

## 科学研究費助成事業 研究成果報告書

平成 30 年 9 月 12 日現在

機関番号：32663  
研究種目：研究活動スタート支援  
研究期間：2016～2017  
課題番号：16H07279  
研究課題名(和文) Productivity gap and technology spillover

研究課題名(英文) Productivity gap and technology spillover

## 研究代表者

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交付決定額(研究期間全体)：(直接経費) 2,200,000円

研究成果の概要(和文)：ベトナム企業データを使って、本研究は生産性のギャップが産業間の技術移転に与える影響を検証したところ、両者は逆U字の関係を持っていることが明らかになった。つまり、生産性の低いと高い外資系企業(特にアジア企業)がベトナムサプライヤーにもたらす技術移転は限られている。頑健性テストを行っても同じ結果が得られる。ベトナムの政策立案者にとって、今後ローカル企業の実産性を如何に高めるかについて、有益なエビデンスを提供している。

研究成果の概要(英文)：After applying statistical methods such as stepwise chow test to divide Asian investors by different TFP cutoffs, we show that the relationship between the productivity gap and vertical spillover takes an inverted-U shape, i.e. Vietnamese suppliers can achieve the most TFP gains from the diffusion of the Asian investors with middle-level TFP. The empirical results are robust against several sensitivity checks, thus providing the evidence that not all the foreign investors with the most advanced technology can bring about the benefits to the local firms in Vietnam. The findings can inform the policy-makers in Vietnam as what kind of actions should be taken to promote the corporation between foreign investors and domestic suppliers accordingly. Thus the framework of this study can offer a new microfoundation for systematically evaluating the role of technology difference.

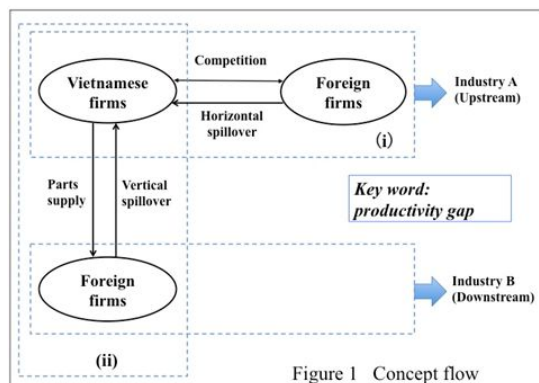
研究分野：経済政策

キーワード：technology spillover productivity gap firm-level data Vietnam

### 1. 研究開始当初の背景

International productivity gap-related study has been of central interest in various fields such as industrial organization and growth theory. Since productivity is representing the level of efficiency when a firm operates, the quantification of productivity gap can help to visualize the systematic technology differences of firms from different countries. On the other hand, the investing foreign firms endowed with high productivity are believed to have superior technology and induce technology spillover to their local partners. Nevertheless, to what extent the productivity gap affects the technology spillover remains an inconclusive question. Under such circumstance, the solution to this question will depend on an empirical approach, rather than a theoretical one. Among all the Asia-Pacific least developing countries, Vietnam has been the most popular investment destination with one of the fastest economic growth rates during the past decade. Also because Vietnam is carrying out the largest structural reforms (in all developing economies) led by FDI-oriented policies, to make clear the mechanism of determinants of spillover by FDI will have instructional influence on the analysis of other countries in the future.

### 2. 研究の目的



The purposes of this research are illustrated in Figure 1, which can be summarized as twofold:

- (1) For firms located in the same industry (A), I would like to verify how the productivity gap between foreign and Vietnamese firms affects the horizontal spillover induced by foreign investors in general.
- (2) For firms located in different industries (A & B) and have vertical

interaction, I would like to group the foreign firms in the downstream industries categorized by the average productivity level and identify which “productivity-marked” group of investors that promote the productivity growth of Vietnamese firms the most in the upstream industry. By so doing, the relationship between productivity gap and the scale of vertical spillover can be decomposed in a more detailed way. Robustness checks will be conducted while taking into account firm ownership, industry and geographical heterogeneity.

### 3. 研究の方法

This will be the main and most critical methodology used for this research. I will follow 4 steps when applying the strategy. (1) First, total factor productivity (TFP hereafter) growth is the most commonly used measure of foreign firms’ spillover effect on domestic firms’ performance in the literature (for example, Javorcik 2004). Thus the discrete calculation a firm’s TFP will be the key to our analysis. The candidates consist of two methods: stochastic frontier estimation, as proposed by Kumbhakar and Lovell (2000), which can prevent the statistical noise of the data. Alternatively, I use the Levinsohn and Petrin (2003) method, which has the advantage of incorporating the correlation between unobservable productivity shocks and input levels.

(2) Second, when evaluating the spillover effect, the modeling of the intra-industry and inter-industry interaction will be necessary. Here I will borrow the method from Javorcik and Spatareanu (2011). The spillover variables are built based on the influence of foreign investors within the same industry and from the downstream industries. The idea is as follows:

$$Vertical\_Group_{jt} = \sum_k \beta_{jkt} Horizontal\_Group_{kt} \quad (1)$$

$Horizontal\_Group_{kt}$  is defined as the share of the output produced by foreign firms within the same sector  $k$  in year  $t$ , and  $\beta_{jkt}$  is the coefficient representing the industry-to-industry linkage, which is taken from the Input-Output table in Vietnam. Thus  $Vertical\_Group_{jt}$  captures all foreign firms’ influence on the local firms in a particular upstream industry  $j$ . By introducing the spillover variables into the econometric model, the scale of their impact can be quantified.

(3) Third, and the most important thing that needs to be prepared before estimation is the categorization of “Group”, as in Equation (1). The grouping criteria are not randomly determined. Instead, it is necessary to choose the productivity thresholds that might cause the structural change of the influence on the spillover level. In order to decide on such thresholds, statistical tests have to be conducted. I used both the endogenous threshold model adopted by Lai et al. (2009), and modified Chow Test, to ensure the rationality of the threshold choice.

(4) Finally, after controlling other spillover-influential factors such as firms’ own “absorptive capability”, foreign firms’ ownership, country and industry heterogeneity, I will regress both the horizontal and vertical spillover variables on Vietnamese firms’ TFP, and identify the most significant group by the sign and magnitude of the coefficient.

#### 4. 研究成果

Table 1

Dependent Variable	Stochastic Frontier			
	LnTFP	LnTFP	LnTFP	LnTFP
Horizontal_total (lag 1)	-0.0444*** (0.00796)		-0.00987 (0.00601)	
Vertical_Asia (lag 1) (<35%)	-0.339** (0.147)	-0.441*** (0.150)	-0.372*** (0.139)	-0.385*** (0.139)
Vertical_Asia (lag 1) (35~80%)	0.0509*** (0.0128)	0.0488*** (0.0124)	0.0444*** (0.0113)	0.0424*** (0.0112)
Vertical_Asia (lag 1) (>80%)	0.00295 (0.00459)	0.00665 (0.00484)	-0.00884* (0.00497)	-0.00852 (0.00518)
Vertical_Europe (lag 1)	-0.134 (0.0867)	-0.0937 (0.0844)	-0.110 (0.0822)	-0.104 (0.0831)
Vertical_NorthAme (lag 1)	0.382 (0.326)	0.334 (0.315)	0.411 (0.294)	0.439 (0.306)
Own_effort	1.01e-05 (6.08e-05)	5.39e-06 (6.03e-05)	2.68e-05 (5.74e-05)	2.71e-05 (5.68e-05)
Herfindal Index	0.0436 (0.0855)	0.00505 (0.140)	0.197 (0.122)	0.181 (0.139)
Observations	421,346	420,720	420,931	420,713
R-squared	0.044	0.044	0.049	0.049
Horizontal_origin control	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes
Industry control	No	No	Yes	Yes

(1) For the baseline estimation results, we find negative signs for Horizontal Group throughout the models, indicating the presence of a strong replacement effect by investors in the same industry. As for the variable of interest *vertical\_Asia*, only the variable

constructed using the firms with low productivity shows consistent and significant results. This reveals that Asian investors endowed with a relatively lower TFP level have the most spillover effect on their upstream Vietnamese suppliers.

(2) When we decompose the Asian firms using both “80%” and “35%” TFP cutoffs of the total distribution, the result is even more explicit. As Table 1 shows, among the low, middle, and high-TFP Asian investors, only those within the middle TFP range (35%-80%) induce the most positive and significant vertical spillover in all cases. Meanwhile, Asian investors within the low TFP range (<35%) have a negative impact on Vietnamese suppliers’ TFP. This is because Asian investors with the most similar technology to that of local firms are likely to purchase the same parts that local firms will also use. Under certain circumstances, it is difficult for the spillover to occur, and on the contrary, these Asian investors will pose as a “threat” to their local suppliers and thus suppress their growth.

(3)

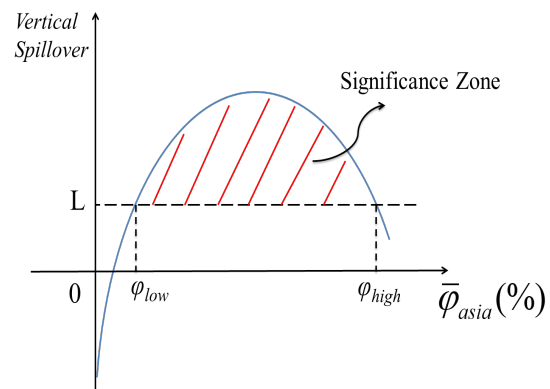


Figure 2

As can be seen from Figure 2, we can find a nonlinear correlation between the technology level that Asian investors own and the vertical spillover they might have on local suppliers. The horizontal axis indicates the average TFP level of Asian investors (shown as percentile) and the vertical axis reveals the induced vertical spillover.

The vertical spillover keeps increasing, but remains insignificant until  $\phi$  reaches point  $\phi_{low}$ . Before  $\phi$  reaches  $\phi_{high}$  the vertical spillover will be significant or

even maximized at some point above the line “L”.

Given that most Asian investors have a higher average TFP level than Vietnamese suppliers do, we can describe the relationship between the technology gap (for Asian investors and Vietnamese suppliers) and the vertical spillover as an inverted-U shape.

#### 5. 主な発表論文等

(研究代表者、研究分担者及び連携研究者には下線)

〔雑誌論文〕(計 1 件)

Bin Ni, Hayato Kato, “Productivity Gaps and Vertical Technology Spillovers from Foreign Direct Investment: Evidence from Vietnam”, Keio-IES Discussion Paper Series, Keio University, DP2017-022

〔学会発表〕(計 3 件)

Bin Ni 2017.10. アジア経済成長研究所ワークショップ, 北九州

Bin Ni 2017.6. Asia-Pacific Trade Seminar Meeting, Vietnam

Bin Ni 2016.11. The 15<sup>th</sup> EAEA international Convention, Indonesia

〔図書〕(計 件)

〔産業財産権〕

出願状況(計 件)

名称：  
発明者：  
権利者：  
種類：  
番号：  
出願年月日：  
国内外の別：

取得状況(計 件)

名称：  
発明者：  
権利者：  
種類：  
番号：  
取得年月日：  
国内外の別：

〔その他〕

ホームページ等

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