FDI-Growth Nexus in Vietnam

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Abstract: The objective of this paper is to investigate the FDI-growth nexus in Vietnam for the period 1986-2002. First, it estimates and decomposes the capital stock of Vietnam using simultaneous determination approach of TFP growth and capital stock. Second, it examined FDI-growth nexus by both growth accounting approach and econometric techniques. Growth accounting was employed to estimate respective contribution of factors of production to growth. By growth accounting approach, FDI contribution to growth was estimated to be about 7% out of 37% of total capital contribution to growth in the period 1988-2002. By regression analysis it is found that FDI has the positive relation with domestic investment and economic growth. Sensitivity analysis was performed and the result was confirmed robust. The results seem to suggest that FDI generates both significantly positive short-run and long-run impacts on economic growth in Vietnam.

1. Introduction

Since 1986, Vietnam has made substantial progress in its economic reforms, which dealt with the two issues: (i) the restructuring of domestic economy; and (ii) the opening up of the economy to the external trade and investment. The reforms have brought about the fruitful results.

In 1992-1997, annual economic growth averaged 8.8% with the significant change in the structure of the economy. The share of agricultural production in GDP fell from 40.5% in 1991 to 21.8 % in 2003 while the industrial and services sectors expanded rapidly. The investment ratio has tripled from 11.7% of GDP at the beginning of the reform in 1986 to a strikingly high ratio of 35.1% in 2003.

Foreign direct investment has deeply involved in the reform process. It has come with considerable amount of capital, technology and management expertise. By the end of 2003, total FDI capital has reached more than USD 47 billion. In 2002, FDI enterprises constituted for about 13.5% of GDP, 35.4% of the industrial output, 24% of exports (excluding oil and gas) and 25% of total state budget revenue. FDI has helped the country developing new industries, such as oil and gas exploration and exploitation, automobile and motorbike industries. It also contributed to the development of food and beverage, and garment and textile industries. FDI is regarded as the engine of growth of the economy for the past years.

Two recent events have put forward the impacts of FDI. First, the Asian Financial Crisis in 1997-1998 has stressed the need for further promoting FDI in the economy for sustainable growth. Second, the reduction of FDI inflows from 1997 has emphasized the crucialty of FDI and the role of this capital in Vietnam's economy.

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There are very few studies on investigating the relation between FDI and economic growth in Vietnam for the last years. Pham Hoang Mai (2002) [1] analyzed the performance of FDI companies in the economy and concluded that FDI has a positive impact on economic growth. Ohno (2004) argued the importance of FDI in Vietnam's industrialization process and recommended the need of a critical mass of FDI in the next period. He suggested that Vietnam should base the industrialization strategy on FDI promotion. Such "management approach" to examine the relation between FDI and economic growth overwhelmed in the previous studies. The traditional macroeconomic analysis seems to be in shortage. An important reason for that is the difficulty in estimating capital stocks[2]. Data insufficiency and short time period prevents the precise approximation of capital stock. It is known that, estimating capital stock is the crucial step in investigation of the role of capital accumulation in growth process.

Employing the more up-to-date data and a newly developed methodology, this study will be the first to deal with capital stock estimation and decomposition of capital stock in Vietnam. The simultaneous determination of capital stock and TFP growth in Vietnam might be a good reference for future studies. Though simple and aggregated, it is more convincing in the sense that the results are rather realistic and comparable with other studies. After obtaining the series of capital stock, the FDI-growth nexus has been explored by the structural decomposition of foreign capital stock and its respective contribution to growth. In addition, traditional approach using regression analysis is utilized to investigate FDI and growth nexus on basis of the result of capital stock estimation. These two approaches were believed to serve satisfactorily the objective of the paper.

The remainder of paper is organized as follows. Section 2 discussed the theoretical background of FDI-growth nexus. Section 3 reviews empirical studies on the issue. Section 4 presents the methodology, estimation results, decompositions and contribution of factors of production on growth. Section 5 discuses the impacts of FDI on economic growth. Section 6 concludes the paper.

2. Theoretical Underpinnings

The traditional approach to examining the relationship between FDI and economic growth mainly relies on the variant of the so-called "resource gap" model (Chenery and Strout, 1966). According to this model, developing countries are trapped in a low-growth path because the lack of financial resources prevents them from speeding up their economic growth. The inflow of foreign capital, in which foreign direct investment take a leading role, can foster economic growth by easing the shortage of capital, foreign exchange and technology.

However, some economists (Agosin and Mayer, 2000) argued that FDI can do harm for the host economies by creating "crowding out" effect for domestic investment and forcing domestic enterprises to go bankrupt. The possible deterioration in balance of payment due to the increase in imports and profit repatriation as well as the results of transfer-pricing practices and tax incentives also draw the serious concerns.

More recently, there is increasing interest on the relationship between FDI and growth mainly due to the surge of FDI flows and uncertainties in financial market. Financial crisis has

[1] Pham Hoang Mai (2002), "The Economic Impact of Foreign Direct Investment Flows in Vietnam: 1988–98", *Asian Economic Bulletin*, Volume 26, Number 4, December 2002

[2] There are some studies on estimating capital stocks of Vietnam, such as Le Thanh Nghiep (2000), Tran Dat Tho (2001), Vu Quoc Ngu (2002). Such studies used quite simple methods.

evidenced that FDI is less volatile than other capital flows. The impacts of FDI are, therefore, more durable.

In neoclassical approach, the growth impact of FDI can be examined by a growth equation as follows:

$$Y = AF(\eta_H K_H, \eta_F K_{F,}, \theta L)$$

Y is domestic output, A denotes technology available at given time, L is the labor force and K_H and $K_{F,}$ are the domestically owned and foreign owned stock of capital respectively.

The variable A represents the disembodied technological change, while the factor-specific η_H, n_F, θ represent embodied technological change.

The two fold impacts of FDI can be illustrated by the above growth equation. In the short-run, output might expand as the foreign-owned stock of capital increased (Ff>0). FDI can also significantly influence output in the long-run through the induced impacts on other inputs: η_H, θ and in the technological parameter A.

To investigate these impacts, one important direction is to see the relationship between FDI and domestic investment. The basic question is whether FDI substitute or complement domestic investment since domestic investment can have direct impact to Y (K_H). If foreign investment helps to increase the performance of domestic firms in the host country, then it increases the K_H and eventually output increases ($F_{HF} \rangle 0$). If FDI crowds out domestic investment, K_H decreases and so that output also decreases ($F_{HF} \langle 0$). The final effect of FDI on output then depend on the difference between F_{HF} and F_F. If $F_{HF} > F_F$ in absolute value, FDI will have negative impacts on output and vice versa.

FDI can have significant effects on labor participations, labor skills and overall technological improvements. The increased labor participation, labor skills and overall technological improvements are the important sources of economic growth. However, their combined impacts on growth can either be positive or negative. The combined effects of FDI on growth, therefore, are still the controversial issue.

3. Empirical Studies.

Empirical studies on FDI and growth nexus can be classified into two groups: growth accounting approach and econometric approach

In standard growth-accounting framework, the growth rate of aggregate output is broken down to respective contribution of growth of factors of production, i.e. capital and labor and productivity growth representing technology improvement. This approach provides rather mechanical decomposition of output growth into various sources, without explaining the sources of such growth from the "fundamentals" of the economy.

The second approach is the estimation of growth equations based on neo-classical theory suggested by Barro and Sala-i-Martin (1995, Chapter 10). In this neoclassical model, constant returns to scale relates output level with input bundles. FDI enters this model as an additional production inputs. More precisely, FDI is treated as additional investment that can increase the domestic capital stock.

However, the inclusion of FDI in neoclassical equation faces with at least two problems. The first problem is causality. It is possible that growth itself or factors that affect growth can also influence FDI. If causality runs from GDP to FDI, the OLS estimation techniques would yield a biased result. To address this problem, several econometric techniques have been

employed, such as the application of Granger causality test and cointegration analysis to time-series data (Mello, 1999; UNCTAD, 2000), the use of instrumental variable techniques to identify the independent impact of FDI on growth (Carkovic and Levine, 2000). The second problem is the spurious correlation resulted from omitted variables. FDI is likely to be significantly correlated with other variables which are expected to affect growth but by some reasons have been omitted. Omitting some important variables from the right hand side of the growth equations might lead to biased result for the growth coefficient of FDI. The growth coefficient of FDI in this case is likely incorporates also the impacts of the omitted variables. The sensitivity analysis might be a good practice for this problem. Domestic capital formation and trade indicators are frequently being regarded as variables likely stimulated by FDI.

4. Estimating Capital Stock.

4.1. Methodology

This part presents the growth accounting approach to investigate the FDI growth nexus in Vietnam for the period of 1986-2002. The central concern of growth accounting approach is the correctness of estimation of capital stock. In general, we first estimate total capital stock, then decompose it into domestic capital stock and foreign invested capital stock. This is possible since FDI comes into Vietnam only from 1988, which we can take the value of investment in 1988 as the initial foreign-invested capital stock. By deducting total capital stock by foreign-invested capital stock, we arrive at domestic capital stock.

There are several ways of estimating capital stocks[3]. This study uses the methodology of Ezaki and Lin Sun[4], which develop simultaneously determination of capital stocks and TFP growth. The essence of this method is the simultaneous and consistent determination of both capital stock series and TFP growth, first, by integrating growth accounting and capital accumulation (stock-flow) relation, and, then, by adding to it annual flow data on real investment. Specifically, the method is as follows:

Denoting growth rate of real GDP by YG, growth rate of labor by LG, and growth rate of real capital stocks by KG, growth rate of TFP by TG, distribution share of labor by ω, real capital stock by K, real investment by I, and rate of depreciation by δ, we can express:

$$YG = \omega.LG + (1-\omega).KG + TG \quad (1)$$

$$KG = I/K - \delta \quad (2)$$

Equation (1) is the growth accounting identity and Equation (2) is the capital accumulation identity. By combining the two identities, we get the relationship between capital stocks (K) and investment flows (I):

$$K = \left[(1-\omega)/(YG - \omega LG - TG + (1-\omega)\delta)\right].I \quad (3)$$

In this relation, we first select an arbitrary proper value of TFP growth (TG) for the target period of 17 years (1986-2002). Next, we use the actual observed values of annual

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[3] There are several ways of estimating capital stocks (K), such as:

$K/Y = (I_k/Y)/(g+\delta+n)$ by Klenow and Rodriguez-Clare, 1997

where I_k =investment in physical capital, g=growth rate of Y/L, and n=growth rate of working-age population

$K = I/(g+\delta)$ by Young , 1994

where g=average growth of investment for several years

[4] See Ezaki. M and Lin Sun (1999), "Growth Accounting in China for National, Regional, and Provincial Economies 1981-1995", Asian Economic Journal, Volume 13, Number 1, March 1999

growth rate (YG, LG), distribution rate (ω), and depreciation rate (δ) averaged for the same 17 years. Finally, we apply the actual data on real investment (I) averaged again for the same 17 years. Then, we calculate the level of real capital stocks (K) for the same period. We regard it as the level of capital stocks at the mid point of the target period (i.e., mid-year of 1994). On the basis of this mid-1994 level of capital stocks, we accumulate actual real investment for each year (I(t)) back and forth for 17 years by the following formula:

$$K(t+1) = (1-\delta)K(t) + (I(t) + I(t+1))/2 \quad (4)$$

$$K(t-1) = \left[K(t) - (I(t) + I(t-1))/2\right]/(1-\delta) \quad (5)$$

Then we got a series of capital stocks for 17 years, from which we can calculate average annual growth rate (KG). Applying this growth rate to the growth accounting formula (Equation (1)), we get a new average growth rate of TFP for the target period (TG), which is different from the initial value set at an arbitrary level at the beginning of the calculation. We, therefore, change the initial value of TG in the proper direction to start the same calculation again, resulting again in a different TG at the end of second calculation. We continue this iterative process until TG at the beginning coincides with TG at the end.

In general, out method lead to polynomial equation of high order with respect to the growth rate of TFP (say, x). For example, the polynomial equation will be of x^{18} for the sample period of 17 years[5]. We will, therefore, obtain several different solutions for the actual economy, of which only one solution will make economic sense.

4.2. Data Processing

The data sources used in this study are from official publications of General Statistical Office of Vietnam, Key Indicators of Asian Development Bank, statistics released by FAO (Food and Agriculture Organization) and UNDP Vietnam statistics. Specifically, we extensively use Vietnam Statistical Yearbook (various issues), Basic Parameters of 1997 SNA. The five parameters or variables (YG, LG, ω, δ and I) are obtained as follows:

First, the GDP growth rate is calculated based on GDP in 1994 constant price, which is found consistent with GDP growth rate reported by Asian Development Bank in Key Indicators 2004

Second, the rate of labor input growth (LG) is based on "economically active population" released by FAO since the series Social Labor Force issued by General Statistical Office could be expected to have a low degree of accuracy in view of present state of data collection in Vietnam. The series Social Labor Force also reported no increase in labor in the year 1988.

Third, the distribution share of labor (ω) is based on "compensation of employees" data. Since the data for the whole period is not available, we take the value in Basic Parameters of 1997 SNA, which is 0.6029 as the value for the whole period.

Fourth, the rate of depreciation (δ) is estimated to be 0.06, which is the rate of depreciation averaged for 27 economic sectors across 5 out of 6 ownership types (state,

[5] if the actual average data are use for YG, LG, ω, δ and I, the mid-point capital stock K is determined by equation (3) as a function of TFP growth rate x only (denoted by K(x)), then actual investment I is accumulated back and forth to arrive at a series of capital stock K(x). From this capital stock series, we can calculate the average growth rate of capital stock for the whole period GK(x). This GK(x) must satisfy the first identity of growth accounting (Equation (1). If the sample period is n years, GK(x) can be express as a rational function with the polynomial of x^n on both numerator and denonimator, resulting in growth accounting identity of the polynomial of x^{n+1}.

collective, private, mixed, individual, foreign-invested) from National Account of 1995 to 1999. We exclude individual ownership type since the value fluctuates too large. The same rate of depreciation was used in some other studies (Le Thanh Nghiep, 1999; Tran Dat Tho 2001, Vu Quoc Ngu, 2002)

Fifth and finally, real investment flow (I) are obtained from "gross fixed capital formation" in Vietnam Statistical Yearbook (various issues). For investment flows after 1994, we take it directly from the Yearbook. For the series from 1994 backward, we deflate 1989 constant price investment figures to 1994 constant price figures.

It is noted that gross fixed capital formation is lump-sum data on total investment which do not allow for the composition and efficiency of component investment goods. Therefore, capital stocks obtained from the accumulation of such investments are also the lump-sum data on total capital, which do not take into account the composition and efficiency of component capital assets or the change in utilization rate of capital by the business cycle. Since we also use the aggregate data on labor, the same is true for this variable. TFP in this study, therefore, will include changes in the quality of capital and labor as well as variations in working hours and capital utilization.

4.3. Growth Accounting Results

Applying the methodology and data as above, through the process of iterations, we obtained the estimate for TFP growth and capital stock[6] at constant price 1994 for the period 1986-2002 as shown in Table 1.

Table 1. Iterations for Vietnam Economy (economically meaningful range of TFP)

TGB	K86	K2002	TGE	TGB-TGE
0.005	238755.0422	639306.2	0.027854	0.022854
0.01	238347.2131	639154.7	0.02782	0.01782
0.015	237939.3839	639003.1	0.027785	0.012785
0.02	237531.5547	638851.6	0.027751	0.007751
0.025	237123.7255	638700	0.027716	0.002716
0.026	237042.1925	638669.8	0.027709	0.001709
0.027	236960.6595	638639.5	0.027702	0.000702
0.0275	236919.8109	638624.3	0.027699	0.000199
0.027697	**236903.898**	**638618.4**	**0.027697**	**3.29E-07**
0.028	236879.1264	638609.2	0.027695	-0.0003
0.03	236715.8963	638548.5	0.027681	-0.00232
0.035	236308.2312	638397	0.027647	-0.00735
0.085	232229.9394	636881.6	0.027295	-0.0577
0.125	228967.306	635669.3	0.027009	-0.09799

Source: Author's calculation

Note: TGB is beginning TFP growth, TGE is end TFP growth.

[6] Le Thanh Nghiep estimated the capital stocks by assigning the ad hoc capital-output ratio of 1.1 to calculate capital stock of initial year. Then, he used PIM to build the whole series of capital stocks. His estimate was smaller than that of this study, especially in beginning years (the capital/GDP ratio is fluctuating around 1.2-1.5 times). Vu Quoc Ngu estimated value of fixed capital of SOEs also by PIM method. He took net value of fixed assets used in industrial SOEs as initial value of capital stock in 1990. In his estimate, the ratio of capital stocks of industrial SOEs to value-added was smaller than this study (fluctuating around 1.2-1.5 times). Tran Tho Dat estimated capital stocks including change in inventories. He followed PIM after he calculated initial capital stock for 1986 using depreciation rate of 0.06, the ratio between stocks of fixed capital and the stocks of inventories.

The average annual rate of TFP growth (TG) is estimated to be 2.7697% for the period 1986-2002. This is the only estimate that makes economic sense through the process of iterations. This estimate is obtained by setting distribution share of labor (ω) and depreciation rate (δ) to be 0.6029 and 0.06 respectively. Based on the estimation of capital stock and averaged TFP for 1986-2002, growth accounting for Vietnam was calculated. This estimation is obtained by applying the basic growth accounting identity:

$$YG = \omega.LG + (1-\omega).KG + TG$$

In which YG is economic growth rate, LG is labor growth rate, KG is capital stock growth rate and TG is TFP growth rate. We assumed Cobb-Douglas production function, therefore the summation of elasticity to labor and elasticity to capital is unity. In this identity, annual YG, LG, KG can be calculated from the available statistics; elasticity to labor is assumed to be 0.6029 then elasticity to capital is 0.3971. The result is presented in Table 2.

Table 2 Growth Accounting in Vietnam (1986-2002)

Year	YG	LG	KG	TFPG	Cap. Stocks (billion VND)
1986	2.84%	2.79%	3.02%	-0.05%	236903.898
1987	3.63%	2.81%	0.46%	1.75%	238001.1254
1988	6.01%	2.80%	1.56%	3.71%	241709.933
1989	4.68%	2.77%	2.13%	2.17%	246848.6786
1990	5.09%	2.72%	0.86%	3.12%	248959.8509
1991	5.81%	2.44%	1.04%	3.92%	251550.9545
1992	8.70%	2.38%	2.87%	6.12%	258776.6528
1993	8.08%	2.30%	6.23%	4.22%	274897.9236
1994	8.83%	2.17%	8.72%	4.06%	298858.1
1995	9.54%	2.03%	9.45%	4.56%	327098.8393
1996	9.34%	1.88%	10.26%	4.13%	360669.409
1997	8.15%	1.75%	10.51%	2.92%	398587.2444
1998	5.76%	1.66%	10.64%	0.54%	440984.5098
1999	4.77%	1.62%	10.04%	-0.19%	485265.9392
2000	6.79%	1.63%	9.44%	2.06%	531072.9828
2001	6.89%	1.88%	9.58%	1.96%	581970.6039
2002	7.08%	1.88%	9.73%	2.08%	638618.3676
1986-2002	**6.59%**	**2.21%**	**6.27%**	**2.7697%**	**356516.18**
1986-1997	**6.73%**	**2.40%**	**4.76%**	**3.39%**	**281905.22**
1998-2002	**6.26%**	**1.74%**	**9.89%**	**3.44%**	**535582.48**

Source: Author's calculation

Real GDP in Vietnam has increased 6.59% on annual average in the period 1986-2002, in which the period before Asian Financial Crisis reached an average of 6.73%. The growth rate of labor remained stable at around 2%-3% annually with decreasing rate in later period. It also corresponds to a declining trend in population growth rate of Vietnam resulted from a very strict family planning policy. Real capital stocks increased more rapidly in later periods with the similar pattern with GDP growth rate. In the period 1998-2002, real capital stock increased with higher rate despite the slowdown in investment growth rate (14.98% in former period and 9.91% in latter period[7]). TFP growth maintain positive in most years, with average growth rate for the whole period of 2.77%.

[7] Author's calculation for GSO data

Contribution to GDP growth by factors of production is shown in Table 3[8]. The contribution of labor to growth was quite fluctuating, with average of 23.43% for the whole period. The highest rate for labor contribution was 59.35%. The contribution of capital increased in later years with the average for the whole period of 36.97%. TFP was the most contributable factor to GDP growth. Its contribution was higher than capital with average of 39.6% for 1986-2002. The relatively high economic growth of Vietnam is therefore, attributable first to TFP growth then labor and capital according to the estimation.

Table 3. Contribution to GDP Growth

	Contribution to GDP Growth (%)		
Year	Labor	Capital	TFP
1986	59.35%	42.32%	-1.67%
1987	46.61%	5.06%	48.33%
1988	28.05%	10.29%	61.66%
1989	35.65%	18.05%	46.30%
1990	32.18%	6.67%	61.15%
1991	25.34%	7.11%	67.54%
1992	16.52%	13.11%	70.37%
1993	17.14%	30.62%	52.23%
1994	14.83%	39.18%	45.99%
1995	12.84%	39.33%	47.83%
1996	12.13%	43.63%	44.23%
1997	12.91%	51.21%	35.88%
1998	17.32%	73.27%	9.41%
1999	20.52%	83.53%	-4.05%
2000	14.49%	55.23%	30.29%
2001	16.43%	55.20%	28.38%
2002	16.05%	54.59%	29.36%
1986-2002	23.43%	36.97%	39.60%
1986-1997	26.13%	25.55%	48.32%
1998-2002	16.96%	64.36%	18.67%

Source: Author's calculation

4.4. Capital Stock Decomposition

Capital stock is accumulated from various sources, in which domestic investment, foreign direct investment, official development assistance and foreign borrowings account for the larger shares. In the case of Vietnam, foreign borrowings made up a negligible number in total foreign capital flows. Therefore, it can be neglected in the decomposition calculation. The data unavailability is another problem for not accounting the foreign borrowing share. Only a complete set of FDI and ODA data are available while the dataset on foreign borrowings is not available.

[8] The estimation is obtained by also assigning the elasticity to labor is 0.6029 and elasticity to capital is 0.3971. The formula for calculating the factor contributions to growth is

$$YG = w.LG + (1-w)KG + TG$$

Then the contribution of labor factor, capital factor and TFP is equal to w.LG/YG, (1-w)KG/YG and TG/YG, respectively.

4.4.1. Foreign Capital Stocks Estimation

As explained above, foreign direct investment has flowed to Vietnam only since 1988. However, the implementation of the first FDI capital was actually in 1991. Therefore, we can take the value of FDI in 1991 as the initial FDI capital stocks. Also using depreciation rate of 0.06, the series of FDI capital stock was calculated by PIM (Perpetual Inventory Method) with the following formula:

$$K(t+1) = (1-\delta)K(t) + I(t+1)) \qquad (6)$$

Similarly, the official development assistance capital restarted in Vietnam from 1993. We also take the value of ODA disbursement in 1993 as the initial ODA capital stock. The ODA capital stock was calculated with depreciation rate of 0.06 by PIM. The result of estimation is shown in Table 4. We use the first and sixth categories for our estimation of ODA capital stock.

Table 4. Foreign Capital Stock
(VND billion, constant price 1994)

Year	Total K	FDI stock	ODA stock	Dom. Cap. Stock	GDP
1986	236903.9	-	-	236903.9	109189
1987	238001.1	-	-	238001.1	113154
1988	241709.9	-	-	241709.9	119960
1989	246848.7	-	-	246848.7	125571
1990	248959.9	-	-	248959.9	131968
1991	251551	3069.512	-	248481.4	139634
1992	258776.7	7746.308	-	251030.3	151782
1993	274897.9	18756.28	3882.997	252258.6	164043
1994	298858.1	35570.79	10207.51	253079.8	178534
1995	327098.8	55514.79	15338.61	256245.4	195567
1996	360669.4	73777.53	22630.81	264261.1	213833
1997	398587.2	93895.6	29569.4	275122.2	231264
1998	440984.5	108110.4	38402.67	294471.5	244596
1999	485265.9	121753	48186.79	315326.2	256272
2000	531073	133594.8	59491.25	337986.9	273666
2001	581970.6	146558.1	68290.73	367121.8	292535
2002	638618.4	162939.3	76673.46	399005.6	313247

Source: Author's calculation.

The Table shows that the foreign capital stock (include FDI and ODA) has increased steadily in the period 1991-2002. In 1991, foreign capital stock accounted for only 2.3% of total capital stock. However, in 2002, this figure became nearly 38%. More than one third of capital formation of Vietnam in the period has been come from the foreign capital inflows, in which, FDI accounted for more than 25%. Domestic capital stock, though increased in absolute value, its share has been reduced from nearly 100% in 1990 to around 63% in 2002. Foreign capital inflows increasingly play an important role in capital accumulation of the country

4.4.2. Estimation of FDI Contribution to Growth.

As discussed above, there are basically two approaches to investigate FDI contribution to growth. One is econometric approach, in which GDP as a dependent variable is regressed on a set of independent variables including FDI variable. In regression analysis, due attention

should be placed on data exploration. Recently, the techniques of unit root test, cointegration and error correction model has been developed and is recommended to apply to time-series analysis, if possible.

In growth accounting approach, the FDI-growth nexus is investigated by decomposing capital stock into various sources and then calculated each sources' contribution to growth. In this paper, the structural contribution of capital to growth is decomposed into domestic capital stock, FDI capital stock and ODA capital stock's contribution. The result is presented in Table 5.

Table 5. Decomposition of Capital Contribution to Growth

Year	Total K	FDI	ODA	Dom.K
1986	42.32%	n.a	n.a	42.32%
1987	5.06%	n.a	n.a	5.06%
1988	10.29%	n.a	n.a	10.29%
1989	18.05%	n.a	n.a	18.05%
1990	6.67%	n.a	n.a	6.67%
1991	7.11%	0.09%	n.a	7.03%
1992	13.11%	0.39%	n.a	12.72%
1993	30.62%	2.09%	0.43%	28.10%
1994	39.18%	4.66%	1.34%	33.18%
1995	39.33%	6.68%	1.84%	30.81%
1996	43.63%	8.93%	2.74%	31.97%
1997	51.21%	12.06%	3.80%	35.35%
1998	73.27%	17.96%	6.38%	48.93%
1999	83.53%	20.96%	8.29%	54.28%
2000	55.23%	13.89%	6.19%	35.15%
2001	55.20%	13.90%	6.48%	34.82%
2002	54.59%	13.93%	6.55%	34.11%
1986-2002	**36.97%**	**6.80%**	**2.59%**	**27.58%**
1986-1997	**25.55%**	**2.91%**	**0.85%**	**21.80%**
1998-2002	**64.36%**	**16.13%**	**6.78%**	**41.46%**

Source: Author's calculation

For the whole period, FDI contributes about 7% of total 37% of capital contribution to growth. The contribution of FDI increased over time. In the period before Asian Financial Crisis, FDI contribute only 3% of total 25.6% of capital contribution to growth. Its contribution increased sharply to 16% in 1998-2002 period. The similar pattern is observed in ODA capital contribution. The contribution of domestic capital was quite stable. The contribution of foreign capital inflows shows the increasing trend in economic growth in Vietnam.

5. FDI and Growth Nexus.

FDI can have both direct and indirect effects on economic growth. This part tries to approach it in both ways. First, the link between FDI and domestic investment will be examined. It aims to answer the question whether FDI substitute or complement domestic investment. To do this, the investment equation including FDI will be estimated. Second, traditional growth equation is estimated in which, capital stock is broken down to various sources.

5.1. FDI and Domestic Investment

a. The Model

There are several hypotheses on level of savings and investments in developing countries. Empirical evidence strongly supports the Keynesian absolute income hypothesis that the level of savings is primarily a function of level of income. Specifying FDI as a additional variable, the simple linear investment model is specified as follow:

$$DI_t = \alpha + \beta FDI_{(t-1)} + \gamma GDP_{(t-1)} + \varepsilon_i \quad (7)$$

where DI, FDI and GDP stand for real domestic investment, real disbursed FDI inflows and real gross domestic product, respectively. ε_i is the error term. The study utilizes the annual time series data of Vietnam over the period 1986 to 2002 to test the relationships. FDI and GDP are one period lag because it is assumed that the impacts of FDI and GDP on domestic investment are lag for one year. The logarithmic transformation is used in the estimation. It compresses the scale and also often reduces the problem of heteroscedasticity.

b. The data:

Data used in this study are from GSO data (Statistical Yearbook, various years), data released by Ministry of Planning and Investment and IMF. Specifically:

For DI: taken from the series Gross Domestic Capital Formation, constant 1994 price.

For GDP: taken from Gross Domestic Product, constant 1994 price.

For FDI: FDI disbursement data, released by IMF, changed to 1994 constant price using GDP deflator

c. Nonstationary, Cointegration and Error Correction Model

Using the above-described data, the OLS estimation is performed with the following result:

DI=	-7.04+	0.021FDI(-1)+	1.458GDP(-1)
t-stat	(-4.12)	(4.03)	(10.2)

Adjusted R-squared: 0.98, Durbin-Watson stat=2.05

The result is good in traditional sense. FDI has a positive relation with domestic investment. If FDI increases by 1%, the domestic investment will increase by 0.021%. However, one big problem while dealing with time-series data is non-stationary nature of the data. If the series are non-stationary, standard inference with such series are not applicable. One solution for non-stationary series is to specify the model in difference form (if the series is differenced stationary). However, such transformation throws away the long-run relationship between variables. If the series are non-stationary but cointegrated, the cointegration techniques should be used. The ADF unit root tests are performed to check the series are stationary or not (Table 6).

Table 6. Augmented Dickey-Fuller Test For Unit Root

Variable	ADF Test (C & T)
Log(DI)	-1.88
Dlog(DI)	-5.64
Log(FDI)	-1.41
DLog(FDI)	-4.69
Log(GDP)	-2.30
Dlog(GDP)	-3.93

Note: The MacKinnon Critical Values for C&T are; 1%: -4.99; 5%:-3.87; 10%:-3.38. Lag length in all cases is 3.

The unit root test indicated that the DI, FDI and GDP are non-stationary in level but stationary in their first difference. Since three variables (DI, FDI and GDP) are integrated of order one, the Johansen cointegration test is performed to determine whether there exist a cointegration among the variables. (Table 7)

Table 7. Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.763251	31.11992	29.79707	0.0350
At most 1	0.451908	9.508607	15.49471	0.3204
At most 2	0.032069	0.488920	3.841466	0.4844

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.763251	21.61132	21.13162	0.0428
At most 1	0.451908	9.019687	14.26460	0.2845
At most 2	0.032069	0.488920	3.841466	0.4844

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

As both trace and maximum eigenvalue tests confirm, there exist only one cointegrating vector among the variables. This cointegrating vector is reported here, which is normalized on DI. The relationship indicates that in the long run, GDP has a significant positive impact on domestic investment. The significant positive between FDI and domestic investment is one again supported by Johansen test.

Normalized cointegrating coefficients

LOG(DI)	LOG(FDI)	LOG(GDP)	Intercept
-1.0	0.012	1.55	8.28
(standard error)	(0.005)	(0.117)	

The test indicates there exists a valid long run relationship between domestic investment, FDI and GDP. The short-run dynamics and long-run equilibrium is now integrated in an Error Correction Model (ECM) which is developed by Granger (1981) and elaborated by Engle and Granger (1987). Following Dutta and Ahmed (1999) type general to specific procedure to estimate an Error Correction Model with most siginificant parameter estimate, we have the following results for ECM for the sample 1986-2002:

DDI=	0.167	-0.198DDI(-2)	+0.0145DFDI(-2)	-0.747DGDP(-2)	-0.18EC(-1)
t-stat	1.31	-0.89	2.17	-0.359	-2.47

Adjusted R-squared: 0.56 F-stat: 5.13

The result shows that the short run coefficient of FDI and income (with two period lag) is positive and significant. The coefficient of the error correction term is highly significant with appropriate negative sign. This suggests that the validity of long-run equilibrium relationship among the variables. The error correction term also suggest that the model converges rather slowly to the equilibrium, with nearly 20% of the discrepancy corrected in each period. The coefficient of FDI is highly significant, thus showing that FDI generates not only short-run positive impacts on domestic investment but also in the long-run perspective. This result seems to correspond to the fact that several FDI projects was put into operation right after getting licensing, which creates the induced effects in local economy.

d. Sensitivity analysis

Consider the following model:

$$DI_t = \alpha + \beta FDI_{(t-1)} + \gamma GDP_{(t-1)} + \theta Z + \varepsilon_i \quad (8)$$

Where FDI is focus variable and GDP is the key-variable which is always included in the model and Z is a subset of variables chosen from a pool of variables identified by previous studies as potentially important independent variables. If Z variables is included in the regression and the coefficient of FDI remains significant and of the same size, a fair amount of confidence on the initial estimate cam be maintained and the results are considered robust. Further, if the highest and lowest values of focus variable fall within a narrow interval, we can conclude that the data yields sturdy information on the coefficient of the focus variables.

In this study, ODA capital flows, exports of goods and services and real exchange rate are chosen as Z variables. The results of the sensitivity analysis are presented in Table 9.

Table 9. Sensitivity Analysis of Investment Equation

Variables incorporated	Coefficient of focus variable	t-stat	Significance
Basic Model	+0.021	4.03	1%
ODA	+0.019	3.60	1%
EXPORT	+0.023	4.84	1%
IMPORT	+0.023	4.69	1%
RER	+0.025	4.96	1%
ALL	+0.020	2.39	5%

Note: OLS regression was performed on the expanded model

It is evident that the positive coefficient of FDI (focus variable) remains highly significant despite the inclusion of possible omitted variables into the model. In every equation, the coefficient of FDI is significant at 1% per cent level, except for inclusion of all variables (which is 5% level). The coefficient of focus variable remains in very narrow interval (the smallest value is 0.019 and the highest value is 0.025). From these results, it can be concluded that the initial estimates are robust.

5.2. FDI and Economic Growth

As discussed earlier, the growth impacts of FDI can be investigated through growth equation. Since we had obtained the series on domestic capital stock, foreign capital stock, employment and TFP growth rate in Vietnam in the previous part, following Barro and Sala-i-Martin, the regression model is specified as follows:

$$YG = \alpha + \beta_1.DomKG + \beta_2.FDIG + \beta_3.ODAG + \beta_4.LG + \beta_5 TFPG + \beta_6 EG + \varepsilon \quad (9)$$

where YG, DomKG, FDIG, ODAG, LG, TFPG and EG are annual economic growth rate, domestic capital stock growth rate, FDI capital stock growth rate, ODA capital growth rate, labor growth rate, TFP growth rate and export growth rate, respectively. ε is the error term. Export is included in the traditional growth equation since many previous studies has found the significant positive relation between export and growth in Vietnam in Doi Moi period. Empirical studies also suggest that export is frequently being regarded as variable likely stimulated by FDI. The data used is from 1986-2002. The data for capital stock and TFP is taken from the estimation in section 4.

The result of OLS estimation is as follows:

YG=	-0.014	+0.125DomKG	+0.134FDIG	+0.045ODAG	+0.230LG	+0.229TFPG	+0.052EG
t-stat	(-0.01)	(4.65)	(7.47)	(3.69)	(0.89)	(7.86)	(3.54)

Adjusted R-squared: 0.98 Durbin-Watson: 1.51 Prob(F-statistic): 0.000

As the result shows, the test statistics are appropriate for statistical interpretation. The focus variable, namely, FDI variable shows significantly positive relation with growth. If FDI increases by 1%, GDP will increase by 0.19%. TFP growth is also an significant source of growth at any confidence level. In term of the size of coefficient, FDI growth and TFP growth are the most contributable factor for growth in Vietnam since Doi Moi policy. This finding seems to correspond to the belief that FDI was the engine of growth for Vietnam's economy for the ending decade of last century.

The robustness of the regression is confirmed by sensitivity analysis. When economic growth, capital accumulation growth, labor growth and export growth are controlled, the size and significance level remain in appropriate range. Thus, the result is highly reliable for the indication of significantly positive relation between economic growth and the growth of FDI capital inflows.

Table 10. Sensitivity Analysis of Growth Equation

Variables Controlled	Coefficient of focus variable	t-stat	Significance
Basic Model	+0.134	7.47	1%
All	+0.145	5.12	1%
All except TFPG	+0.122	5.78	1%
TFPG	+0.238	4.18	1%
DOMKG	+0.056	2.57	1%
ODAG	+0.120	3.87	1%

Note: OLS regression was performed on the restricted model

The above analysis has shown that FDI inflows in Vietnam have not only contributed to capital accumulation but also on economic growth. Even the mechanism of how FDI supplemented domestic investment and contributed to economic growth was not clearly identified, the robustness of both results seems to correspond to the increasing importance of FDI in economic growth in Vietnam. It is widely agreed that FDI has been a factor contributing to the more efficiently utilization of idle domestic resources for growth.

6. Conclusion.

This study is a pioneering study in estimation and decomposition of capital stock in Vietnam. Employing the new methodology, capital stocks was estimated through an iteration process. The result of estimation is highly consistent with the actual trends in development process of the economy. It is also comparable with other studies.

Growth accounting approach was utilized to investigate the contribution of factors of production to growth. It found that TFP growth and capital accumulation was the main contributors for growth of the economy during 1986-2002 period. However, the country seems to be more capital-intensive in the later period. The contribution of FDI to growth was estimated to be about 7% out of 37% total contribution of capital accumulation on growth. The result also showed that the contribution of domestic capital accumulation was higher in later period. It might be a sign of positive impact of FDI inflows to domestic investment.

Such conclusion was confirmed by regression analysis on investment equation. FDI was found to be significantly correlated with domestic investment. Cointegration techniques and error correction model was employed to evidence both short-run impact and long-run equilibrium of relationship between FDI and domestic investment. The positive relationship between FDI and economic growth was further analyzed by estimating growth equation. FDI is found to be significantly positive relates to GDP growth rate. Sensitivity analysis was performed to confirm the robustness of the results.

The results of this study might be a good reference for future studies on the relationship between FDI and growth. However, it suffers from at least two considerable drawbacks. First, the quality of data and sufficient length of time-series. The study has utilized various sources of data, thus consistency of data might be questionable. The short time-series of 17 annual observations from 1986 to 2002 though acceptable for statistical analysis, the problem of degree of freedom may draw concern. Second, the methodology of statistical analysis. It is more valuable if the causality test was performed on the relationship between FDI, domestic investment and economic growth. Given the few observations, such limitation can be overcome in the future by availability of better dataset.

In conclusion, the result of this study has strongly indicated that the promotion of FDI is crucial for economic growth sustainability in Vietnam. Government should devise an implementable strategy for a resurge of FDI flows into Vietnam. The new wave of FDI inflow into Vietnam is needed for the realization of industrializing the country by the year 2020.

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