THE IMPACT OF TECHNOLOGY SPILLOVER FROM FOREIGN DIRECT INVESTMENT ON ECONOMIC GROWTH: EVIDENCE IN VIETNAM

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Abstract

This study aims to provide an empirical research of FDI spillover effect in Vietnam province level. The frameworks of the spillover effect of FDI, which follow the past studies (Alfaro, 2004) and (Alfaro, 2009), describe the effect of FDI on economic growth of each province. The Dixit-Stiglitz aggregator in the intermediate goods market is used as same as product variety model, which is used in Romer's study (1992). The main purpose of those studies is that showing FDI can have a negative effect on province economic growth because of the gap between domestic technology level and foreign technology level. The co-integrated effect between FDI and productivity perform their positive significant on economic growth. The empirical results are conducted by using Different-General Method of Moments (GMM) (Blundell and Bold, 1998) and Fixed effect GLS (Fixed-EGLS) (Wooldridge, 2010) with Vietnamese provinces panel data. Those two methods, which are recently used by many researchers, are highly recommended in this study. Before policy makers apply researcher's suggestions for their country's economy, understanding FDI spillover and its effect on economic growth are very importance. The empirical evidence for a positive spillover effect on growth is very important.

Keywords: FDI, FDI spillover, FE-GLS, GMM, Growth.

JEL Code: F23, M16, O16, P23

1. Introduction

Over the last decade, the trend of global business has taken lead in MNEs strategies. The business environment around the world had also rapidly followed the globalization as early as possible. Thus, many economists have focused on Foreign Direct Investment (FDI) and its causality effect in host countries' economic growth. In the past, researchers recognized FDI as an important economic sector among three information. First, FDI had been rapid growth in global

environment since the late 1980s. Second, there was a sudden appearance of a large volume of FDI into the U.S, where was the most attracted FDI in the world. Finally, during the 20ᵗʰ century, the majority of the developing economies were effectively shut out of the international capital markets as over debt and a belief system that the unbalanced between foreign capitals and domestic capitals caused the financial crisis in Asia in 1998. Thus, this financial constraint, particularly severe for the heavily indebted countries, the growth diagram quickly transformed in a sharp decline in investment and growth rates figures in their economy. This results contributed the importance of FDI as a roof for liquidity of capital flows from the LDCs.

In the literature, many studies use cross-country regressions to find implication correlation between FDI and a variety of economic variables. All of the national account variables are used to explain its significant on FDI. The neoclassical growth model, which extend by Mankiw et al, (1992), are also applied to the theoretical model. However, there are very few of them confirm the relationship between FDI and economic growth in developed country and the results are very mixed in developing sides. Economists have a strong belief on a significant of FDI to domestic country growth in developing sides (Driffield et al., 2016; Dawid & Zou., 2017; Fatima., 2016; Gönel & Aksoy.,2016). But most studies capture the very mixed results about this correlation, however, their findings consistently support for positive growth rate on FDI effect with some thresholds condition as productivity level, financial development level. This study has a procedure consistently with others investigators, who have considered only a small number of explanatory variables at a time to overcome the problem of heteroscedasticity. Moreover, we are advantaged to apply our research as provinces level, which implies that the effect of MNCs technologically transfers to the domestic firms have a restricted condition on province barriers.

We choose our evidence as Vietnamese provinces level at the time from 2006 to 2011 by some criteria, such as developing the country with big market size, many provinces or area, high growth rate, focus on the provinces have a high frequency of FDI inflows. Therefore, Our case becomes imperative to examine whether variables can have most confidence and, if so, how correlation reached by the province level data of growth regressions. We expect to find a directly strong significant of FDI and an indirectly positive significant of the interaction variable between FDI and PRODUCTIVITY on economic growth in province cases rather than cross-country level. Earlier applications of this kind analysis may be found in the literature, which is used pool

OLS and pool 2SLS with growth rate as FDI is instrumental variable (IV). We use Fixed Effect GLS also to warrant that the effect of the financial crisis in 2008, which exists in the dataset, are none of any presence in our regression. I also concerned the confidence of variables in terms of their likelihood of being correlated with FDI by assigning each of them a level of confidence, following Sala-i-Martin's (1997)'s study on growth. The finding is robustness and supports the advantages of GMM and GLS to overcome the different variances between objects.

The previous study's models, theories, implications, and methodologies will be pointed in the next part. The third part will work on empirical results. The last part in this papers is the conclusion.

2. Literature review and methodology

2.1. Foreign Direct Investment, Economic growth, and others variable.

In the two journal papers, (Alfaro et al, 2004) and (Alfaro et al,2009) describe very clearly. How technological transfer to developing countries via international capital inflow? Even though, those paper explain the same effect of FDI on the growth of the host country by interaction effect of foreign capital inflow and financial development to the host country's productivity. But the two journals are totally divergent in terms of the channels that FDI broadcast their technological transfer. In (Alfaro et al, 2004), authors describe and give proof that the technological transfer from foreign firm's human capital to domestic firms as bleeding of intelligent. Beside of that, they describe another mechanism in 2009, which name is backward linkages. Thus, the two journals are very good literature when we conduct the research relative to FDI as country level panel data.

See in (Alfaro and ate, 2004). They found in the literature that attracts more FDI streams will increasing growth because FDI has several positive effects which include productivity gains, technology transfers, and also managerial skills and know-how, employee training, international production networks, and access to markets in developed countries. Author's assumptions are that an economy which individual will have two choices to work for foreign firms or work for their all company. In the papers, they promote a threshold for those individuals, who gain the advantages by work with foreign capital streams to start up as entrepreneurship. Eventually, individuals can increase the domestic productivity by bleeding of intelligent as domestic employees move from foreign to domestic firms. In this both cases, FDI can play an important

role in modernizing the national economy and promote growth. However, authors mention the effect of limited access to credit markets restricts entrepreneurial development. They find that higher financial costs reduce the number of entrepreneurs. Conversely, an improvement in the efficiency of the financial sector tends to reduce the threshold level of entrepreneurship thereby leading to an increase in the number of entrepreneurs in society. The interaction effect of FDI inflows and financial development, which they used to advantage, will be not investigated in this study. We strongly believe that the role of the local financial market is very importance to research at countries data level. But it will be less evidence for a difference financial development level from provinces to others within the same country. This study assumes that there is no difference in financial development level within the same country. To the extent that FDI brings with its knowledge spillover which increases total factor productivity. Their model allows us to understand how FDI will impact output in host country's economy, and how this effect depends on the local financial market conditions. It increases the output produced in the FDI sector and also causes the output to go up in the domestic sector. There are essentially two effects working here. First, an improvement in the province's productivity increases the number of entrepreneurs in society. An increase in the number of entrepreneurs raises the marginal product of FDI since the two are complements. Second, there is a negative directly effect of the inflation on the amount of foreign capital stock. Overall, higher efficiency of the local markets raises the social marginal product of foreign capital in the domestic sector. Therefore, I will consider the interaction effect between FDI and provinces level productivity as variables in my model, which are a positive effect on growth, If overall Vietnamese financial development level affords to support technological transfer.

See in (Alfaro al et, 2009), Their study contribute again the new mechanism to explain the financial development role and promote the others research good empirical results. Besides of macroeconomic theory of model, their study contributes one more approach conduct by the microeconomic foundation and give the more strongly confident results. In terms of the micro empirical evidence, most of the studies using firm-level panel data to find no effect of the foreign presence or they find negative productivity spillover effects from multinational enterprises (MNEs) in the developing country firms. Positive spillover effects are found only for developed countries. This means the externalities from FDI will manifest themselves through forwarding or backward linkages, i.e., contacts between domestic suppliers of intermediate inputs and their

multinational clients in downstream sectors (backward linkage) or between foreign suppliers of intermediate inputs and their domestic clients in upstream sectors (forward linkage). Base on this divergent of host country characteristics, authors build a new hypothesis to solve this issue. The hypothesis is that the mechanism depends on the extent of the development of the local financial sector and use both micro and macro empirical evidence. they use the model to quantitatively gauge how the response of growth to FDI varies with the level of development of the financial markets. Their assumption is the open economy with small size, only two firms in industry. As same as, the product variety endogenous growth model (Romer, 1994), they use Dixit-Stiglitz aggregation to perform the economy. The two kind of firms is the difference in terms of their production (final good sector & intermediate good sector), local (foreign MNCs & host or domestic), the range of capital input (high & low). Romer contributed this model by using micro foundation to explain the macroeconomic output growth in 1994. Alfaro al et (2009)'s study treats the MNCs, who produce final goods, are the monopoly by their advantages in technology, finance, and networks. As with product variety endogenous growth models, the rate of expansion in the range of intermediates is the driver of economic growth. By that assumption, the entrepreneurs in the host country tend to produce the intermediate goods rather than competitive with MNCs. Hence, they still need to big budget to invest the technology for producing intermediate goods. The more developed the local financial markets, the easier it is for credit constrained entrepreneurs to start their own firms. But they have no discussed on R&D sector, which contributes in Romer's research. Their study contributes a framework and evidence for other researcher work on empirical research.

2.2. Product Variety product model

In product variety model, Romer (1994) contributes the price of innovation for the domestic firms, which want to transform from final goods sector to intermediate sector. There are three sectors are assumed to present in the economy. They are final good sector, intermediate sector, R&D sector. The final good sector, who use all of the *L* workers and merge the intermediate goods, produce the final goods and also measured by total output. The Final goods equation, which given by Romer is that:

$$Y = L^{1-\alpha} \sum_{j=1}^{A} (X_j)^{\alpha} = L^{1-\alpha}(X_1^{\alpha} + X_2^{\alpha} + \cdots + X_A^{\alpha}) \qquad (E.1)$$

And final goods producer maximizing their profits:

$$\max_{X} \prod{}^{F} = L^{1-\alpha} \cdot \sum_{j=1}^{A}(X_j)^{\alpha} - \sum_{j=1}^{A} P_j^* X_j \qquad \text{(E.2)}$$

On the other hand, FDI inflows will cause strong competitors to domestic firms as known as MNCs. The domestic firms have no chance to compete. Thus, they have to change to produce the intermediate goods otherwise go bankrupt. These papers treat the final goods sector come from both international and host countries at the time of open-economy(t=0). The country's growth rate is assumed to negative at t=0 (first period). The story is that all the domestic firms must lose money by sharing the market with MNCs. Thus, they will treat the intermediate goods as their priority because they must to join this market rather than compete with MNCs and lose everything. This is called fluctuation effect between MNCs and domestic firms. At time t=1, MNCs and domestic firms comove and gain from the bigger market share (MNCs's network) in the second period. The country's growth rate is assumed to positive at t=1 (second period). Besides of that, they have to face to innovation as the requirement of new technology. The intermediate sector will buy the patents from R&D sector. Most of the case in developing country, domestic researcher's patent fail into full-fill the technology demands at the beginning of technology transfer process. Thus, the final goods producers, who are MNCs, also in charge of the role of patents suppliers. When the giant number of firms need their budget to new technology, the more developed financial market will raise the economic wings by reach the advantages from MNCs. Final goods sector equation (Romer,1992), therefore, written as:

$$X_j = \left(\frac{\alpha}{P_j^*}\right)^{\frac{1}{1-\alpha}} \cdot L \qquad \text{(E.3)}$$

Because of no labor in used and the MNCs are a monopoly in this sector by the patent. The intermediate sector profit function:

$$\prod{}_{j}^{A} = (P_j^* - 1) \cdot X_j(P_j^*) \qquad \text{(E.4)}$$

With P_j^* is the price of the intermediate goods or the summarize between price of the patent in each intermediate product (marginal cost) and expected profit from intermediate goods producer. According to "mark-up pricing" phenomenon, the intermediate goods producer will set up a higher price (P_j^*) than the patent value/produce (P_j). Hence, we know that $X_j(P_j^*) = A$ can become indicator of the state of technological knowledge (Romer. P, 1994). Finally, The equation (E.1) can write as:

$$Y^* = A\alpha^{\frac{2}{1-\alpha}} \cdot L^{2-\alpha} \qquad \text{(E.5)}$$

The last sector, The R&D sector are described that they are firms come from the host country in Romer's research and have not been concerned in (Alfaro al et,2009)'s research. This study gives an assumption for R&D sector that the host country does afford to produce any of patent. The intermediate sectors will have to repurchase the patent, which valued in time equal T years, from the MNC's R&D department. This assumption allows us to separate the FDI inflow into two parts. First, the physical capital, which is used to pay wages of labor and rent the fixed asset ($K^{FDI} = L$). Second, the technological knowledge, which are total value of patents, transfer to the intermediate goods (P_j*total price of patent value in stocks of intermediate goods). Because of the fluctuations changing of the domestic firms (from final goods sector to intermediate goods sector) and take time for this intermediate sector to adapt new technology and take into their main roles. Thus, the economy growth will take downward in short-term by the downward volatility effect from the negative revenue of intermediate sector by purchase the patents, the high installing cost for the new technological process at the beginning. After the firms adapt and is ready to earn profit from new technology by supply the intermediate goods, which produce by MNCs' patent or requirement. The economic growth become upward in long time by productivity level is enhanced. All of the domestic firms will assume to tend produce intermediate goods. Therefore, FDI inflows are in charge a very importance roles to cause economic growth by both direct effects and interactive effect via technological knowledge.

2.3 Databases and methodology:

The databases are collected from 41 cross-sectional provinces in Vietnam, which the year from 2006-2011. Variables are that: $GROWTH_{it}$: real economic growth of province i, at time t; FDI_{it} is the FDI inflows to province i, at time t; $PRODUCTIVITY_{it}$ is the productivity level at each i province; at time t; $INFLATION_{it}$ is the price level in within province i, at time t. Thus, the sample size equal to 984 observations.

There is a small number of study concern the relationship of FDI on economic growth at provinces level. There are many data use pool OLS and pool 2SLS for the data in the literature to apply to panel data. However, the sample contains the year 2008, which is known as "global financial crisis", are an advantage in this study. We expected that there is an econometric model can overcome or exclude the effects of 2008 financial crisis. If the effect from financial crisis exists in the databases. It will cause bias on the estimators and its standard error. Because the

economy variables will be stability and high growth rate before the financial crisis, but its volatility will be more stochastic and take downward in financial crisis time. Our prior is that using a time dummy variable detect them year by year. Thus, this study applies Fixed effect GLS (Fixed-EGLS), which are discussed in Wooldridge's textbooks "Econometric analysis of cross section and panel data" in 2010. Wooldridge's textbook discussions about FE-GLS, which is applied to panel data, is a methodology allow us to consider the difference in time variance effect by co-operating GLS and a time weight matrix.

The GMM methods are the last model in this study. Results of system GMMs by Blundell and Bold (1998), which are explained in their paper that the importance of initial condition information in generating efficient estimators for dynamic panel data models, where the number of time series observations is small. The GMM methods allow the researcher to use the weight matrix, which considers the main equation and its moment conditions and also optimizes the weight matrix. We observe the initial values to obtain the system that under certain conditions can be consistently proxy for GLS with the add-in dummy variable for the time period. The hypothesis of the dummy variable is that there is time period affect or it is not fixed. Thus, we can expect the system GMM's S.E of regression is small and good robustness model. System GMMs performs better than 2SLS in case that using the lagged term as instrument variable are high correct than the others IV. Because system GMMs allow us to exclude the effect of endogenous explanatory variables and also auto-correlations effect (Blundell and Bold, 1998).

The empirical results of Pool OLS, 2SLS, FE-GLS and System GMM models will be compared in terms of estimator's standard error and how it is fixed to the theoretical model.

3. Empirical results

Our model is the regression function, where FDI and the others variable are explanatory variables of economic growth regression. There is the interaction variable between FDI and productivity level, which are representative for technological transfer in Romer's theory. Growth regression is known as:

$$GROWTH_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 PRODUCTIVITY_{it} + \beta_3 FDI * PRODUCTIVITY_{it} + \beta_4 INFLATION_{it} + u_{it} \quad \text{(E.6)}$$

Both Pool OLS and FE-GLS will be apply using Equation (E.6). For Pool 2SLS, we use FDI as the instrument variable. The empirical results are shown in Table 1:

Tab. 1: Estimation results

	Pool OLS	Pool 2SLS	Fixed EGLS	System GMM
C	184.1458**		171.0202***	
	(80.5967)		(58.57754)	
FDI	0.070631**	0.072930**	0.0807***	-0.310541***
	(0.031029)	(0.031382)	(0.022290)	(0.065308)
PRODUCTIVITY	52.05747**	68.61701***	21.60328**	731.3688***
	(20.04641)	(18.85368)	(9.938242)	(59.30673)
FDI*PRODUCTIVITY	-0.004019	-0.005093	0.0086***	0.013902***
	(0.004265)	(0.004276)	(0.002924)	(0.004125)
INFLATION	-9.738091*	-0.065339	-7.081899*	-16.00927***
	(5.279891)	(3.184371)	(4.023207)	(5.974761)
GROWTH (-1)				-0.617542***
				(0.016234)
DUMMY(2008)				250.9559***
DUMMY (2009)				405.1739***
DUMMY (2010)				191.6993***
	Pool OLS	Pool 2SLS	Fixed EGLS	System GMM
DUMMY (2011)				153.0625***
				(37.22033)
R^2	0.092489	0.072819	0.343608	
S.E of regression	519.5664	524.0809	483.1258	419.5522

Note: * is significant at 10% level; ** is significant at 5% level, *** is significant at 1% level

Pool 2SLS's IV function is that: $FDI_{it} = \beta_0 + \beta_1 PRODUCTIVITY_{it} + \beta_2 INFLATION * PRODUCTIVITY_{it} + \beta_3 INFLATION_{it} + u_{it}$

System GMM use the GROWTH at lagged 1 as instrument variables (IV)

Empirical results show us the better outcome of Fixed EGLS methodology than the other two methods. By watching at Table 1, we can capture the unreasonable in both pools OLS and 2SLS outcome in terms of their estimator and estimator's standard error. The standard regressions are also high, which imply there is no heteroscedasticity in time variance in the sample. According to Wooldridge's textbook; Fixed EGLS is advantage method to capture and exclude the effect of heteroscedasticity. Further, the goodness of fit in FE-GLS outcome also gives the consistent conclusion. The FDI is found to have a positive strong significant level to economic growth, which is explained that the domestic firms are adapt the new technology and earn a profit on the intermediate sector's roles. This implication is very contradiction, weakly supporting evidence and rarely happen in an emerging market as Vietnam. This finding will be true If and only If both financial development level and productivity level in Vietnam are as high as enough to afford economic growth. In 2009, Alfaro's research concludes the same results but in the case of US data. However, we can conclude that FE-GLS well performances to exclude the financial crises effect out of the dataset without any reasonable explanation on this statement. GMM method's result performs the lowest regression standard error but the high value of estimator on PDT variable with strong significance are more robustness. Too high in term of standard error can associate for some omitted variables, which absent from regression equation. The result of FDI variable's parameter is -0.310541 is consistent with other findings in emerging market studies. It is very hard to say that system GMM are better than FE-GLS and the opposite too by their performance.

The empirical results also describe very well the variety product model of Romer, which we determine in literature. First, FDI gives an effect to economic growth, which implies the roles of FDI as a final good sector in the economy. MNCs use their physical capital to pay a wage for host country's labor force. PRODUCTIVITY is strongly significant to growth, imply for the intermediate sector, who is local firms and promote economic growth by supply intermediate good for MNCs. This result contributes a good evidence for technological transfer from MNCs to local firms, which proof by the interaction effect of FDI via PRODUCTIVITY on economic growth. However, we cannot provide the evidence for the support of finance development as same as Alfaro's work in province data level. Thus, the negative effect of INFLATION to growth only imply the importance of price level's stability in our function.

Conclusion

First, this study success to use FE-GLS and GMM methods to proof the strong significant effect of FDI inflows on economic growth in developing countries as same as previous researcher's work (Alfaro, 2009), but different in purpose. This signal is very lack from the previous literature, developed cases, cross-countries cases. Second, our model, we contribute a new assumption that the patents to produce the intermediate good are global high-technological in developed countries. In other hands, R&D sector also comes from external rather than internal of Romer's assumption, which supports us the new ways to detect for technological knowledge transfer and how it is the effect on economic growth. Third, our findings support for the FE-GLS and Dummy time period-System GMM model's power, which is usually used to make weakness the bad effect of differencing in time variance for panel data, (Wooldridge, 2010). Policy makers, whose responsibility to enhance developing country have also kept hard working for stabling price level in their countries. For country level, financial development has been treated as a prior sector to build up in developing countries, as same as we discuss in literature, strongly and the healthy financial market will promote entrepreneurs, productivity level, and growth, (Alfaro, 2004). This research can be more robustness If we add more good reasonable variables or expand the sample size.

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