
VDF Working Paper No. 0815
November 2008

Keywords: Economic growth, investment led, export led, VAR, Vietnam.
EconLit Subject Descriptors: C51, O47.

Abstract

The objective of this study is to determine which factor has been the main driving force behind Vietnam's economic growth since the beginning of the Renovation "Doi Moi" in 1986. With the database from 1986 to 2007, this study followed the structural Vector Auto-regression (VAR) methodology and procedures employed by Bradford and Chakwin (1993), in which two VAR models and four variables - GDP, investment, export, and productivity - were used, to examine whether Vietnam's economy has been driven by export (export-led economic growth) or by investment (investment-led economic growth). In the VAR model of export-led growth, export was assumed to be an exogenous variable affecting all the other variables whereas in the VAR model of investment-led growth, investment was used as an exogenous variable affecting the other three variables. The results of both models supported the investment-led growth hypothesis showing that for the past two decades, investment has been the main factor behind Vietnam's economic growth. In contrast, the impact of export on the country's GDP growth was found to be very small. The results also indicated that neither investment nor export has helped improve productivity, which in turn was assumed to promote economic growth.

Pham Mai Anh

1. Introduction

Economic performance recorded in Vietnam over the past 20 some years has made the country known as a very successful story in the socio-economic reform among developing countries. Vietnam has been ranked among the fastest growing and most dynamic economies in Asia (Ishii, 2007), and reported to be one of the world's fastest growing economies in 2003 by the Asian Development Bank. The figures show that the country's GDP growth rate has started to improve in 1986, and accelerated after 1992. During the mid-1980s, the GDP growth rate increased by more than 5% on average per annum and achieved an impressive record of GDP growth in the mid-1990s, averaging 9% between 1992 and 1997. After a few years of suffering the negative impact of the 1997 Asian financial crisis, which diminished the GDP growth by half, Vietnam's economic growth has started to rise since 2000. According to the latest figures, the GDP growth rate hit 8.5 % in 2007 (Figure 1, Appendix).

As indicated in many papers and reports (World Bank's country reports, International Monetary Fund's reports), it was the launch of Renovation known as "Doi Moi" in 1986 and the acceleration of Vietnam's international economic integration process in the following years that triggered the economy's growth (IMF, 1999). The country's Renovation initiated in 1986, which was designed to transform the centrally planned economy to a "market oriented economy under the control of the state," paved the way for a range of economic and legal reforms. Accordingly, the economy's structure has been dramatically changed, from the one prevailed by agriculture to the one mainly dominated by industry and service sectors. In 1986, agriculture constituted more than 38% of the country's GDP whereas the industrial and service sectors accounted for 27 and 35% respectively (Statistic Year Book, 1989). More than 20 years later, the proportions of the three sectors in the country's GDP are respectively 20 per cent, 41 per cent and 39 per cent (Statistic Year Book, 2007). At the same time, Vietnam has been steadily integrated into the regional and global economies. The country has become an official member of the Association of South East Asian Nations (ASEAN) and the ASEAN Free Trade Area (AFTA) (1995), Asia-Pacific Economic Cooperation (APEC) (1998) and the World Trade Organization (WTO) (2006) and has signed several bilateral trade agreements with major economies, including the European Union, Japan and the US.

Due to its reforms and economic integration, Vietnam has experienced a boom in investment and export over the two decades. The issuance of a series of laws, including Foreign Investment Law in 1988 and Domestic Investment Law in 1986 now merged into the common Investment Law in 2004 and Enterprises Law amended in 2004, have created a favorable playing field for all the economy's stakeholders to join, facilitating investment by foreign investors, the domestic private sector and state-owned sector. As the figures show, the annual growth rate of the country's total investment has been well above 10% on average and was particularly high when it peaked at more than 50% in 1991 (Figure 2, Appendix). During the same period, the country has recorded a high annual growth rate of exports as well, reaching more than 10% on average (Figure 3, Appendix).

Although many researchers (e.g., Giang Thanh Long & Nguyen Khac Minh, 2007, IMF, 1999, Ohno, 2007), have indicated that investment and export have been the main engines pushing Vietnam's economic growth for more than 20 years, only a few empirical studies have been undertaken to analyze the major determinants of the country's economy. More specifically, there have been no studies to determine which engine, investment or export, has driven Vietnam's economy. Pham Thu Hien (2008) investigated the impact of official development assistance (ODA) on the inflows of foreign direct investment (FDI) in 64 provinces of Vietnam in 2002–2004 and found a positive relationship between ODA, FDI and

economic growth in the long run. Le Viet Anh (2005) examined FDI-growth nexus in Vietnam during 1986-2002 and found that FDI has had a positive impact on the economic growth in both the short and long term. Giang Thang Long & Nguyen Khac Minh (2007) found evidence supporting their argument that labor productivity promotes economic growth. Nevertheless, these researchers have not attempted to discover the main driving force behind Vietnam's economic growth, and to determine whether investment or export has been the most important engine driving Vietnam's economy.

In an attempt to fill this gap and analyze the country's economic growth more thoroughly, this paper examines whether Vietnam's economy has been driven by export (export-led economic growth) or by investment (investment-led economic growth) since 1986. The first hypothesis stems from the fact that there has been a boom in export along with the country's economic growth. The line of reasoning is that the external demands for Vietnamese exports, accumulated from the economic integration process, have been transmitted to the country's industries and have pushed economic growth. The second hypothesis that assumes Vietnam's economy to be driven by investment is built based on the context that FDI, and private and public investment have increased steadily over the two decades, which may have improved the productivity and efficiently facilitated the economic growth. The two hypotheses are explored within the approach of reduced-form structural Vector Auto-regression (VAR) models and VAR Granger causality. These econometric procedures were used by Bradford and Chakwin (1993) in their study to examine a trade-output correlation in five East Asian countries. I find that investment rather than export has played the key role in the country's economic growth during the past two decades but there is no evidence showing that investment has transmitted its impacts on economic growth through productivity.

The remainder of this paper proceeds as follows. Section 2 gives a brief literature review on alternative explanations on GDP between export-GDP nexus and investment-GDP nexus. Section 3 specifies the methodology used in this paper. Sections 4 describe the properties of data. Section 5 demonstrates empirical results and Section 6 provides conclusion and some recommendations.

2. Literature review

In the recent two decades, numerous empirical studies have been undertaken to determine what the main factors that drive economic growth are. These studies can be divided into two groups. One includes those investigating the correlation between export and economic growth and the hypothesis that export expansion is attributed to a country's economic performance (e.g., Feder, 1983; Kavoussi, 1982; Michaely, 1977; Ram, 1987; Tyler, 1981). The other includes those attempting to determine the relationship between economic growth and investment in the hypothesis that economic growth may be driven by investment through export growth or vice versa (e.g., Baldwin and Seghezza, 1996; Herrerias and Orts, 2007; Rodrik, 1995). Which factor, export or investment, is more responsible for economic growth has remained an issue of debate.

The economic development and growth literature have had intensive discussions on the relationship between export and economic growth for years. Most of the studies (e.g., Feder, 1983; Kavoussi, 1982; Ram, 1987; Tyler, 1981) have found significant results to support the export-led growth (ELG) hypothesis (Giles & Williams, 1999). However, the empirical procedures as well as explanations and conclusions on the correlation between export and growth have varied among the studies conducted in different periods of time.

During the late 1970s and early 1980s, several economists, including Feder (1983), Kavoussi (1982), Michaely (1977), Ram (1987), and Tyler (1981), conducted cross-section econometric studies and found a strong correlation between export and economic growth, but they did not attempt to test whether this relationship was causal or correlational. For example, Kavoussi (1982) sought empirical evidence of the association between export expansion and economic growth in a sample of 73 developing countries, both low and middle-income countries, using data for the period 1960-1978. He found that the Spearman coefficient of correlation between the average annual real growth rate of merchandise exports, used as export expansion index, and the average annual real growth rate of GNP, a proxy for economic performance, was positive and highly significant. He then performed an ordinary least square regression with the annual real growth rate of merchandise exports as the dependent variable and obtained a positive and highly significant result with the annual growth rate of total factor productivity. Based on these findings, the author concluded that “export expansion is associated with the better economic performance and that an important cause of this association is the favorable impact of exports on the total factor productivity.” (p.3) However, Kavoussi failed to determine what kind of relationships these were. This shortcoming is often seen in the studies undertaken two decades ago within the cross-section framework, in which the coefficients tend to have questionable structural stability across the observations.

Given the weaknesses of the cross-section framework, in the later studies, during mid-1980s and early 1990s, economists investigated the export-led growth hypothesis by using time-series data. The time-series data have facilitated them better in the check for an assertion of causation running from export to the economic growth as it involves the comparison of each individual country's time series (Jung & Marshall, 1985).

Les Oxley (1992) and John Thornton (1995) followed procedures of a Granger-causality test in their studies to investigate the direction of the export-growth relationship. While the test results of Thornton showed a positive and significant Granger-causal relationship running from export to economic growth in Mexico over the period 1895-1992, the other studies unveiled interesting and various findings, which did not always support the export-led growth hypothesis as found in the results of Thornton and the previous studies. Jung & Marshall (1985) performed the Granger-causality tests between export and growth for 37 developing countries based on the data during 1950-1981 and found only four of them passed the test for causation from their export to economic growth. Even more surprisingly, Les Oxley (1992) discovered the reverse causality between export and economic growth in the Portuguese data between 1865-1985.

However, Hsiao (1987) pointed out that Granger causality test had certain shortcomings which included arbitrariness in the choice of lag length and level of significance. He suggested a two-step procedure combining Granger's causality test and Akaike's (1969, 1970) Final Prediction Error Criterion. Supporting Hsiao's views, Bahmani-Oskooee et al. (1991) followed this procedure, which, as Bahmani described, “used optimality criterion of minimizing the mean square prediction error and eliminated the ambiguity in the choice of significance level” (p.9) to re-examine the causality between export and growth (and vice versa) in 20 countries. He found some support for the growth-promoted export hypothesis in the case of newly-industrialized countries, though on balance, the findings were inconclusive for the whole sample.

Instead of using Granger-causality, Chow (1987) applied Sims' (1972) framework and found evidence supporting the hypothesis that economic performance was improved by export growth in only one of the eight newly industrialized countries he analyzed.

The studies mentioned above out of hundreds of the studies of the topic indicate that the export-led growth hypothesis has been overwhelmingly verified by economists. Although the findings were various, there seemed to be slightly stronger consensus that export was one of the main factors resulting in the economic growth (Giles and Williams, 1999). Nevertheless, in more recent studies, economists have tended to be skeptical of this conclusion. Some of the economists, e.g. Baldwin and Seghezza (1996), said that the authors of the previous papers attempted only to verify the positive correlation or causality between export expansion and economic growth but did not try to look into the "economic mechanism" by which the two elements were linked. Recent studies have started to examine whether it was export that directly caused economic growth or whether there were another factor, specifically investment, leading to the better economic performance through inducing the export growth or vice versa.

When explaining the economic growth of Korea and Taiwan in the 60s, Rodrik (1995) concluded that the two countries' outward-oriented economies were more caused by the investment boom than by the export surge. He specified that the rapid growth in investment increased the demand for imported capital goods, which had to be met by subsequent increase in export revenues.

Based on a theoretical model and equations derived from the model as well as the three-stage least squares on a cross-country data sample, Baldwin and Seghezza (1996) found a mechanism, called "trade-induced investment-led growth", which seemed to be the same as Rodrik's argument but was supported by opposite evidence. Their findings were that the domestic protection in studied countries depressed investment, and therefore slowed down their economic growth.

Several studies have focused on testing two alternatives hypotheses: export-led growth and investment-led growth but did not provide a uniform empirical result. Yoon-Ha Yoo (2008) used the Granger causality conducted within the context of a co-integrated vector autoregressive VAR system to test whether the Korean and Taiwan economic miracles were export or investment-led. The test results were contrary to Rodrik's (1995) above conclusion, showing that the two countries' economic achievements were Granger caused by export rather than investment. Hsiao and Hsiao (2006) also adopted the same test as Yoo's for their examination of the Granger causality relations between GDP, exports, and FDI using the time-series and panel data from 1986 to 2004 of among China, Korea, Taiwan, Hong Kong, Singapore, Malaysia, Philippines, and Thailand but they got results opposite to those of Yoo (2008). According to the panel data causality results, FDI had unidirectional effects on GDP directly and indirectly through exports, and there additionally existed bidirectional causality between exports and GDP for the eight rapidly developing East and Southeast Asian economies.

In the meantime, the study results Herrerias and Orts (2007) got from a bid to solve "China's growth puzzle" were neutral between export and investment-led growth hypotheses, in which both export and investment (in physical capital and R&D) were the main drivers of China's labor productivity and output in the long run. In this study, the two economists used the methodology of Johansen's (1988) cointegrated vector autoregressive (VAR) model, which

were slightly different from Yoo's and Hsiao and Hsiao's. They made assumptions on exogeneity of one variable in each model, which efficiently allowed the data to reveal the nature of the interactions among them. With this framework, they discovered to a significant degree that exports exogenously drive economic growth in the both VAR models they developed.

Under the same approach with block exogeneity, Bradford and Chakwin (1993), however, employed VAR techniques introduced by Sims (1986) and Bernanke (1986) to investigate the trade-output correlation based on the two possible hypotheses: export-led output and investment-led output in Hong Kong, Japan, South Korea, Taiwan and Singapore. Their findings showed that exports were not been the causal factor of the economies' growth and that investment was more important in explaining the countries' output variations. Like Herrerias' and Orts' (2007), Bradford and Chakwin also built two different structural models: one model testing export-led growth, in which export was set as exogenous and the other testing investment-led growth, in which investment was set as exogenous. Under this approach, the two economists also found that investment is an exogenous variable in the two models.

Compared with the results and procedures followed by Herrerias' and Orts' (2007) as well as the others', those employed by Bradford and Chakwin (1993) seem to be more preferable for their efficiency in determining the interactions between the selected variables. Moreover, the two economists' study needed only for basic variables – dynamic export, investment, manufacturing sector's productivity and GDP growth, which can be easily collected in many countries. In addition, the VAR approach they used has some advantages as well. It not only allows the variable released from theoretical restrictions but also enables researchers to verify empirical regularities implied in the time-series data even in the absence of a well specified structural equation (Sims, 1986). Finally the multi-equation model in VAR systems has more explanatory power than the single one. Given the advantages of VAR systems and particularly the strong points in Bradford's and Chakwin's (1993) research approach, this study, which shares the same research target with the two economists' study, will follow exactly their economic procedures to examine which factor, export or investment, has been the most important impetus of Vietnam's economic growth since the country launched Renovation "Doi Moi" in 1986.

3. Methodology

To investigate whether Vietnam's economy is export-led or investment-led, this study follows the reduced-form structural VAR models employed by Bradford and Chakwin (1993) and uses four variables - dynamic export (X), total investment (I), productivity of industrial sector (D) and GDP (Y). The line of reasoning for why I follows not only the same empirical procedures but also chooses the same four variables as those chosen by the two authors are that I have the same research target with the two authors and that their VAR models are quite efficient in analyzing the economic growth of a country by looking at the interactions among major determinants of the economy.

In fact, Vietnam's economic experience is quite similar to those in five East Asian countries that Bradford and Chakwin empirically studied for the hypotheses of export-led and investment-led growth. As argued by the two economists, dynamic exports (X) have been "the fundamental distinguishing feature" of the development pace in the five East Asian countries. Likewise, Vietnam's economic development experience has been imprinted by an

increasingly outstanding export performance since it implemented the Renovation and opened up its economy. Therefore, export is an indispensable variable in this paper's empirical systems.

The second variable, investment (I), is chosen because it has been long proved to be a major determinant of the economic growth throughout the economic literature. In the economic model named after him, Solow pointed out that if one country devotes a large fraction of its income to saving and investment, the economy will have a large capital stock and a high level of output or growth in the steady state (Mankiw, 2006). More recently, Herrerias and Orts (2007), in a study on "China's growth puzzle", also used investment as a key input for their VAR systems. They argued that without the investment efforts, including those paid in transport systems, infrastructures and technical improvements, China would have not be able to achieved a speedy economic growth rate. The two economists' arguments can also be used to back the variable choice of this paper as Vietnam has the same economic development pace as China does, though the country's economic records and scales have been not as outstanding as China's. In this paper, investment is referred to the total investment that consists of the state-owned sector's investment, domestic private sector's investment and foreign direct investment (FDI). In that sense, investment is expected to play a key role in Vietnam's economic growth.

The third variable chosen for this paper's empirical research is productivity. Productivity has been widely used by researchers who tried to test either export-led growth hypothesis, investment-led growth hypothesis or both as mentioned in the literature review. The researchers who added this variable in their empirical models believed that it may be the factor linking export or investment and GDP growth in the way that export or investment helped to improve the productivity that, in turn, promote the GDP growth or vice versa. In their VAR model, Bradford and Chakwin (1993) used productivity of manufacturing sectors in the five East Asian countries, presuming that it is higher than the other sector and makes the most contributions to the countries' economic growth. In this paper, productivity is measured through the industrial sector's value per labour. Although this measurement is not a perfect one that can fully reflect the nature of real labor productivity, it is the best possible proxy for the real labor productivity in industrial sector given the data availability. Moreover, the industrial value per workers is also a good indicator of Vietnam's economic growth as it is derived from the revenue and labor forces of the domestic industrial sector, which occupied the largest fraction in the economy.

The last variable used in this paper is GDP growth (Y), which is the endogenous variable whose causes will be examined in both VAR models.

This paper uses the four variables as inputs of the VAR systems employed by Bradford and Chakwin (1993) that have been proved to be good tools for investigating the hypotheses in the models where the variables are very closely correlated with each others. According to the two economists, the technique of VARs were introduced by Sims (1980), who has pioneered the methodology of using a multivariate autoregressive system without priori theoretical restrictions on the chosen variables, and developed by Bernanke (1986). This VAR methodology are also called structural VAR as the chosen variables are all expected to have economic interpretations and the results of dependent variable can be predicted from variations of the rest variables (Sims, 1986). In addition, one of the typical features of VAR approach is that it can examine the hypothesis built without the base of any specific theories. Therefore, under this approach, the paper can remain check thoroughly whether Vietnam's

economic growth is driven by export or investment and see though if the productivity is a link among those factors without being restricted to any economic growth theories. Last but not least, the VAR technique this paper uses, as pointed out by Bernanke (1986), can discriminate among structural hypothesis, which are, in this paper, export-led economy and investment-led economy. The economist specified that the VAR technique first introduced by Sims (1980) is different form the usual VAR approach in the way that “it orthogonalizes the estimated VAR residuals into the “true” underlying structural disturbances Instead of extracting the disturbances via the standard Choleski decomposition (a procedure sometimes treated as neutral, but which in fact embodies strong assumptions about the underlying economic structure), the method used here calculates the disturbances by inverting an estimated, explicitly structural model of the relation among the contemporaneous VAR residuals” (p.3).

More specifically, this paper follows an empirical procedures exactly the same as Bradford and Chakwin (1993), in which VAR models of the export-led economic growth and that of the investment-led economic growth hypotheses are developed separately. As agued in their paper, they needed to develop the two VAR different models as the results of correlations among residuals of the four variables shows that both residuals of investment and export are correlated with that of the GDP growth. However, this paper will use the variables themselves, which are presented in per cent changes, to plug in the model’s equations, rather than the residuals of the variables as the two authors used. I expect that using variables presented in per cent changes would generate more predictable responses from GDP growth to impulses in export, productivity, and investment. Correlations among the four variables are firstly checked. The results show that both investment and export are correlated with GDP economic growth. Therefore, it is reasonable to strictly follow the two different steps of Bradford and Chakwin (1993). Besides, this paper would also present Granger causality test for the both VAR models to examine more carefully the directions of interactions among the four variables.

4. Estimation Results

VAR model of export-led growth

In the VAR model used to investigate export-led economic growth (Model 1), the restriction or structure to be determined in this model is placed on export. Under this model, four following equations would be regressed under the VAR technique:

Model 1

- (1) $X = u_1$
- (2) $I = \beta_1 Y + \beta_2 X + u_2$
- (3) $D = \beta_3 I + \beta_4 X + u_3$
- (4) $Y = \beta_5 D + \beta_6 X + u_4$

In Model 1, the variable export presented in equation (1) is assumed to impact all other variables of the models. In this model, export variable is treated as exogenous in the sense that the variable is plugged in every equations for testing its direct impacts on the three variables investment (I), productivity (D) and GDP (D) but these variables are not allowed to interact with export variable. In other words, Model 1 is formed under an assumption that export is the only factor that directly drives the whole economy but no shocks from other variables, i.e., investment, productivity, and GDP, have direct effects on export. Accordingly, export variable is presented as a structural disturbance in Model 1.

In equation (2), investment (I) is expected to be affected by GDP (Y) and export (X) in the way that increases in GDP and export turnover would stimulate the total investment in the economy.

Equation (3) implies that increases in export and investment are hypothesized as a facilitator of productivity improvement. In other words, investment in production, facilities and infrastructures are expected to create positive externalities enhancing the labor productivity while the higher demand for exports creates more pressures for enterprises to stimulate their productivities.

In the last equation, equation (4), GDP (Y) is expected to respond to changes in export and productivity. More specifically, this equation assumes that given the implementation of trade liberalization, which is shown by increase in export revenue, the domestic resources are reallocated in a more efficient way, thus, leads to improvements in productivity that, in turn, pushes the economy's output.

In short, Model 1 tests the export-led growth hypothesis by allowing export to have direct effects on the whole economy, represented by GDP, productivity and investment, but restricted these variables from having responses to export shocks.

VAR model of investment-led growth

In the VAR model of investment-led growth (Model 2), investment is assumed to be the deterministic factor of the economic growth while export is assumed to be a transitive factor that only affects the economic growth through investment. As mentioned in the literature review, this hypothesis has recently been investigated in a lot of empirical studies, e.g., Baldwin and Seghezza (1996), Hsiao & Hsiao (2006). Model 2 has the same four-variable systems as those of model 1 but with the restriction placed on investment.

Model 2

$$(5) \quad I = u_1$$

$$(6) \quad D = \beta_1 I + u_2$$

$$(7) \quad Y = \beta_3 I + \beta_4 D + u_3$$

$$(8) \quad X = \beta_5 I + \beta_6 D + \beta_7 Y + u_4$$

Similar to the approach of Model 1, in Model 2, investment (I) is treated as an exogenous variable that disturbs all other variables – productivity (D), export (X), and GDP (Y), as shown in equation (5). However, in this system, no interactions from these variables to investment would be expected. Equation (6) assumes that only investment has effects on productivity in the sense that investment-induced productivity would better meet the demand for exports. In equation (7), GDP or output (Y) is assumed to respond to shocks in investment (I) and productivity (D) while the final equation in Model 2 implies that export is expected to be influenced by all other variables. Generally, Model 2 tests the hypothesis that economic growth is foremost determined by supply-related factor that is investment rather than the demand-related one like export to be tested in the Model 1.

4. Data

Data for the four variables used in the two VAR models are 1994 constant price annual data from 1986 to 2007, which are converted into per cent changes and fitted with three-year lags. The dataset for GDP (Y), investment (I) and export (X) is collected from Statistics Year

Books published since 1989 by Vietnam’s General Statistics Office (GSO). The rest variable productivity (D) of the industrial sector is calculated by dividing the industrial sector’s annual revenue over the sector’s annual labor forces, whose data are also collected from Vietnam GSO’s Statistics Year Books. Before running the VAR models, I use Augmented Dickey-Fuller tests to check the stationary and non-stationary possibility of the four variables. Table 1 presents the results of Augmented Dickey-Fuller tests, showing that variables D and I show the time trend term and all the variables have unit roots for data in levels. Therefore, I transform the variables’ data into per cent changes and do the tests again. The results indicate that I reject non-stationary at 5% level for the variables Y, D and X. In the case of variable I, it shows the trend term at 5% level and is stationary at the 5% level.

Table 1: Augmented Dickey-Fuller Tests

	Data in levels 1986 to 2007				Data in percent changes 1986 to 2007			
Variable	Lags	Trend	<i>t</i> -statistic	p-value	lags	Trend	<i>t</i> -statistic	p-value
D	0	1	-2.300	0.4351	4	0	-8.984	0.0000
Y	0	0	13.207	1.0000	4	0	-3.648	0.0049
I	0	1	-2.329	0.4192	0	1	-3.562	0.0332
X	1	0	5.908	1.0000	4	0	-7.107	0.000

Note: D (productivity); Y (GDP); I (investment); X (export)

5. Empirical Results

In this section, I respectively investigate the two hypotheses on export-led growth and investment-led growth to Vietnam’s economy with reference to results of Granger causality tests, variance decompositions and impulse response functions in the two VAR models.

VAR model of export-led growth

The table 2 shows the result of Granger causality tests under the assumption that X disturbs all the three variables Y, I, and D but no interactions from these three variables to X are allowed. Therefore, in the table, there is no existence of Granger causality from investment, productivity and GDP to export.

As indicated in the table 2, both export and investment Granger causes GDP growth at 5% level while only GDP Granger causes investment, but export does not. The table 2 also shows that productivity is Granger caused by both investment and export at 1% level but the productivity does not show any significant evidence of Granger causality to investment, export and GDP growth. However, the productivity does not seem to have a significant Granger causality to the GDP growth. Therefore, the assumption that productivity may be the

factor that transmits the effects of investment and export to the GDP growth is not verified by this VAR Granger causality test' results.

Table 2: Granger Causality Wald Tests

Dependent Variables	Excluded variables	p-value
D	Y	NA
D	I	0.000
D	X	0.000
D	ALL	0.000
Y	D	NA
Y	I	0.003
Y	X	0.026
Y	ALL	0.003
I	D	NA
I	Y	0.000
I	X	0.321
I	ALL	0.000
X	D	NA
X	Y	NA
X	I	NA
X	ALL	NA

Note: D (productivity); Y (GDP); I (investment); X (export); NA (not available)

I further examine the export-led growth hypothesis in Model 1 by looking at the role of Vietnam's export, investment and productivity to the country's economic growth, which are exhibited in the decomposition of the forecast error variance of GDP from the structural model. Table 3 shows the variance decomposition of GDP, in which contributions of productivity, investment, and export to the GDP are decomposed. More specifically, for each period, 100 per cent of GDP is explained by shocks from exports, investments and productivity for that period that are summed up to 100 per cent. In other words, the importance of each variable in explaining GDP will depend on the size of its decomposition or the percentage it takes in the total 100 per cent occupied by the three variables. For instance, in the second period, investment and GDP itself respectively explains 50 per cent and 46 per cent of the forecast error variance of GDP while productivity and export each explain only 2 per cent approximately. According to the results shown in Table 3, Vietnam's investment seems to be the most important factor that explains the highest percentage of the forecast error variance of the country's GDP growth. For most of the periods, investment

explains nearly 50 per cent of the GDP variation, well higher than the GDP's own explanatory percentages. It indicates that Vietnam's economic growth could be better predicted by looking at the information on the country's investment than looking at the other factors like GDP itself, productivity and export.

Table 3: Decomposition of Forecast Error Variance of GDP in the Export-led Model

Variable	D	Y	I	X
Period 1	3.0436	96.9564	0	0
Period 2	1.7239	46.1944	50.533	1.5486
Period 3	1.6307	49.0785	47.7508	1.5399
Period 4	7.6396	45.0304	46.2447	1.0853
Period 5	6.7210	39.6087	52.4326	1.2377
Period 6	6.3645	44.3050	48.2036	1.1269
Period 7	6.7254	38.2985	53.9315	1.0446
Period 8	6.4202	38.1989	54.2973	1.0836

Note: D (productivity); Y (GDP); I (investment); X (export)

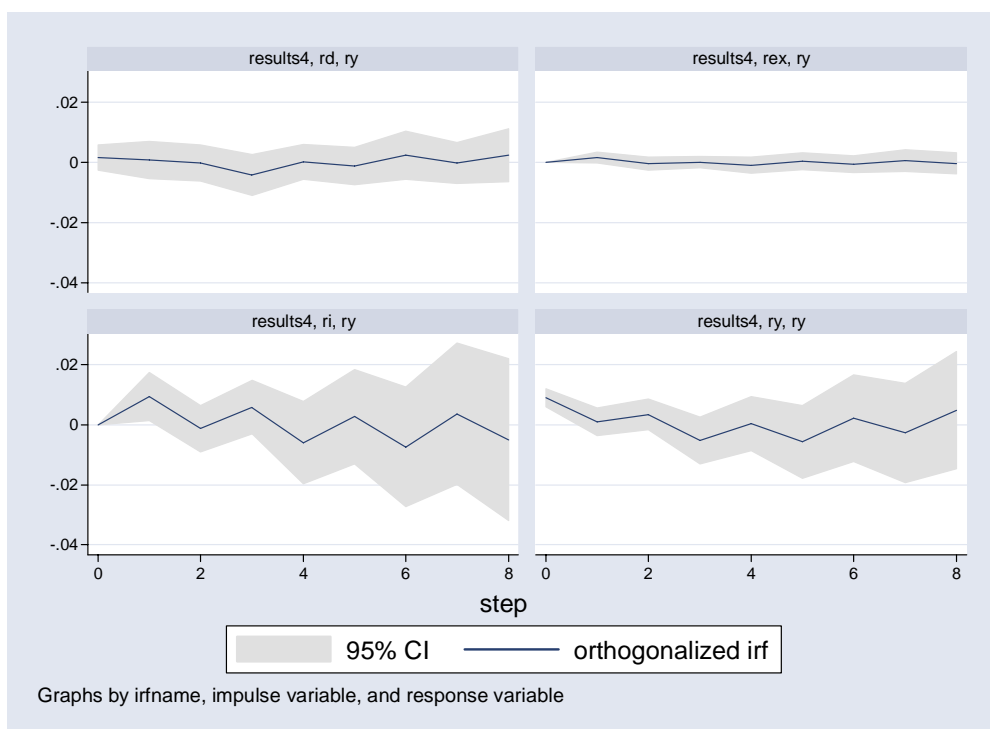
The results of Granger causality tests and the variance decomposition of GDP seem to be against the hypothesis that export is the main engine that drives Vietnam's economic growth. Instead, investment shows the stronger evidence of the higher important role it seems to take in forecasting the country's economic performance.

To further explore the suggestions indicated from the results so far, I take the final step with using an impulse response function of the GDP. The concept of impulse response function was put forth by Sims (1980), who used it to determine the dynamics of an error shock in the system on the future predicted economic variables. Although, the impulse response function, as argued by Bradford and Chakwin (1993), use almost the same information set as the decomposition, they relate the information differently. In their study that used this technique, the two economists commented that impulse response functions "trace the response of the variables in the system to an unanticipated shock of one standard deviation" and "show the direction of the decomposition system" (p.16). In that sense, I expect the impulse response function of the GDP to reveal how it responds to sudden changes in investment, export and productivity. Figure 4 shows the responses of GDP (Y) to shocks from investment (I), export (X) and productivity (D).

The top part of Figure 4 shows that shocks in productivity and export have very small effects on GDP. In particular, the line illustrated the GDP's responses to shocks in export is almost horizontal throughout all the periods, showing that export gives very little information to

forecast GDP. Therefore, this evidence further weakens the export-led growth hypothesis of Model 1.

Figure 4: Impulse Responses of GDP to Shocks from Each Variable in the Export-led Growth Model



*Note : results4, rd, ry (Impulse Response of GDP to productivity)
 results4, rex, ry (Impulse Response of GDP to export)
 results4, ri, ry (Impulse Response of GDP to investment)
 results4, ry, ry (Impulse Response of GDP to GDP)*

In the meantime, the GDP’s responses to investment shocks appear to be strongest, though they are not consistent over the period. As seen in Figure 4, the line is quite bumpy, indicating that investment have various effects on GDP during different periods. The positive and negative effect of investment on GDP from period to period could be explained by the feature of the variable investment used in this model. As specified in the methodology section, investment used in this paper is referred to total investment, consisting of public investment, private investment and foreign direct investment. Therefore, that investment exhibits the negative effect on GDP in one period and then positive effect in the following period may be because investment is prevalingly put in construction of infrastructures and improvement of production facilities in one period that only helps to improve the GDP growth in the following period.

In general, the empirical results shown in Granger causality test, variance decomposition of GDP and its impulse response function to shocks in investment, export and productivity seem to reject the hypothesis in Model 1 that Vietnam’s economic growth is led by export. Instead, they suggest that investment appears to be the key factor in determining and forecasting the country’s GDP. Moreover, the possibility that productivity has a role in linking investment with GDP is not backed by the empirical results of Model 1, either. I proceed to VAR Model 2 for further confirmation of suggestions arising from Model 1.

VAR Model of Investment-led Growth

In this model, I follow the same economic procedures as those done in the VAR model of export-led growth but under the assumption that investment is a structural disturbance. Similar to variable export (X) in Model 1, investment (I) is expected to enter all equations explaining productivity (D), GDP (Y), and export (X) but one of the three variables is plugged in the equation to explain investment.

I also do the VAR Granger causality test to study the interactions of the variables with each other, particularly the relations between GDP and investment, productivity and export. The test's results are presented in the table 4.

Table 4 shows that productivity and investment Granger cause GDP at 5% level. There is no evidence of Granger causality from export to GDP but there is highly significant evidence that export is Granger caused by all the three variables investment, GDP and productivity. The results for existence of Granger causality to productivity from other variables are quite different from those displayed in Model 1. As seen in Table 4, none of the three variables investment, export, and GDP Granger causes productivity. Therefore, it is hard to imply from these results that GDP is affected by investment through productivity. Besides, although productivity Granger causes both export and GDP at 5% level, there is no connection among the three factors as export does not Granger causes GDP.

Table 4: Granger Causality Wald Tests of Investment-led Growth Model

Dependent Variables	Excluded variables	p-value
D	Y	NA
D	I	0.493
D	X	NA
D	ALL	0.493
Y	D	0.000
Y	I	0.000
Y	X	NA
Y	ALL	0.000
I	D	NA
I	Y	NA
I	X	NA
I	ALL	NA
X	D	0.000
X	Y	0.000

X	I	0.000
X	ALL	0.000

Note: D (productivity); Y (GDP); I (investment); X (export); NA (not available)

I study the investment-led growth hypothesis in more details by looking at the decomposition of the forecast error variance of GDP that is figured out under the restriction placed on investment (Table 5). The decompositions from the structural model of investment-led growth are quite consistent with those from the structural model of export-led growth, especially in the case of investment. Like the variance decompositions shown in the Model 1, export in the Model 2 bears almost no information for the GDP growth. In the meantime, productivity is a quite strong explanatory factor of the variations of GDP, which explains nearly 40 per cent on average of the GDP variations. However, the more important finding indicated from Table 5 is that investment appears to be the most exogenous in the model. It explains well above 40 per cent of the variations of GDP on average. In particular, for the third period, investment accounts for more than 60 per cent of the GDP variations. These decomposed contributions from investment to GDP implies that the information on investment helps forecasting GDP much more than that on productivity, export and GDP itself.

Table 5: Decomposition of Forecast Error Variance of GDP in the Investment-led Model

Variable	D	Y	I	X
Period 1	63.6027	36.3973	0	0
Period 2	15.0002	21.1986	63.8012	0
Period 3	40.7819	14.5723	44.6458	0
Period 4	42.8302	13.732	43.4378	0
Period 5	42.246	13.7845	43.9695	0
Period 6	42.246	13.7845	43.9695	0
Period 7	42.151	13.793	44.0559	0
Period 8	42.151	13.793	44.0559	0

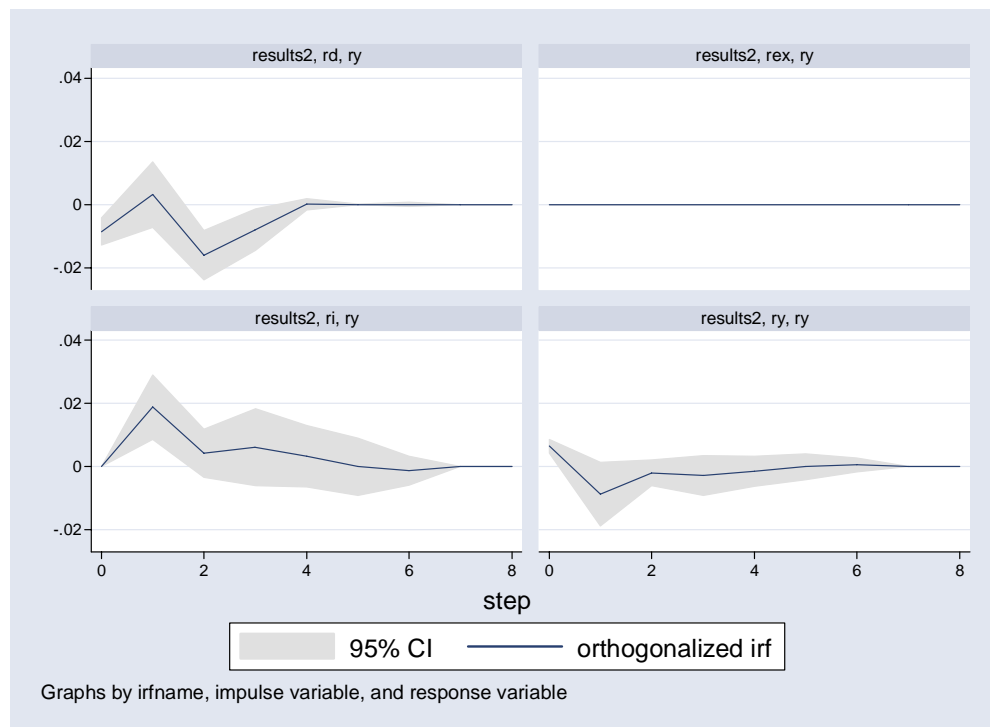
Note: D (productivity); Y (GDP); I (investment); X (export)

Within the same procedures with those I follow in the VAR Model of export-led growth, the final step of the model of investment-led investment growth is also to examine the impulse response function. I will see how the GDP responds shocks in investment, export, and productivity with the restriction placed on investment (Figure 5).

As shown in Figure 5, shocks in investment seem to have the strongest and most persistent effects on GDP, which only become negative and then null after 6 periods. On the contrary, shocks in export seem to make no difference to GDP. The line illustrating the GDP's movements against export shocks is almost flat for all periods. This result is quite similar to the result of the impulse response function of GDP demonstrated in Model 1. It can be said that changes in Vietnam's investment gives much more information to predict the country's GDP growth than changes in export do.

Figure 5 also traces the GDP's responses to the changes in productivity. The GDP's responses to productivity shocks in Model 2 display differences among the first four periods. It is positive in the first period and negative in the next period and positive again in the following period. These various movements may be interpreted by the fact that there was a big structural change in Vietnam's economy when the country implemented series of economic and legal reforms during the late 1980s and early 1990s. The passages of time coincide with the first periods in the time series of the data used for this empirical study.

Figure 5: Impulse Responses of GDP to Shocks from Each Variable in the Investment-led Growth Model



Note : results2, rd, ry (Impulse Response of GDP to productivity)
 results2, rex, ry (Impulse Response of GDP to export)
 results2, ri, ry (Impulse Response of GDP to investment)
 results2, ry, ry (Impulse Response of GDP to GDP)

In general, the empirical results generated from the VAR model of investment-led growth as well as those analyzed in the VAR model of export-led growth tend to strongly support the hypothesis that investment plays the most important role in Vietnam's economy in the sense that it Granger causes GDP at 5% level, explains most of the GDP variations and its shocks have stronger effects on the country's GDP than the other variables do. Besides, the results

also show the productivity is an important factor determining Vietnam's economic growth but there is no evidence proving that investment's effects are transmitted to GDP growth through productivity.

6. Conclusion

This study followed the structural VAR methodology and procedures used by Bradford and Chakwin (1993) to investigate which factor were the main engine that drives Vietnam's economy since the country launched the Renovation "Doi Moi" in 1986. Two VAR models and four variables, GDP, investment, export and productivity, were used to examine two hypotheses: export-led growth and investment-led growth. In the VAR model of export-led growth, export was assumed to be an exogenous variable that was allowed to have effects on all other variables but they are not allowed to impact export. Similarly, the second model treats investment as an exogenous variable that supposed to affect the other three variables but they are not allowed to interact with investment. The results of both models supported the investment-led growth hypothesis showing that investment has been the main factor that determines Vietnam's economic growth over the past two decades. On the contrary, the impacts of export implied in the both models on the country's GDP growth appeared to be very small. In addition, the results also did not support the expectation that investment or export helped to improve productivity, which in turn promote the economic growth.

That this study found empirical evidence showing that investment, rather than, export takes the key role in Vietnam's economic growth, but no evidence showing that investment or export promotes economic growth through improving productivity suggests that Vietnam's economic growth may not be sustainable. According to the economic theories, export and investment are supposed to stimulate the economic growth by respectively reallocating the country's resources efficiently and improve the labor productivity. However, in Vietnam's case, even though the country has experienced a boom in export and investment over the two decades, the country's GDP, as shown by the empirical study, is mainly explained by investment while export seems to give no information on GDP. Moreover, the evidence of causality from export and investment to productivity is not found. This indicates that the country's investment may have stimulated domestic consumption that, in turn, has promoted the GDP growth. At the same time, the positive impacts of exports on the country's GDP records were outpaced by the simultaneous boom in imports. Therefore, Vietnam should question about the real effectiveness of investment on the economy in the way that investment is supposed to create more positive externalities, including improving the productivity, to the country's economy.

References

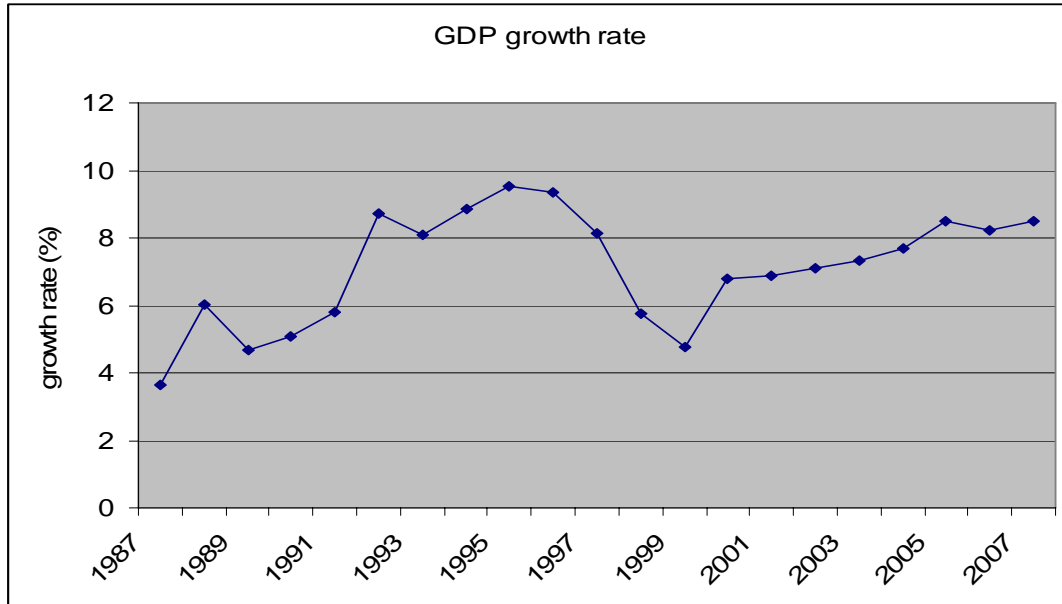
- Bahmani-Oskooee, M., & Alse, J. (1993). Export growth and economic growth: An application of cointegration and error-correction modeling. *Journal of Developing Areas*, 27, 535–542.
- Bahmani-Oskooee, M., Mohtadi, H., & Shabsigh, G. (1991). Exports, growth and causality in LDCs: A re-examination. *Journal of Development Economics*, 36, 405–415.
- Balassa, B. (1978). Exports and growth: Further evidence. *Journal of Development Economics*, 5, 181–189.
- Baldwin, R., & Seghezza, E. (1996). *Testing trade-induced investment-led growth*. National Bureau of Economic Research (NBER). Working paper No. 5416.

- Bernanke, B. (1986). Alternative explanations of the money-income correlation. *Carnegie-Rochester Conference Series on Public Policy* 25, 49-100.
- Bradford Colin and Chakwin Naomi. (1993). *Alternative explanations of the trade-output correlation in the East Asian economies*. OECD Development Centre. Working paper No. 87.
- Chow. (1978). Causality between export growth and industrial development: Empirical evidence from NICs. *Journal of Development Economics* 36, 405–415.
- Feder, G. (1983). On exports and economic growth. *Journal of Development Economics* 5, 59–73.
- Giles Judith and Williams Cara. (1999). *Export-led growth: A survey of the empirical literature and some non-causality results*. Econometric Working paper EWP 9901. ISSN 1495-6441.
- Giang Thanh Long & Nguyen Khac Minh (2007). *Technical Efficiency and Productivity Growth in Vietnam*. Publishing House of Social Labour, Hanoi, Vietnam.
- Hsiao Frank, S. T. and Hsiao Mei-chu, W. (2006). *FDI, export and growth in East and Southeast Asia – Evidence from time series and panel data causality analyses*. Paper presented at 2006 International Conference on Korea and the World Economy V (July 7-8, 2006). Korea University, Seoul, Korea.
- Herrerias Maria Jesus and Orts Vincente. (2007). Chinese Growth Puzzle. Paper presented at the 6th International Conference on Chinese Economy, 2007. Centre d'Etudes et de Recherches sur le Développement International. Université d'Auvergne, CNRS, France. (Center of Studies and Research on International Development. Auvergne University, France.)
- Hsiao, M.W. (1987). Tests of causality and exogeneity between export growth and economic growth. *Journal of Development Economics* 18, 143–159.
- Ishii Shogo (2007). Statement at Consultative Group Meeting for Vietnam on December 6-7, 2007. Retrieve from <http://www.imf.org/external/np/dm/2007/121007.htm>.
- International Monetary Fund. (1999). *Vietnam – Selected Issues*. (IMF Staff Country Report No.99/55). Retrieved from <http://www.imf.org/external/pubs/ft/scr/1999/cr9955.pdf>
- Johansen, S. (1988). Statistical analysis of cointegrated vectors. *Journal of Economic Dynamics and Control* 12, 131–154.
- John Thornton. (1996). Cointegration, causality and export-led growth in Portugal, 1895-1992. *Economic Letters* 50, 413-416.
- Jung, W.S. and Marshall, P.J. (1985). Exports, growth and causality in developing countries. *Journal of Development Economics* 18, 1–12.
- Kavoussi, R.M. (1984). Export expansion and economic growth: Further empirical evidence. *Journal of Development Economics* 14, 241–250.
- Les Oley. (1992). Cointegration, causality and export-led growth in Portugal, 1865-1985. *Economic Letters* 43, 163-166.
- Le Viet Anh (2002). *FDI-Growth Nexus in Vietnam*. Graduate School of International Development, Nagoya University
- Michaely, M. (1977). Exports and growth: An empirical investigation. *Journal of Development Economics* 4, 49–53.
- Mankiw, N. G. (2006). *Macroeconomics* (4th ed.). New York: Worth Publishers.
- Ohno Kenichi (Ed). (2007). *Building Supporting Industries in Vietnam. Vol.1.* (pp.ii). Tokyo: Vietnam Development Forum.
- Pham Thu Hien (2008). *The effects of ODA in infrastructures on FDI flows in provinces of Vietnam, 2002-2004*. Vietnam Development Forum (VDF) Working Paper Series 2008. Retrieved from <http://www.vdf.org.vn/workingpapers.html>
- Ram, R. (1985). Exports and economic growth: Some additional evidence. *Economic Development and Cultural Change* 33, 415–425.

- Rodrik Dani. (1995). Getting Interventions Right: How South Korea and Taiwan Grew Rich. *Economic Policy* 10, 55-107.
- Sims, C.A. (1972) Money, income and causality. *American Economic Review* 6, 540–552.
- Tyler, W. (1981). Growth and export expansion in developing countries: Some empirical evidence, *Journal of Development Economics* 9, 121–130.
- Yoon-Ha Yoo. (2008). *The East Asian miracle: export or investment led*. KDI School of Public Policy and Management Working Paper Series. Retrieved from <http://www.kdischool.ac.kr/faculty/paper.asp>
- Vietnam General Statistics Office. (1989, 1994, 2005, 2006, 2007). *Statistic Year Book*. Hanoi: The Statistics Publisher.

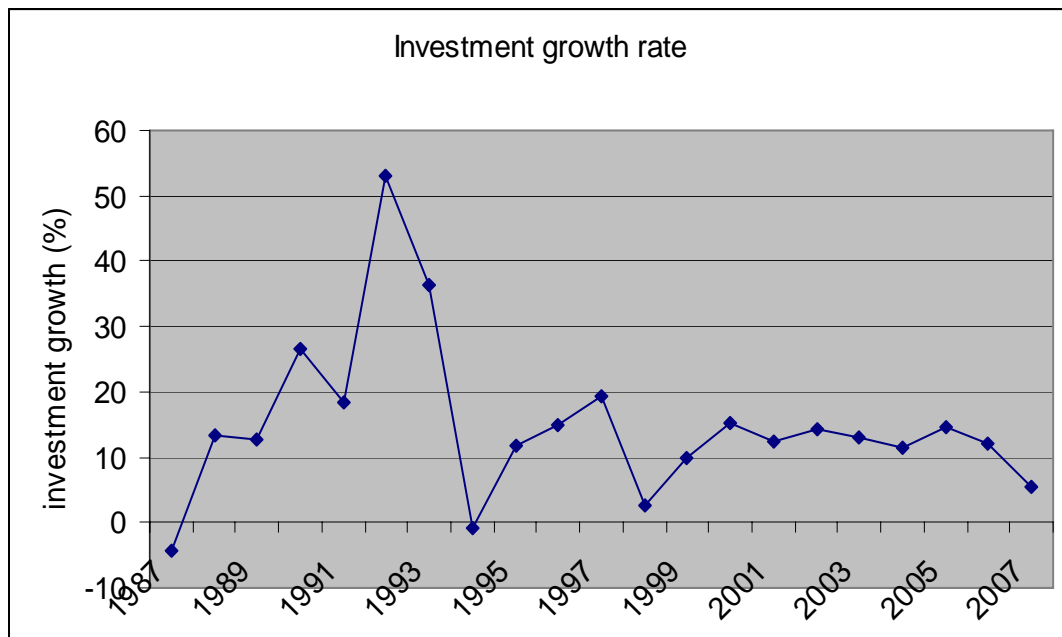
Appendix: Figures

Figure 1: Vietnam's GDP growth rate between 1987 and 2007 at the 1994 constant price



Source: Statistic Year Books in 1989, 1994, 2000, 2006, 2006, 2007

Figure 2: Vietnam's total investment between 1987 and 2007 at the 1994 constant price



Source: Statistic Year Books in 1989, 1994, 2000, 2006, 2006, 2007

Figure 3: Vietnam's export between 1986 and 2007 at the 1994 constant price



Source: Statistic Year Books in 1989, 1994, 2000, 2006, 2006, 2007