

The role of Patent on Foreign Direct Investment: Evidence in Vietnam

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Abstract

Purpose: In the period of international integration, how is the implementation of intellectual property regulation in developing countries? Do intellectual property rights help attract more Foreign direct investment (FDI)? This study aims to show the effect of intellectual property rights, reflect in the number of patent registered (Patent distribution into two components: Patent_residents and Patent_non-residents) on FDI attraction in Vietnam. **Research design, data and methodology:** Using Autoregressive distributed lag (ARDL) model for the data collected from 1990 to 2018 with EViews version 9 software. **Conclusions:** The results indicate that the number of patent protection has a positive effect on FDI in both short term and long term. In particular, only patent registration of foreign individuals and organizations has a significant positive effect on attracting FDI, while that of Vietnamese patents is not statistically significant. From the results of this study, we provide some recommendations to help attract FDI based on raising awareness of intellectual property rights: Increase international cooperation for innovation to learn and encourage patent; Improve the capacity of inventing as well as the ability to register patents of Vietnamese people; Government agencies are tasked to support a nd review registration procedures; Encouraging patent registration based on the patent.

Keywords : Autoregressive distributed lag, ARDL model, Foreign Direct Investment, Distribution of the patent

JEL Classification Code: A14, F15, F43

1. Introduction

FDI plays an important role in Vietnam's socio-economic development. Overall, FDI enterprises contribute about 23.55% of the aggregate social investment (accounting for nearly 20% of GDP) in 2019. FDI helps create more jobs for the local economies that receive the capital, and raises income levels of the host country (Ho, Bui, Nguyen, Dao, & Nguyen, 2020; Nguyen, Dao, & Bui, 2014, Nguyen, Nguyen, Nguyen, & Vu, 2017). At the same time, FDI helps improve transport infrastructure in the area

of FDI projects, and provides access to cutting-edge technologies that can be transferred from investors to receiving countries (Gui-Diby, 2014; Nguyen et al., 2014, 2017; Tang & Tan, 2015). FDI enterprises are better positioned to compete in the market of developing countries (host countries) than are domestic enterprises. Therefore, for FDI investors, investment decision in these countries will help them reduce risks from local competitors (Pfister & Deffains, 2005). Over the past few years, Vietnam has seen continuous increases in the inward flows of FDI and the trend will keep up in the coming years. In order to take full advantage of this, Vietnam needs to have sound attraction policies to ensure stable investment flows. One of the critical factors that FDI investors are concerned about in developing countries is patent registration.

For developing countries like Vietnam, participation in global or regional economic communities will bring great challenges in terms of intellectual property rights and patent protection. The development of an improvement in areas of patent protection will help reduce barriers to

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participation in trade organizations. Nonetheless, in Vietnam the awareness and implementation of patent registration in general are still limited, especially in domestic sector. This lack of awareness has led to plenty of disputes and copyright violations over the decade. Currently, the domestic patent rate of Vietnam is only about 10% (about 700 inventions) of the total number of patents granted at the National Office of Intellectual Property to enhance the innovation index. Therefore, in the current and future periods, it is essential for policymakers and business leaders to raise awareness and promote activities related to intellectual property rights.

There have been a few studies by scholars around the world indicating a relationship between patents and FDI attraction. In particular, several studies show that patents play an important role in promoting FDI inflows (Seyoum, 2006), while others demonstrate that on average, patent rights exert only a negligible influence on the location choices, the effect of patents reduces the possibility of investment in that country (Pfister & Deffains, 2005). Research results are mixed and contexts vary in regions. In Vietnam, there has yet a particular study to assess the influence of patents on foreign direct investment. Therefore, this research aims to shed light on the relationship focusing on FDI inflows into Vietnam from 1990 to 2018.

2. Literature review

Invention is a technical solution in the form of a product or a process aimed at solving a specific problem based on application of laws of nature. Inventions are protected exclusively by mode of grant of invention patent or utility solution patent. Inventions are protected by mode of grant of invention patent if they fulfill the following requirements: being novel, involving an inventive step, being capable of industrial application. Inventions are protected by mode of grant of utility solution patent if they are not common knowledge and meet the conditions of being novel and capable of industrial application. All countries have their own patent rights protection measures which are intended to protect property of applicants and ensure the enforcement of patent-related activities (Alexiou, Nellis, & Papageorgiadis, 2016; Yang & Sonmez, 2013). Each protected patent shall be effective in certain scope and time in accordance with patent law (Alexiou et al, 2016). However, each country is subject to a different legal regime regarding patent protection. In particular, some countries impose stringent legal systems of patent regulation and enforcement, while others adopt lower standards than the general rule (Seyoum, 2006). The Paris Convention is considered to be the first international

standards when publishing the minimum set of rules on patent protection by the World Intellectual Property Organization

Foreign direct investment (FDI) refers to the flow of capital from the investor's country to a host country (capital can be cash, assets, or technology) in order to gain profits for enterprises. Due to the change in business environment, foreign enterprises will be faced with cultural differences or issues related to copyrights and patent rights in the host country. Intellectual property or patent rights help promote a nation's scientific and technological developments; furthermore, patent plays an important role in attracting FDI flows into developing countries (Seyoum, 2006). At the same time, countries with better technological capacity tend to attract more FDI (Kogut & Chang, 1991). Additionally, FDI not only benefits investors but also helps receiving countries to accelerate innovation activities in their industry (Dunning, Kim, & Lee, 2007). Increase in the number of patents in host countries will make the transparency of information and copyrights even better. As such, greater awareness of patent infringement will reduce business's concerns over the issues of copyrights and/or patent rights. That the patents of FDI investors are better protected in host countries reassures them of a safe and stable investment environment (Cantwell, 1989, 1995)

3. Method

3.1. Research model and hypothesis

Following Seyoum (2006), Pfister and Deffains (2005), và Alexiou et al (2016), we propose a research model as follows:

$$\Delta FDI_t = \alpha + \sum_{i=0}^n \beta_i \Delta FDI_{t-i} + \sum_{j=0}^k \beta_j \Delta Patent_{t-j} + \gamma_1 Patent_{t-1} + \varepsilon_t$$

Where variables of interest are described in Table 1.

The research hypothesis is presented as follows:

The patents registered in Vietnam are divided into patents registered by residents and those by non-residents. The number of patents registered annually will provide information to FDI investors. These signals are reviewed and serve as foundations for investors' decisions based on their desires of protection of patents related to their businesses and/or general situation of patent protection in Vietnam. When they are aware of the country's good practices of patent protection and compliance with intellectual property rights, these FDI investors will be more ready to invest in Vietnam (Seyoum, 2006; Kogut &

Chang, 1991). Therefore, the research hypothesis is proposed as follows:

H1: The number of patents registered has a positive effect on FDI flows into Vietnam

Table 1: Definition of variables

Variables	Definition	Expected	Reference
Distribution of patent: Patent- residents Patent – nonresidents	The number of patents registered by residents and non-residents	+	Seyoum (2006); Pfister and deffains (2005)
FDI	The annual FDI flows into Vietnam	+	Seyoum (2006); Pfister and deffains (2005)
Δ Stationary variables, t-i, t-j denotes the lagged variables, respectively.			

Source: Authors' collection

3.2. Data analysis

Data on the variables used in this study are collected from 1990 to 2018 on the WorldBank database for Vietnam (Data.worldbank.org), then encoded and input into EViews software (version 9) for analysis. Techniques used for statistical analysis include:

3.2.1. Stationary test

As the data are in time series form, before analyzing we conduct stationary tests to verify whether a series is stationary. The ADF unit root test is employed and the p-value of unit root test less than 0.05 (the significance level of 5%) indicates stationary variables (Gujarati & Porter, 2009; MacKinnon, 1996; Nguyen et al., 2016; Ramanathan, 2002). In case the variables have not achieved stationary, we will take the difference and test again until these variables are stationary. ADF test is described as follows:

$$\Delta Y_t = \alpha_o + \beta Y_{t-1} + \sum_{j=1}^k \varphi_j \Delta Y_{t-j} + \varepsilon_t$$

In which:

$$\Delta Y_t = Y_t - Y_{t-1}$$

Y_t : data series over consider time

k: the length of lag

Testing hypothesis:

$H_0: \beta=0$ (Y_t is not stationary)

$H_1: \beta<0$ (Y_t is stationary)

3.2.2. Long-run relationship test

For economic variables, regression analysis needs to consider both short-term and long-term relationships (Mankiw, 2006). The variables after taking difference will be examined for short-term relationships (Gujarati & Porter, 2009; Nguyen et al., 2016; Ramanathan, 2002), and those do not will be tested for long-term relationships. However, before considering the variables for analysis, Johansen test is conducted to find out whether cointegration (long-term relationship) exists between the variables or not. In case the Johansen test indicates existence of long-term relationships among variables, the regression analysis will consider these possibilities. On the contrary, if there is no evidence for long-term relationships among variables, the regression analysis only considers the short-term ones (Johansen, 1995)

3.2.3. Optimal lags selection

Time series data often find impacts of lagged independent variables, so this study also conduct tests to determine the optimal lag through VAR (vector auto regression) model. AIC criteria will be selected to determine the optimal lag length (Ho et al., 2020; Nguyen et al., 2016; Nguyen et al., 2014; Ozcicek & McMillin, 1999)

3.2.4. Regression analysis

To examine the effects of patent on FDI and GDP, linear regression model will be employed with the dependent variables being FDI and GDP, respectively. The ARDL model is considered appropriate for this study when analyzing time series data and evaluating both short-term and long-term relationships (Gujarati & Porter, 2009; Ho et al., 2020; V. D. Nguyen et al., 2014). After obtaining results from the ARDL model, we continue to evaluate those results against the assumptions of of auto-correlation and heteroscedasticity. Significant tests then allow us to rigorously analyze the effect of patent on FDI.

4. Results

4.1. Descriptive results

Table 2 shows that the average number of patents registered per year is 207 with the maximum being 646. For patent –nonresidents, the average is 1328 and the largest is 5425. It is shown that the number of patents varies greatly between residents and nonresident. The average annual FDI is about 4.99 billion USD

Table 2: Descriptive results

	PATENT-Nonresidents	PATENT_residents	FDI(USD)
Mean	2081.172	207.7241	4.99E+09
Median	1328	103	2.22E+09
Maximum	5425	646	1.55E+10
Minimum	17	22	1.80E+08
Std. Dev.	1605.091	206.6802	4.66E+09
N	29	29	29

Source: The results from EViews software

4.2. Stationary test

Stationary test's result in Table 3 indicates that all of the variables are not stationary but their first difference forms are stationary. Therefore, the first-order difference of variables will be used in the analysis of optimal lag selection as well as the regression analysis.

Table 3: The result of unit root test (stationary test)

Variables	ADF-test	p-value
Patent_residents	1.437	0.999
Patent_nonresidents	2.519	1.000
FDI	-2.204	0.210
1st different		
Patent_residents	-5.063	0.000
Patent_nonresidents	-4.432	0.002
FDI	-3.940	0.006

Source: The results from EViews software

4.3. Long-run relationship test

Table 4: The result of Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value 0.05	p-value
None *	0.732037	58.089	47.85613	0.0041
At most 1	0.44007	23.850	29.79707	0.2069
At most 2	0.254828	8.7715	15.49471	0.3869
At most 3	0.042307	1.1239	3.841466	0.2891
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: The results from EViews software

The result of cointegration rank test shows that there exists at least one long-run relationship (p-value of 0.0041

less than 0.05 as strong evidence against null hypothesis). Therefore, long-run relationship will be considered in ARDL regression analysis.

4.4. Optimal lags selection

The result in Table 5 indicates that the variables are related to each other at the lag of zero (immediate effect felt within the year of the change). Therefore, in regression analysis, the lag of zero are defined optimal to be used for analysis.

Table 5: The result of lag selection criteria

Endogenous variables: D(PATENT_NONRE) D(PATENT_RES) D(LFDI) D(GDP)						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-308.3	NA*	2359*	26.02*	26.22*	26.07*
1	-298.7	15.10	4143	26.56	27.54	26.82
2	-286.9	14.71	6705	26.91	28.68	27.38
3	-269.2	16.25	8360	26.77	29.32	27.44
4	-246.3	13.38	11350	26.19	29.53	27.07
* indicates lag order selected by the criterion						

Source: The results from EViews software

4.5. Regression analysis

The regression results for both short-term and long-term relationships are robust to autocorrelation and heteroskedasticity as the p-values of the tests are both greater than 0.05. Between the two components of patent, we only find the significant and positive effect of the number of patents registered by non-residents on FDI inward flows in short and long run at the 5% level (the coefficient on patent-nonresidents > 0 and p-value < 0.05). The coefficient for the number of patents registered by residents, however, is found insignificant as p-value much greater 0.05. Overall, these results provide support for our research hypothesis, based on the data, stating that the number of patents registered contributes to FDI attraction into Vietnam. Increase in the amount of patents help protect businesses better. Also, as production of counterfeit goods is discouraged and reduced, foreign enterprises will be less worried about competing with those steal their inventions.

The analysis results show that the patent registration in Vietnam is only significant for the patents registered by non-residents or foreigners. Patent registration by Vietnamese people does not directly translate into promoting FDI flows into Vietnam. It can be observed that the number of Vietnamese patents is much more limited, about 10 times fewer, than that of foreign patents

registered in Vietnam. Such a small number has resulted in the unclear effect of domestic patent registration on FDI attraction. However, the number of patents in Vietnam registered by foreign individuals / organizations also helps FDI investors to consider and conduct investment in Vietnam. This finding also suggests the issue of international cooperation in terms of science and technology in the current period, which is beneficial for Vietnam in attracting FDI in general and for learning experiences on innovation as well as intellectual property protection.

Table 6: The result of regression

ARDL Cointegrating And Long Run Form				
Dependent Variable: ΔFDI				
Selected Model: ARDL(1, 0, 0)				
Sample: 1990 2018				
Included observations: 27				
Cointegrating Form				
Variable	beta	Std. Error	t-stat	p-value
ΔPatent_residents	-0.0006	0.0018	-0.365	0.7179
ΔPatent_nonresidents	0.00049	0.0002	2.298	0.031
CointEq(-1)	-0.729	0.1792	-4.068	0.0005
Cointeq = D(LFDI) - (-0.0009*D(PATENT_RES) + 0.0007 *D(PATENT_NONRE) + 0.0131)				
Long Run Coefficients				
Variable	beta	Std. Error	t-stat	p-value
ΔPatent_residents	-0.0009	0.0024	-0.377	0.7091
ΔPatent_nonresidents	0.00068	0.0003	2.151	0.0422
C	0.01311	0.1079	0.121	0.9044
Autocorrelation test	0.9066			
Heteroskedasticity test	0.0626			

Source: The results from EViews software

At the same time, the analysis results also show the impact of both short-term and long-term Patent on FDI. This result shows the positive effect of Patent on FDI attraction. The development of investment for Patent is not only beneficial in the short term when the FDI enterprises refer to making positive decisions. With a long-term strategy, FDI is also based on positive changes from Patent in Vietnam. However, it can be seen that in the long term, the development of Vietnamese Patent is not a factor affecting FDI investment decisions. The reason is not only the number of Vietnamese Patent registrations is too little compared to foreigners but also from the content and

effective application of Patent. FDI investors are still more interested in foreign patents than Vietnamese. Therefore, improving the content as well as the high applicability of Vietnamese patents need to be paid more attention in the coming period.

5. Conclusion

This research has explicitly shown some limitations in patent registration in Vietnam. The issue of intellectual property has not been paid enough attention by individuals as well as businesses, and thus led to increasing number of disputes recently. Employing quantitative analysis techniques, this study has shown the important role of patents in attracting foreign direct investment. Specifically, increase in the number of patents registered in Vietnam help attracts more inward FDI flows. From the results of this research, we also offer some recommendations to help attract FDI by improving the number of patents in Vietnam: (1) Increase international cooperation for innovation to learn and encourage patent registration in Vietnam; (2) Improve capacity of inventing as well as ability to register patents of Vietnamese people to help increase the number and quality of Vietnamese patents to create a balance with the number of patents of foreigners in Vietnam; (3) Government agencies are tasked to support and review registration procedures in Vietnam; (4) Encouraging patent registration based on patent; (5) Enterprises and state agencies should be aware of the concerns of FDI enterprises in terms of intellectual property issues in Vietnam to overcome and attract more FDI in the future.

This study has contributed to the theory of the existence of Patent's influence on FDI attraction in Vietnam environment. An interesting feature drawn in this study is that only foreign patents are of interest to FDI investors. This result also provides some suggestions for domestic enterprises to register more patents to create a competitive advantage of copyright for FDI enterprises. In addition, opportunities for cooperation with FDI enterprises become easier when the patent registration of domestic enterprises is interested by FDI enterprises.

Although research has shown the positive effect of patents on attracting foreign direct investment. But with the analysis of limited time series data from 1990-2018, the separation of data by periods before and after joining trade organizations such as the WTO for analysis will be limited. The difference between before and after joining large economic sectors can change the effect of Patent on FDI. Therefore, we also make some recommendations for further studies on the same topic to collect more data (possibly quarterly) to make further assessments related to development stages. of the economy. This analysis will

help readers better understand the importance of joining the economic sector for Patent as well as attracting FDI.

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