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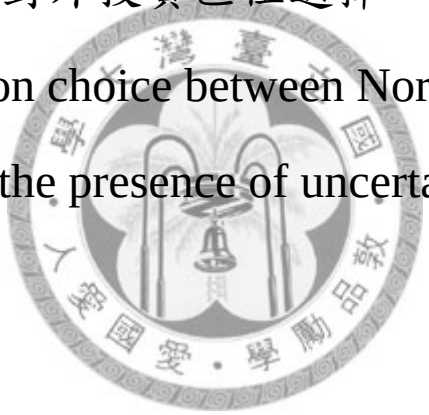
master thesis

考慮不確定性的對外投資區位選擇：南國或是北國？

FDI location choice between North and South in the presence of uncertainty



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2009 的夏天，在一場午後雷陣雨之後，我開始整理兩年來的講義、課本、上課筆記、還有一份即將離開學校的心情。金融海嘯讓我在離開校園的這一刻，體驗到台灣失業率(5.94%)和失業人數(64.7 萬)的歷史新高；也因爲如此，這一刻並沒有以往那般倉卒，反倒是有種說不出的從容。

慢慢地回想兩年來的點滴：感謝自己給自己一次全新的機會，肆無忌憚地去想像、去嘗試；台大經研所讓我認識了許多志同道合的朋友，因爲有你們，研究大樓三樓的燈永遠都是亮著的；不論是周末還是颱風天，永遠都有一群宅宅窩在研究室、待到很晚才回家。這群朋友對學術的熱誠和執著，深深地感動著我。我知道這時候已經和「學生的本分就是唸書」沒有關係了。

一年前的暑假，開始著手碩士論文的撰寫。每個週六的早晨，感謝指導教授林惠玲老師，耐心地傾聽我的問題以及提供寶貴的建議；感謝蓉慈的包容，讓我毫無後顧之憂地完成論文；感謝研究室的大家，提供軟體和硬體上的支援。最後，我要感謝我的家人，雖然不知道我在忙什麼，卻還是默默地支持著我。

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論文摘要

我們將對外直接投資的不確定性納入考量，以 Aw and Lee (2008) 的理論架構爲基礎作進一步的延伸，試圖提供一個更完整的對外投資區位選擇模型。在我們的理論模型中，除了固定投資成本、勞動成本、對稱的運輸成本、國家間的相對市場大小是決定廠商投資地點的重要因素，對於來自中等收入國家 (middle-income country) 的母公司而言，生產力以及對投資國風險認知的異質性也被視爲對外投資區位選擇的重要因素。首先，我們發現生產力最低的廠商傾向用出口的方式來代替對外直接投資；進行對外投資的廠商之中，生產力最高的廠商很可能選擇對已開發和開發中國家進行直接投資，生產力次高的廠商則是選擇已開發國家作爲直接投資的地點，而生產力較低的廠商則是選擇在開發中國家進行直接投資。以上的結論與其他理論模型的預期相符。有別於這些模型，本文將廠商風險認知的異質性納入考量之後，我們發現：當開發中國家的風險下降時，對開發中國家進行直接投資的廠商會充分的利用海外子公司的產能，除了供應當地市場之外，也會將部分的產出以出口的方式來供應已開發國家的市場。反之，當開發中國家的風險上升，廠商雖然對開發中國家進行直接投資，卻會選擇由母國出口的方式來供應已開發國家的市場。

利用 2005 年的廠商對外直接投資資料把台灣的跨國公司分爲五類：投資開發中國家的廠商(不包含出口平台)、投資開發中國家的廠商(包含出口平台)、投資已開發國家的廠商、同時投資已開發和開發中國家的廠商，以及其他類別的廠商。爲了建立實證模型來驗證我們的理論預測，我們合併廠商 2004 年的工廠校正資料以及使用 MNL (multinomial logistic) 模型來進行實證分析。實證結果顯示：第一，生產力較高的廠商都會傾向同時對已開發和開發中國家進行投資。第二，當開發中國家的風險增加的時候，供應當地市場是廠商對開發中國家進行直接投資的主要目的。第三，面臨投資國的風險上升，相對市場大小很可能是廠商

決定對已開發國家或是開發中國家進行直接投資的重要因素。最後，廠商對於投資國當地資源的依賴性，不論是投資地點的區位選擇，或者是海外產品的銷售流向都扮演著重要的角色。

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Abstract

As an extension for Aw and Lee (2008), this paper tries to provide a more complete picture of the FDI location choice by taking the sovereign risk into account. In our theoretical part, the optimal production location of multinationals headquartered in a middle-income country depends on not only their productivity levels but their individual knowledge about sovereign risks of FDI locations in a setting where fixed set-up costs, labor costs, symmetric transportation costs and the relative market size between North and South are also determinants of FDI location choices. Consistent with other theoretical models, the least productive firms would serve the foreign markets via exporting from the parent country rather than outward FDI. Among the firms engaging in FDI activities, the productivity level is the highest for those investing in both North and South, intermediate for those investing in North and the lowest for those investing in South. Unlike existing theoretical models, we introduce the role of uncertainty into our theoretical framework, which predicts that firms tend to serve not only the local market but the North market via FDI in South as the sovereign risk in South is low. In contrast, firms tend to serve the North market only via exporting from Home while they invest in South where the sovereign risk there is high.

Using confidential firm-level data in the year 2005, Taiwanese multinationals are classified into five categories: South firm without export platform, South firm with export platform, North firm, Global firm and others. In order to develop the empirical connection between the observable data and our theoretical model, the outward FDI information of individual firm is merged with its own plant-level data in 2004, and the multinomial logistic model is used in our empirical analysis. The

empirical model yields four main conclusions. First, more productive firms prefer locating production in both North and South to investing in South only. Secondly, with the increase of uncertainty in South, firms locating production in South tend to serve the local market only. Thirdly, as the sovereign risk rises, firms would invest in North rather than South resulting from the relatively large North market. Finally, constructing relational networks plays an important role in not only firms' decisions of FDI locations but the destinations of their goods.

1. Introduction

As regional and bilateral trade liberalization in Asia has progressed at an extremely high pace in recent years, how Asian multinational corporations decide where to locate their production factories has received considerable attention. The basic logic is that in the absence of tariff barriers, it would in many cases be optimal for Asian MNCs to produce in other countries where the wage level is lower. Then these outputs are sold to the third-country market and even sold back to the home-country market. In other words, trade liberalization, which allows the unrestricted flow of goods and services sharpens competition and motivates innovation. It augments the rewards that result from producing the best products, with the best design, at the best price. However, the success in trade will not last long, and it will shift from one firm to another while the market changes or the latest technology make cheaper and better goods possible. According to this point of view, manufacturers are encouraged to go abroad in order to exploit firm-specific advantages, locational advantages, and internalization advantages (Dunning, 1981). Therefore, the role of regional comparative advantages in shaping the pattern of production locations is evident due to such a discernible trend of trade liberalization.

According to the *World Investment Report* (2008), there is a widespread increase in inward FDI (foreign direct investment), which rose for the fifth consecutive year and reached $249 billion (a 18% increase), in South, East and South-East Asia due to improvements in the investment environment. In recent years, further liberalization of trade and FDI, continued economic growth and robust industrial development in some counties of this region are all important factors which contribute to attracting FDI. At the same time, South, East and South-East Asia with $150 billion in

outward flows has been an evident source of FDI for other developing countries. In other words, this region plays a crucial role in cooperating with other developing countries. It is self-evident that firms from this region tend to globalize more actively than those from other developing countries. In particular, started from mid 1990s, Taiwanese firms increased their outward FDI to exploit their assets, which include patents, technological assets, reputation, production efficiency, marketing, and advertising. Taiwanese FDI outflow is conventionally concentrated in less-developed countries, such as China and Southeast Asian. However, this pattern shifts toward developed countries like the U.S. and Europe after 1996 under the ”go-slow, be patient” policy, which puts a $50 million cap on any single investment in China, as well as the strike of Asian financial crisis. As a result, in order to shed the light on the tradeoff in FDI in North versus in South, our paper uses firm-level data of Taiwan, which is top 10 sources of FDI outflows in South, East and South-East Asia in the year 2005.[1]

This raises the question of how the uncertainty has an influence on Taiwanese MNCs' decision makings of FDI locations. Foreign direct investment (FDI) is conventionally considered as an attempt to exploit firm-specific assets in a foreign market (Hymer, 1960). To exploit these ownership advantages via FDI arises while the transaction costs of licensing and joint venture are too high (Buckley and Casson, 1976). Moreover, the decision of FDI location depends on the geographic advantages that maximize the value of firm-specific assets minus set-up costs (Dunning, 1981). However, we recognize that exploiting firm-specific advantages and resource seeking orientations are all important factors to describe the reason why

[1] Source: UNCTAD, FDI/TNC database (www.unctad.org/fdistatistics) and annex table B.1.

domestic firms go abroad, but they are not the whole story. In reality, all firms inevitably face incomplete information for FDI decision-making, and on the other hand, domestic firms investing overseas directly for the first time would lack experience in foreign markets compared to established multinational firms.

Our focus throughout is on the decision of FDI locations, which is related to the trade-off of how to allocate their manufacturing factories and their final outputs. This paper investigated the pattern of FDI location by firm heterogeneity in the spirit of Aw and Lee (2008) in which the authors develop a three-country model accounting for the interdependence between host country and other final consumption countries. In addition, we modify the framework of Aw and Lee (2008) by drawing on the insight from the process model of internationalization (Johanson and Vahlne, 1977, 1990) to explore the role of uncertainty on locating production overseas. In contrast to Aw and Lee (2008), the export function of domestic factories is not completely replaced by that of Southern ones even though there is a comparative advantage of cheap labors in South country. Accordingly, "pure" horizontal FDI in South would be the optimal strategy in our theoretical analysis. Furthermore, our paper contributes to the literature by using plant-level data to examine how either firms' concerns with sovereign risks or their own production levels affect their decision makings of FDI locations. More specifically, we use the data on the operations of Taiwanese MNCs in twenty-four manufacturing industries and eighteen foreign countries in the year 2005. In contrast, most of previous works in this area have used data of multinationals in a small number of industries or used data aggregated to the country level.

Our analysis proceeds as follows. The next section begins with some literature

reviews. The data used for our empirical estimation is described in the subsequent section, followed by the development of a theoretical model for firms' decisions of locating production overseas and the empirical counterpart to the theoretical model. The penultimate section goes on the empirical results. The final section provides some conclusions drawn from this study.

2. Literature review

There have already been theoretical analyses incorporating multinationals with microeconomic, general-equilibrium theory of international trade since early 1980s. Markusen and Maskus (2001) provide an excellent overview of the current FDI literatures which adopt a general-equilibrium trade-theoretical view of multinationals. They first review some early studies, noting how multinationals have been incorporated into traditional general-equilibrium models, which are constant return to scale and perfect competition, and those, in which activities of multinationals are thought of as a part of the theory of portfolio capital flows. These theories predicted that capital tends to flow from capital-abundant countries to capital-scarce countries. In other words, inward or outward FDI between identical countries is nearly impossible to obtain by any traditional model. Relative to conventional trade theories, the “new trade theory” on multinationals, in which concepts of increasing return to scale and imperfect competition are introduced into traditional general-equilibrium models, is divided into two branches. One is "vertical" model, in which firms fragment production process across countries in order to take advantages of factor price differentials, for example, by locating unskilled labor-intensive parts of the process in low-wage countries. The other is “horizontal” model, in which given firms basically replicate the entire production process in multiple countries in order to avoid tariff and transportation costs. They note that the pattern of foreign direct investment depends on country characteristics, such as relative size and relative endowment differences, as well as trade and investment costs.

Compared with how country heterogeneity is related to the FDI pattern, Helpman

et al. (2004) introduce heterogeneous firms into a simple multinational and multi-sector model where firms face a proximity-concentration trade-off: exporting entails lower fixed costs while FDI entails lower variable costs. In their model, heterogeneous firms decide whether or not to serve foreign markets, and once they choose to do so, they face two alternatives: serving overseas markets through either exports or FDI. They show that, in equilibrium, only the most productive firms choose to serve foreign markets, and the most productive ones among those engaging in foreign activities will further choose to serve these markets via FDI. They also provide robust empirical results at industry level to support their theoretical prediction by using U.S. exports and affiliate sales data that cover 52 manufacturing sectors and 38 countries.

In contrast to Helpman et al. (2004), Aw and Lee (2008) use firm-level data in 2000 to examine the extent to which how Taiwanese electronics MNCs decide to locate their production overseas reflects their underlying pattern of productivity as well as introduce the strategy of exporting from a third country. The authors develop a theoretical three-country model based on the Grossman et al. (2006) framework to explain four strategies of locating production overseas: locating domestically, locating in the high-income country, locating in the low-income country, and locating in both high-income and low-income countries. Their theoretical model shows that MNCs' equilibrium decisions depend upon fixed set-up costs, production costs, transportation costs, the relative market size, and their own productivity. In addition, their theoretical prediction, which is consistent with the finding showed in Helpman et al. (2004), indicates that the least productive firms serve foreign markets via export. For the firms engaging in foreign activities via FDI, those investing in China are the least productive, followed by those investing in the U.S., and the most productive

multinationals are those investing in both China and the U.S.. They also provide the empirical estimation to investigate their theoretical prediction by using the data that covers 2 manufacturing sectors: Computer and Telecommunications and Parts and Components. The results in the first industry are consistent with their theoretical prediction, but those in the second industry are not.

The role of uncertainty is seldom taken into account in most of the theoretical FDI literatures including the works reviewed by Markusen and Maskus (2001). At the very beginning of internationalization, domestic firms face a tremendous challenge from engaging in overseas activities. The process models of internationalization posit that domestic firms without any experiences in foreign markets start internationalizing through relatively less risky activities, such as exporting (Johanson and Vahlne, 1977, 1990). While firms get more and more international experiences through early exporting, they would increase their international commitments gradually through licensing and joint ventures, and eventually via FDI in the form of sales subsidiaries and manufacturing factories. To be more precise, exporting refers to a low international commitment since market entry and exit would not result in too much cost and loss in this way. Exporting is followed by licensing and joint venture, which refer to a medium international commitment. By cooperating with others, domestic firms could lower and spread most of risks from engaging in foreign markets via licensing and joint venture, but it is not as well as exporting for reducing cost and loss from market entry and exit. Since FDI, which refers to the highest international commitment, brings about the highest market entry and exit barrier, both set-up costs and the particularity and insurability of risks are given great attention by decision makers of multinationals.

3. Data description

In this paper, we use the firm-level data of Outward FDI Survey in Manufacturing in the year 2005. This survey is conducted annually by the Ministry of Economic Affairs (MOEA) in Taiwan. In addition to collecting the information on firm's annual revenue, total employment, R&D expenditures, and outward FDI by country of destination, MOEA also provides a unique firm identification number for each firm. Using these firm identification numbers and another data set, Correction and Operation Investigation of Factory, which is also conducted by MOEA, we can combine the outward FDI information of a firm with .the operation status of its own factory. In order to examine the extent to which FDI location choices of Taiwanese multinational corporations reflect sovereign risks encountered by them and their underlying productivity patterns, we merge these two data sets together by the firm identification numbers and sum up the values of variables across plants when we encounter the firms which own more than one plant in Taiwan. Since the outward FDI information is collected in 2005, we apply Correction and Operation Investigation of Factory collected in 2004 to avoid causality from the FDI location decisions to the operation status of their own factories. After these two data sets combine into one, the sample set contains 1,305 Taiwanese manufacturing firms investing overseas during the years 2003-04. In addition, our empirical analysis is based on the manufacturing sector so that we exclude the firms engaging in the manufacturing sector domestically but in other sectors overseas.[2] As a result, our sample contains 1,124 Taiwanese multinationals engaging in the manufacturing sector

[2] These sectors, which are excluded from our samples, comprise farming, forestry, fishery, animal husbandry, mining and quarrying, construction, wholesale and retail trade, lodging and catering services, transport, storage, post and telecommunications, banking and insurance, real estate and rentals, scientific research and technical services, and others.

both domestically and overseas during the period of 2003-04.

The intersectional cells of Table 1 indicate the number of Taiwanese multinationals that engage in each kind of integration strategy in the year 2004. It summarizes that almost 73% of Taiwanese multinationals engage in FDI activities in order to serve the local market, suggesting the importance of conserving transportation costs. Within 1,040 sampled firms which serve the local market via FDI, 53% of the firms locate their production overseas not only to serve local customers but to export their final goods to third country, possibly indicating both transportation costs and production costs play important roles on FDI activities. The determinants of these integration strategies and the relationship between integration strategies and FDI locations are the main interest of our research.

Since the pattern of foreign direct investment depends on country characteristics, we sort firms by their strategies and host countries. Table 2a and Table 2b present the number of Taiwanese multinationals engaging in each kind of integration strategy by host countries respectively. One feature of Taiwanese multinationals is that the affiliates located in some developed countries, namely United States, Western Europe, Japan, and Australia and New Zealand, tend to serve local markets only so that the market-access incentive FDI accounts for almost 51% of Taiwanese FDI activities in developed countries. In contrast, the affiliates located in developing countries may either serve local markets or serve both the local market and the third country. Each of these two integration strategies mentioned above constitutes 33% and 40% of the FDI activities engaged by the firms, which locate their manufacturing units in developing countries, indicating that for multinationals from a mid-income country such as Taiwan, to locate their production in developing countries is far more

complicated than just the trade-off in the market-access incentive versus the resource-seeking incentive.

We then classify the 1,434 firms in our sample into five categories.[3] (1) South firms without export platform (H, H, S)[4]: those locating their production in South to serve local markets; (2) South firms with export platform (H, S, S): those locating their production in South to serve both local markets and third countries; (3) North firms (H, N, H): those locating their production in North to serve local markets; (4) Global firms (H, N, S)[5]: those locating their production in both North and South to serve local markets; (5) Others. However, this classification is not all based on firms' primary FDI location, but we take secondary and tertiary FDI locations into account as well, which is very different from the bulk of research on the FDI location choice. For instance, the firm whose primary, secondary and tertiary FDI locations are United State, Canada and China respectively may be classified into the category of undertaking FDI only in developed countries, but we categorize it as firms undertaking FDI in both developed and developing countries, e.g. Global firms.

The pie chart below illustrates the relative frequencies of these five categories mentioned above. As the pie chart shows, Taiwanese multinationals, which locate their plants in South to serve local markets only, accounted for 26.7% of the outward

[3] North countries and South countries are defined as follows. North countries: United States, Canada, Western Europe, Japan, Singapore, Australia, and New Zealand. South countries: Mexico, Central and Southern America, Eastern Europe, China, Malaysia, Thailand, Indonesia, Philippines, Vietnam, Southern Asia, and Africa.

[4] (*a, b, c*) is defined as the choice set from serving the local markets of Home, North and South in manufacturing locations *a, b* and *c* respectively. That is, if a firm locates his manufacturing units in Home and South, and it serves the North market by exporting from Home, it is described as (H, H, S) in our framework.

[5] Due to the limitation of the data, we have no information except that in the primary FDI location so that firms are categorized as Global firms when locating production in both North and South and engaging in local sales in their primary FDI location as well.

FDI stock in manufacturing sector. Compared with North firms and Global firms, South firms without export platform are much more prevalent in Taiwanese manufacturing sector. This stylized fact indicates that a "pure" horizontal FDI in South (H, H, S) would be the optimal integration strategy for multinationals headquartered in a middle-income country in some given situations. Therefore, the strategic behaviors of firms investing in South might have more to do with other concerns such as their individual knowledge about the sovereign risk of FDI locations, and it is worth going a step further.

In order to quantify the influence of multinationals' individual knowledge about the sovereign risk on their location choices and their integration strategies as well, we construct an indicator, U, that could be a proxy for multinationals' concerns with sovereign risks. U is measured as the ratio of the difference between the number of difficulties encountered by a given firm and the average number per firm in a given industry to the average number per firm in a given industry. The details on the variable construction are described in Table 3, and the correlation matrix for the variables is presented in Appendix A. Accordingly, Table 4 provides descriptive statistics for the explanatory variables used in the study. As Table 4 presents, South firms without export-platform on average face more difficulties than South firms with export-platform do. In addition, South firms with export-platform generally rely more on local resources than those in other categories do. North firms are the most R&D intensive ones among Taiwanese multinationals in general. Moreover, Global firms are more productive, larger, more foreign technology purchasing intensive and more experienced than those in other categories averagely.

Table 1
Sample number of multinationals engaging in each kind of integration strategy (2004)

	Export to third country	Non export to third country	Total
Local sales	555	485	1040
Non local sales	260	134	394
Total	815	619	1434

Source: Outward FDI Survey in Manufacturing, the Ministry of Economic Affairs (2005)

Table 2a
Sample number of multinationals engaging in each kind of integration strategy by developed country (2004)

Strategy / Country	Both local sales & export to third country	Local sales	Export to third country	Others	Total
United States	23	42	5	16	86
Canada	0	0	1	0	1
Western Europe	2	6	0	0	8
Japan	3	6	0	0	9
Singapore	5	1	0	0	6
Australia and New Zealand	0	2	0	0	2
Total	33	57	6	16	112

Source: Outward FDI survey in Manufacturing, the Ministry of Economic Affairs (2005)

Table 2b
Sample number of multinationals engaging in each kind of integration strategy by developing country (2004)

Strategy / Country	Both local sales & export to third country	Local sales	Export to third country	Others	Total
Mexico	0	0	1	0	1
Central and South America	2	1	5	2	10
Eastern Europe	1	0	0	0	1
Hong Kong	17	15	6	4	42
China	447	367	194	95	1,103
Malaysia	9	7	4	1	21
Thailand	11	10	9	1	31
Indonesia	7	4	4	1	16
Philippines	1	3	9	3	16
Vietnam	14	11	8	2	35
South Asia	0	0	3	0	3
Africa	0	1	2	0	3
Total	509	419	245	109	1,282

Source: Outward FDI survey in Manufacturing, the Ministry of Economic Affairs (2005)

Pie Chart: FDI types in Taiwanese manufacturing sector (2004)

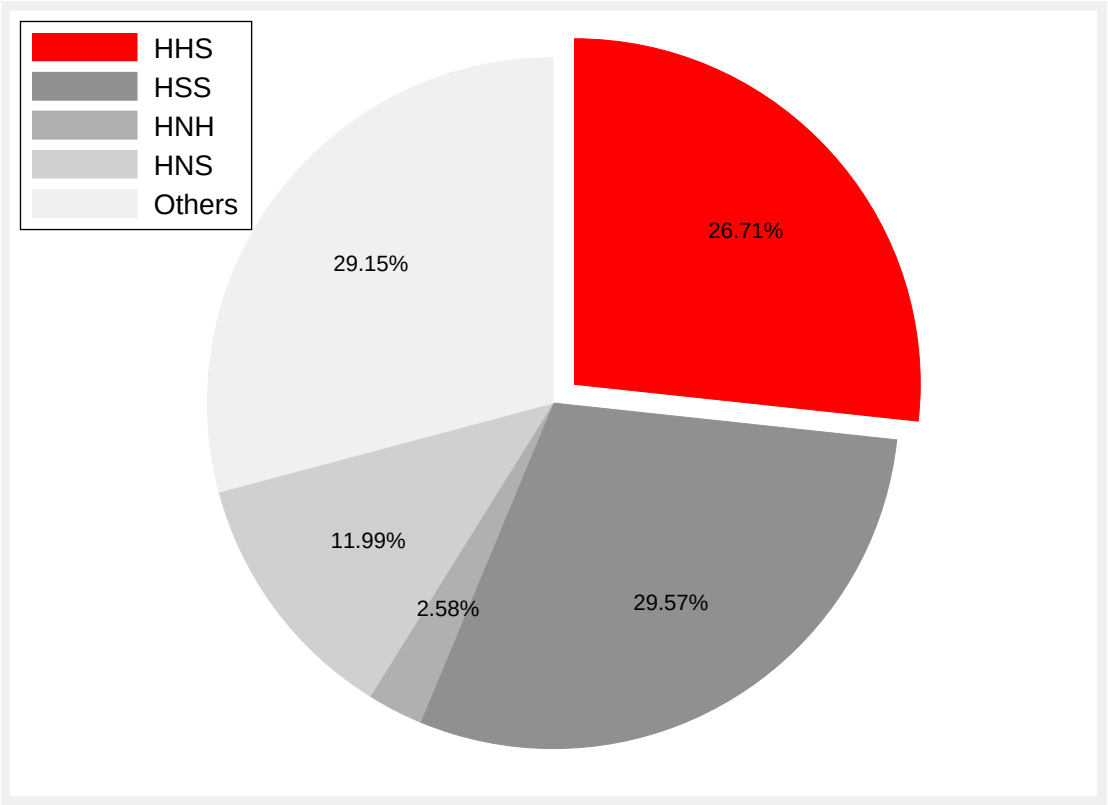

Table 3: Definition of explanatory variables

Explanatory Variable	Definition
Labor Productivity	Labor Productivity = ln (Q/Q') - ln (L/L'), where Q' and L' are the industrial mean levels of the value added and the total employment respectively.
Local Dependency	Local Dependency = max (N1, N2), where N1 and N2 are the percentages of materials and intermediate goods sourcing from local suppliers respectively.
Size	Size = ln (total employment)
RD intensity	RD intensity = (Sum of total R&D expenditure and Domestic Technology Purchases) / (The business income).
FTP intensity	FTP intensity = (Foreign Technology Purchases) / (The business income).
FDI Experience	FDI Experience = (2003 – The starting year of FDI)
U	U = (D – D') / D', where D' is the average number of the difficulties encountered by firms in a given industry.

Table 4: Descriptive statistics for Taiwanese multinationals by FDI types (2003)

South firms without export platform (H, H, S)

Variable	Obs	Mean	Std. Dev.	Min	Max
Labor Productivity	330	-.2373415	.9086081	-4.806683	3.081613
Local Dependency	330	49.47273	41.40695	0	100
Size	330	4.208502	1.303551	0	7.970395
RD intensity	330	.0320181	.1932724	0	3.350875
FTP intensity	330	.0007763	.004061	0	.0546569
FDI Experience	330	5.857576	3.749085	0	16
U	330	.0566021	.7059536	-.6329698	3.771393

South firms with export platform (H, S, S)

Variable	Obs	Mean	Std. Dev.	Min	Max
Labor Productivity	360	-.2834611	.8917764	-3.318951	2.76061
Local Dependency	360	53.78056	36.86578	0	100
Size	360	4.167092	1.373067	0	9.05684
RD intensity	360	.014745	.02769	0	.2865893
FTP intensity	360	.0007364	.0035062	0	.0382632
FDI Experience	360	7.294444	5.165988	0	41
U	360	-.0079989	.5955467	-.6329698	4.138423

North firms (H, N, H)

Variable	Obs	Mean	Std. Dev.	Min	Max
Labor Productivity	19	-.1458584	.7326079	-2.329064	1.221284
Local Dependency	19	15.26316	35.01879	0	100
Size	19	4.48702	1.347419	1.386294	6.580639
RD intensity	19	.1028358	.295748	0	1.305955
FTP intensity	19	.0021322	.0073762	0	.0313565
FDI Experience	19	4.263158	2.232142	1	8
U	19	.0175439	.4810494	-.3095238	1.071429

Global firms (H, N, S)

Variable	Obs	Mean	Std. Dev.	Min	Max
Labor Productivity	178	.0586121	.7610706	-2.418964	1.818764
Local Dependency	178	37.96067	38.37171	0	100
Size	178	5.196384	1.327959	1.609438	9.584177
RD intensity	178	.0348046	.0410573	0	.2353804
FTP intensity	178	.0037148	.0136851	0	.1627693
FDI Experience	178	9.769663	6.897783	1	39
U	178	.0081011	.498251	-.5339169	1.330416

4. The model

We adopt a three-country framework, in which firms from Home country (H) would invest in either North country (N), or South country (S), or both, to explore the role of uncertainty on locating manufacturing units overseas. Each firm is willing to serve not only the domestic market but also the foreign markets via either local production or exporting from other country. In this model, each firm engaging in production activities faces an array of integration strategies that include choices of production locations and final consumption destinations. While an additional set-up cost is incurred by establishing a production facility overseas, there is an "iceberg" transportation cost for a firm to serve a specific market through exporting from other place.

Households consume goods produced by n firms. Each firm supplies one single differentiated goods. Consumers share the same preferences that can be represented by the CES utility function

$$V = \left(\sum_{i=1}^{n} q_i^{\alpha}\right)^{1/\alpha}, \qquad 0 < \alpha < 1 \tag{1}$$

where q_i is the consumption of the goods produced by firm $i \in \{1,..., n\}$. Given the CES utility function, the demand function of goods produced by firm i in country j is derived as:

$$q_{ij} = Yj\, p_{ij}^{-\sigma} \tag{2}$$

where $\sigma = 1/(1-\alpha) > 1$ represents the elasticity of substitution between any pair of goods, and $Y_j = E_j / P_j$ is a measure of the total expenditure in country j, E_j, divided by the price index for all products in country j, P_j. Here the price index for all goods

in country j is represented as: $P_j = \sum_{i=1}^{nj} p_{ij}^{1-\sigma}$.

The market sizes E_j, the wage rates W_j, and the fixed set-up cost F_j all vary from country to country. Let the subscript j indicates the country: Home (H), North (N) and South (S). Following Ekholm et al. (2003) and Yeaple (2003), we assume that one of the host countries, South, has a low production cost and a relative small market size while the other one, North, has a higher wage rate and a larger market. Moreover, the average wage rate in Home country is "sandwiched" between North and South, which is the same as Aw and Lee (2008). For expositional simplicity, let us assume for the time being unit wage in Home country, i.e. $W_H = 1$. Then $W_S < W_H = 1 < W_N$. Furthermore, firms differ in their productivity level Φ_i, which is the ownership advantage for individual firm i so that there is no difference in the productivity level between a domestic manufacturing facility and an overseas one as long as both production units belong to the same firm. Specifically, the production function for each firm takes the following form:

$$q_i = \Phi_i L_i \tag{3}$$

where L_i units of local labor are the only inputs, which are required in the production process. Given this production technology, the constant marginal cost of an output produced by firm i with productivity level Φ_i in country j is given by $MC_{ij} = W_j / \Phi_i$.

The optimal pricing strategy for CES-induced demand function is $p_{ij} = \overline{MC}_{ij} / \alpha$. Here $\overline{MC}_{ij}$ depends on the pattern how MNCs engage in foreign activities. That is, $\overline{MC}_{ij} = MC_{ij}$ if firms serve overseas markets through their local manufacturing facilities. While firms choose to access foreign markets via exporting and the transportation cost would be taken into consideration, $\overline{MC}_{ij} = MC_{ij} t$, where $t > 1$ and

symmetric. This pricing strategy then yields the following profit for firm i in country j:

$$\pi_{ij} = (p_{ij} - \overline{MC}_{ij})\, q_{ij} - F_j = (1-\alpha)\, Y_j \overline{MC}_{ij}^{1-\sigma} (1/\alpha)^{1-\sigma} - F_j$$

$$= (1-\alpha)\, Y_j (1/\alpha)^{1-\sigma} (W_j t / \Phi_i)^{1-\sigma} - F_j \qquad (4)$$

For expositional simplicity, let $S_j = (1-\alpha) Y_j (1/\alpha)^{1-\sigma}$ and $\Theta_i = \Phi_i^{\sigma-1}$. Then we can rewrite equation (4) as:

$$\pi_{ij} = S_j\, \overline{W}_j^{1-\sigma}\, \Theta_i - F_j \qquad (5)$$

where $\overline{W}_j = W_j t$. If the output is sold to the overseas market via exporting, $t > 1$, and if otherwise, $t = 1$.

Until now, we have been concerned with the situations, which a firm would encounter under conditions of certainty. In contrast to previous studies, our work is designed to highlight how the choice of locating production overseas is affected by the role of uncertainty. Hence we assume that firm i in country j would make a profit, π_{ij}, with probability $(1-\Omega_{ij})$ and get zero revenue with probability Ω_{ij}. Firm i must pre-commit to whether or not to locate production in country j prior to the realization of shocks. While each firm is risk-neutral, it will choose the integration strategy, which maximizes its expected profit

$$E(\pi_{ij}) = (1-\Omega_{ij})\, [S_j (\bar{W}_j)^{1-\sigma}\, \Theta_i] - F_j \quad , \qquad \Omega_{ij} \in [0, 1] \qquad (6)$$

To simplify notations, we rescale the market sizes of two host countries relative to that of the parent country by $S_H = S$, $S_N = \lambda_N S$, and $S_S = \lambda_S S$. (a, b, c) is defined as the choice set from serving the local markets of Home, North and South in manufacturing locations a, b and c respectively. That is, if a firm locates his manufacturing units in North and South, and it serves the domestic market by

exporting from South, it is described as (S, N, S) in our framework.

Although there are a large array of integration strategies that includes options of production locations and consumption destinations, i.e. 3×3×3= 27, many of them would not be taken into account by the decision maker of a firm. Given the presence of the "sandwiched" domestic wage rate, the symmetric transportation cost of exporting final goods, and moreover, the impact of uncertainty, neither the Home market nor the South market would be served by the factory located in the North. As a result, there are 12 strategies left over, i.e. 2×3×2= 12. Besides, since locating production overseas incurs an additional fixed cost and shipping entails an "iceberg" transportation cost, the existence of locating production in either North, or South, or both can be inferred that to serve the local market through the local plant is the most profitable than that through the overseas plant. So among these 12 strategies, (H, H, H), (H, H, S), (H, N, H), (H, N, S), (H, S, H), (H, S, S), (S, H, H), (S, H, S), (S, N, H), (S, N, S), (S, S, H), and (S, S, S), we can eliminate 5 strategies, in which firms have established manufacturing units, but these plants are not used to serves the local markets. In short, there should be the following 7 ones taken into consideration: (H, H, H), (H, H, S), (H, S, S), (H, N, H), (H, N, S), (S, S, S) and (S, N, S).

The expected profit functions of the remaining 7 strategies are as follows:

$$E(\pi_{HHH}) = S\Theta\,[1+\lambda_N t^{1-\sigma} + \lambda_S t^{1-\sigma}] \tag{7}$$

$$E(\pi_{HHS}) = S\Theta\,[1+\lambda_N t^{1-\sigma} + (1-\Omega_S)\lambda_S W_S^{1-\sigma}] - F_S \tag{8}$$

$$E(\pi_{HSS}) = S\Theta\,[1+(1-\Omega_S)\lambda_N (W_S t)^{1-\sigma} + (1-\Omega_S)\lambda_S W_S^{1-\sigma}] - F_S \tag{9}$$

$$E(\pi_{HNH}) = S\Theta\,[1+(1-\Omega_N)\lambda_N W_N^{1-\sigma} + \lambda_S t^{1-\sigma}] - F_N \tag{10}$$

$$E(\pi_{HNS}) = S\Theta\,[1+(1-\Omega_N)\lambda_N W_N^{1-\sigma} +(1-\Omega_S)\lambda_S W_S^{1-\sigma}\,] - F_S - F_N \qquad (11)$$

$$E(\pi_{SSS}) = S\Theta\,[(1-\Omega_S)(W_S t)^{1-\sigma} +(1-\Omega_S)\lambda_N(W_S t)^{1-\sigma} + (1-\Omega_S)\lambda_S W_S^{1-\sigma}\,] - F_S \qquad (12)$$

$$E(\pi_{SNS}) = S\Theta\,[(1-\Omega_S)(W_S t)^{1-\sigma} +(1-\Omega_N)\lambda_N W_N^{1-\sigma} + (1-\Omega_S)\lambda_S W_S^{1-\sigma}\,] - F_S - F_N \qquad (13)$$

According to the above strategies, we recognize that firms may not locate their manufacturing units in Home country all the time. In Eqs. (7)- (11), plants are established domestically, and then they are used to serve domestic customers and even foreign ones. In Eq. (7), final goods produced in Home country are not only used to serve domestic customers but also exported to both North and South. The combination of "horizontal" FDI and "export-platform" FDI is found in Eq. (9): firms locate production in South not only to serve the local market but also to export some parts of final outputs to another host country, namely North countries. Eq. (8) and Eq. (11) provide a pattern of "pure" horizontal FDI. The market-access incentive FDI is described in Eq. (10), where firms locate production in North to serve the local customers even though there is a sovereign risk in North and the labor force provided there is such expensive. Eq. (12) appears a mixed strategy of "vertical" FDI and "export-platform" FDI, whereby firms are headquartered in Home country and manufacture in South. Another mixed strategy, which is a pattern combining "vertical" FDI and "horizontal" FDI, is presented in Eq. (13): firms are headquartered in Home country and manufacture in both North and South.

Due to the impact of the uncertainty incurred by FDI, the relative cost advantage of South becomes indefinite though the wage rate in Home country is sandwiched

between North and South. In sum, the profitability of the above strategies depends crucially on the sovereign risks of each host country. In addition to all of the above, as the transport of final goods is costly, the shipping cost also plays a role in firms' decisions of locating their manufacturing units overseas. We will discuss each condition in turn.

Case 1-1 Low uncertainty in South and high transportation cost

Locating production overseas requires a firm to incur an additional set-up cost, which varies across host countries. We begin with the case, in which firms locate their overseas factories only in South, and next we consider the case, in which firms' foreign manufacturing units are located in both North and South. At last, establishing foreign plants only in North is taken into consideration. For firms investing only in South with high transportation costs, (H, H, S) and (S, S, S) are dominated by (H, S, S) when their own sovereign risks of South country are low, such as

$$(1-\Omega_S)\, W_S^{1-\sigma} > 1 \;\&\; (1-\Omega_S)\,(W_S t)^{1-\sigma} < 1 \qquad (14)$$

In other words, (H, S, S) is the dominant strategy for a firm with a given productivity. Additionally, the inequality mentioned above implies $(1-\Omega_S)\, W_S^{1-\sigma} > 1 > t^{1-\sigma}$; i.e., to serve South market via locating production locally is more profitable than that via exporting from Home in the absence of fixed set-up cost. Fig. 1 depicts the expected profits for strategies (H, H, H), (H, S, S), (H, H, S), and (S, S, S). While the production costs, including the wage rate and the sovereign uncertainty in South are lower and the shipping cost is stiff, the slope of $E(\pi_{HSS})$ becomes steeper than that of $E(\pi_{HHH})$. In this case, more-productivity firms tend to establish an additional plant in South and ship parts of the output produced in South to North in order to gain

higher returns generated by lowering unit production cost and saving shipping cost. Besides, the pattern, in which firms engaging in foreign activity via FDI are more productive than those via exporting, is consistent with that predicted by Helpman et al. (2004).

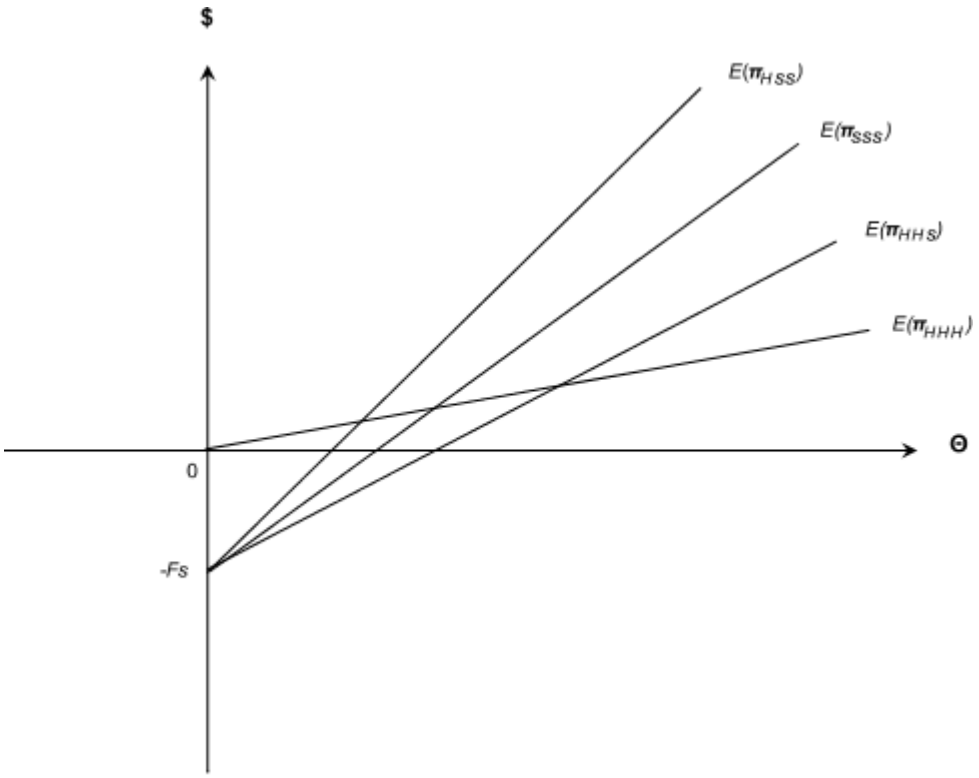

Fig. 1. Expected profit of different strategies.

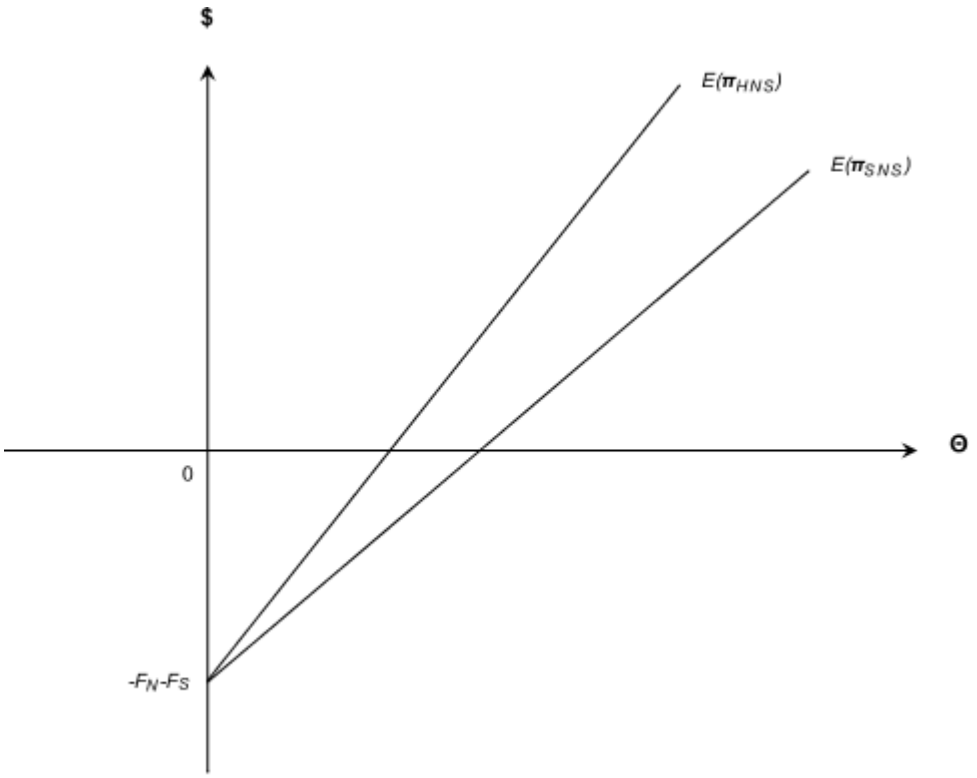

Fig. 2. Expected profit of different strategies.

For firms investing in both North and South, if Eq. (14) holds, it would be profitless to use South plants as a substitute for Home plants to serve Home market. The sovereign risk in South and the costly shipping cost offset the advantage of the cheap labor force provided by South. That is, (H, N, S) dominates (S, N, S) under such a condition; i.e., the slope of $E(\pi_{HNS})$ is steeper than that of $E(\pi_{SNS})$ as the finding depicted in Fig. 2.

In such a circumstance of high shipping costs, the high odds ratio between South and North also offsets the relative cost advantage of producing in South, and it is clear that $(1-\Omega_N)\, W_N^{1-\sigma} > (1-\Omega_S)\, (W_S t)^{1-\sigma}$, which leads to that $E(\pi_{HNS})$ is steeper than $E(\pi_{HSS})$. This result is shown in Fig. 3. Moreover, if the odds ratio between South and North is insufficiently large, i.e., $(1-\Omega_N)\, W_N^{1-\sigma} < (1-\Omega_S)\, (W_S t)^{1-\sigma}$, $E(\pi_{HSS})$ is

steeper than $E(\pi_{HNS})$, and strategy (H, N, S) will not be the optimal choice for firms.[6] In accordance with our data, the existence of overseas plants in both North and South is consistent with the condition that $(1-\Omega_N)\ W_N^{1-\sigma} > (1-\Omega_S)\ (W_S t)^{1-\sigma}$. Therefore, our following discussion is under this assumption.

Since Eq. (14) infers that producing in South country to serve the local market is more profitable than exporting from Home country, i.e., $(1-\Omega_S)\ W_S^{1-\sigma} > t^{1-\sigma}$, we observe that the slope of $E(\pi_{HNS})$ is steeper than that of $E(\pi_{HNH})$ in Fig. 4. Accordingly, firms with the most productivity tend to locate production in both North and South, rather than only in North. This prediction is consistent with the finding in Aw and Lee (2008). However, in order to determine the relative profitability reflected in Eq. (8) and Eq. (10), we should add one more assumption to Eq. (14). For the slope of $E(\pi_{HNH})$ to be steeper than that of $E(\pi_{HSS})$, the relative market size between South and North, $\lambda = \lambda_S / \lambda_N$, must be less than a threshold value, $\bar{\lambda} = [(1-\Omega_N)\ W_N^{1-\sigma} - (1-\Omega_S)(W_S t)^{1-\sigma}] / [(1-\Omega_S) W_S^{1-\sigma} - t^{1-\sigma}]$. That is, the South market must be much smaller than the North one. In this case, strategy (H, N, H) is more profitable than strategy (H, S, S) for firms with more productivity. If the South market is either insufficiently small or insufficiently risky or both i.e., $\lambda > \bar{\lambda}$, $E(\pi_{HSS})$ would be steeper than $E(\pi_{HNH})$. In sum, the relative profitability of strategy (H, S, S) and strategy (H, N, H) depends on the relative market size and the odds ratio between South and North.

---

[6] If $(1-\Omega_N)\ W_N^{1-\sigma} < (1-\Omega_S)\ (W_S t)^{1-\sigma}$, firms which have already had plants in South have no motivation to locate production in North in the presence of an additional set-up cost. In this case, if $F_N > F_S$, (H, N, H) will not be the optimal choice for firms. Since it is more profitable to serve the North market via producing in South than producing in North, the relative market size between South and North doesn't play a role here. Firms prefer (H, S, S) to (H, N, H) until F_S is big enough to offset the relative cost advantage in South. The high set-up cost in South will force firms with less productivity switch from (H, S, S) to (H, N, H) since it is less profitable for them to locate overseas plants in South than in North. Therefore, the optimal outcome depends on the scale of the set-up costs. For example, if $F_N > F_S$, only (H, H, H) and (H, S, S) would be the outcome in equilibrium.

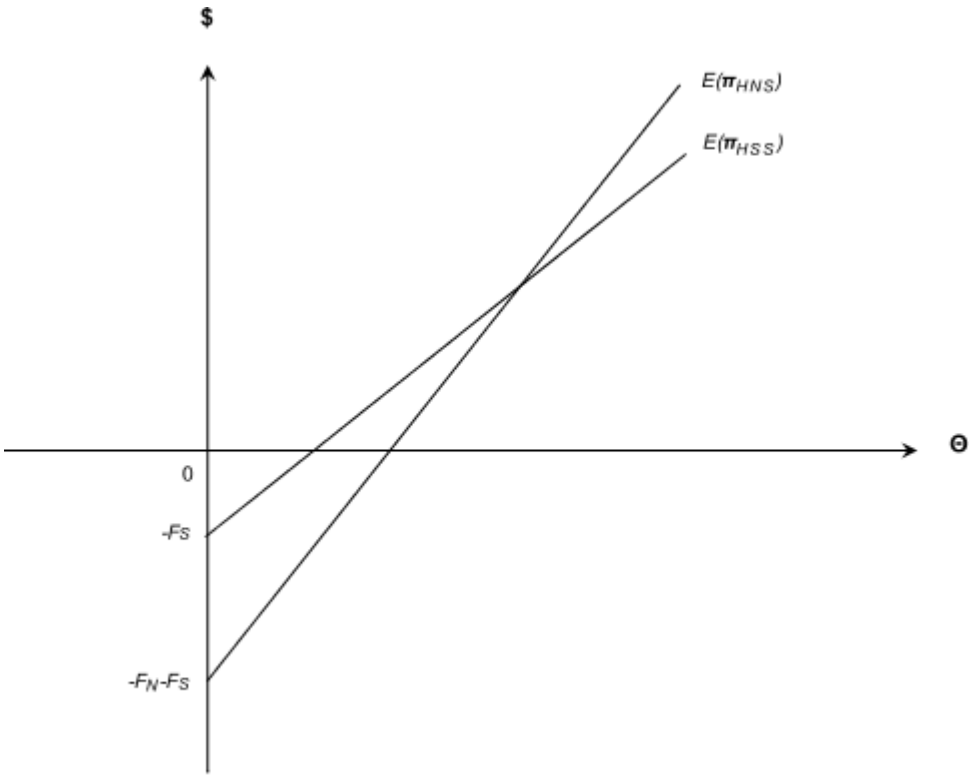

Fig. 3. Expected profit of different strategies.

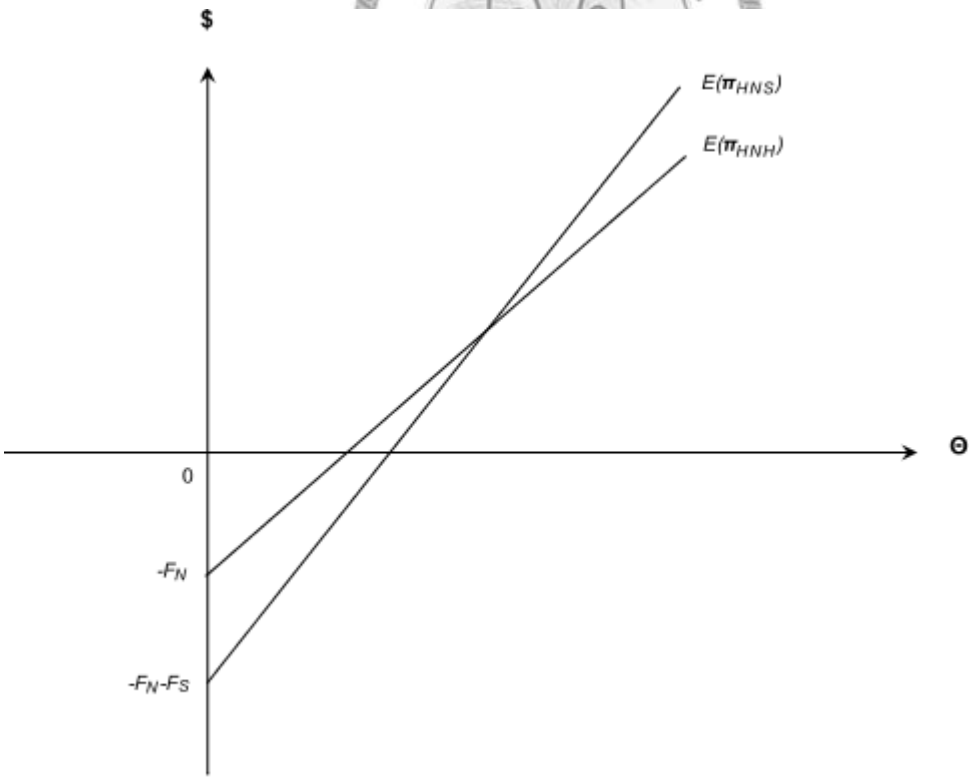

Fig. 4. Expected profit of different strategies.

While the market in South is sufficiently small relative to that in North, i.e., $\lambda < \bar{\lambda}$, $F_N > F_S$ must hold to ensure the whole four strategies to co-exist. On the other hand, when South market is large enough compared to North, $\lambda > \bar{\lambda}$, $F_N < F_S$ must be the case for the co-existence of the all four strategies. Fig. 5 and Fig. 6 depict the above two conditions respectively.

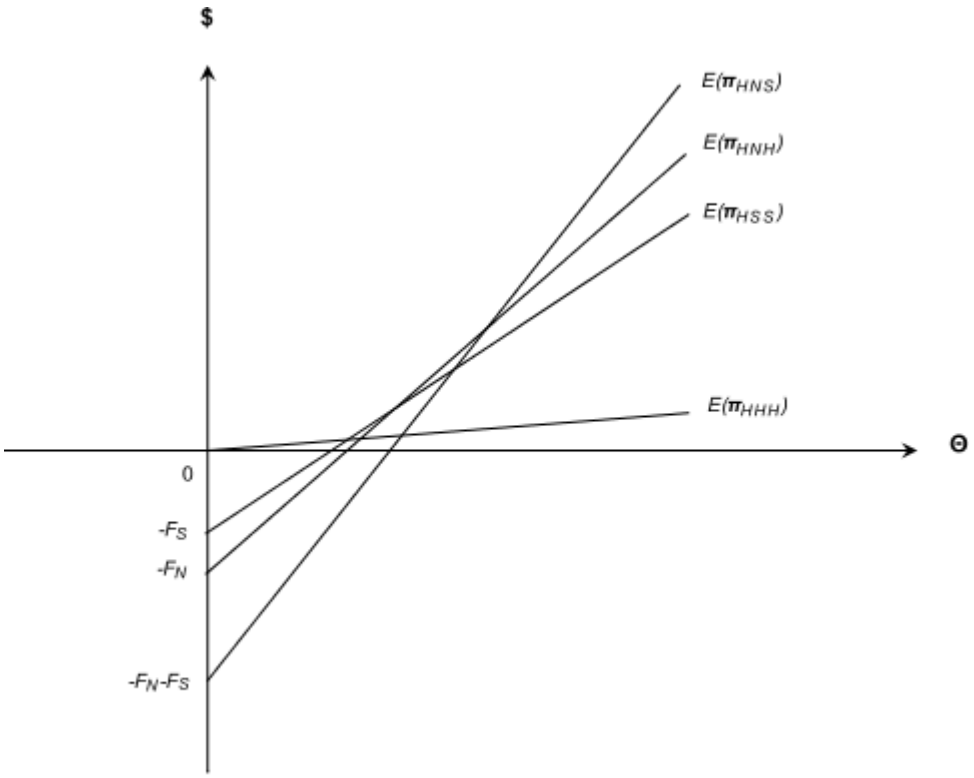

Fig. 5. Expected profit of different strategies.

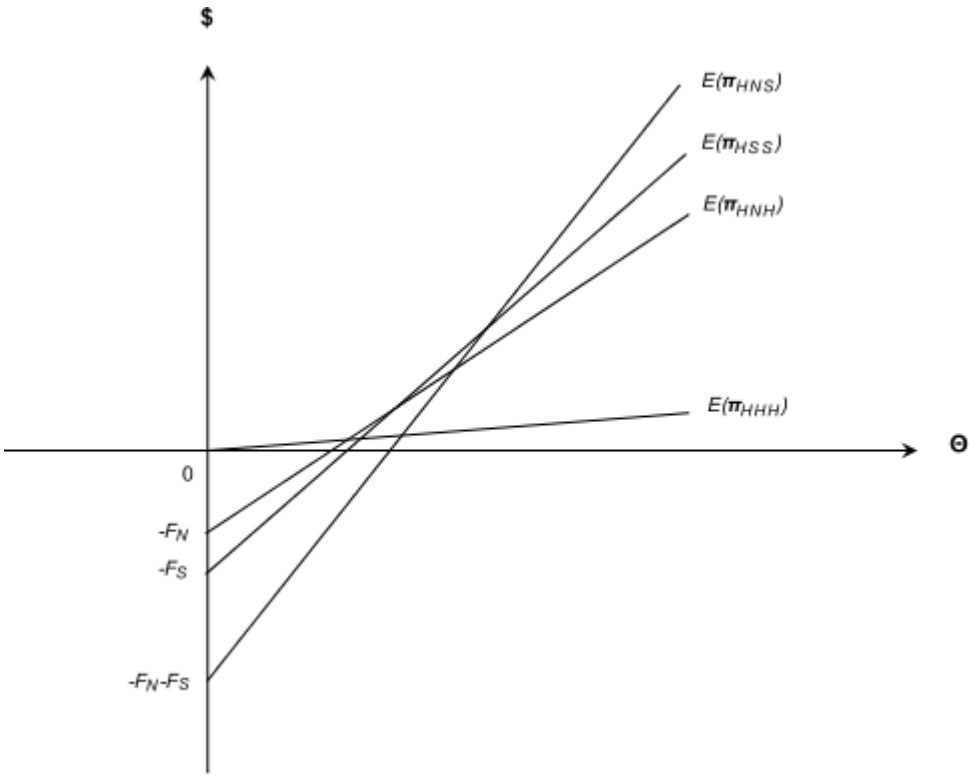

Fig. 6. Expected profit of different strategies.

Case 1-2 Low uncertainty in South and low transportation cost

We next consider the case, in which firms are facing both the low sovereign risk in South and the low shipping cost. The sense where we assume that both Ω_S and t are small is that

$$(1-\Omega_S)\, W_S^{1-\sigma} > 1 \;\&\; (1-\Omega_S)\,(W_S t)^{1-\sigma} > 1 \qquad (15)$$

This restriction implies that it is more profitable for firms to produce final goods in South than in Home, and it is even more gainful to serve the Home market through exporting from South than through producing domestically. Accordingly, both strategy (H, S, S) and strategy (H, H, S) are dominated by strategy (S, S, S), i.e., firms move their manufacturing units from Home to South in order not only to satisfy the local demand but also to export parts of their final goods to both the Home market and the North market. Also, strategy (H, N, S) is dominated by strategy (S, N, S), i.e.,

firms locating production in both North and South will not keep their Home factories and will serve the Home market by exporting from South instead. Moreover, under our assumption of the symmetric transportation cost, $t > 1$, Eq. (15) also implies $(1-\Omega_S) W_S^{1-\sigma} > 1 > t^{1-\sigma}$, i.e., it is more costly to serve the South market via the Home plant than via the local one. Consequently, firms with more productivity are motivated to serve the foreign markets via engaging in FDI rather than via exporting from Home. In addition to the above assumption, $E(\pi_{SSS})$ is steeper than $E(\pi_{HHH})$, and $E(\pi_{SNS})$ is steeper than $E(\pi_{HNH})$. That is, it is more beneficial for firms with more productivity to locate production in South than in Home. The conditions mentioned above are shown in Fig. 7 and Fig. 8 respectively.

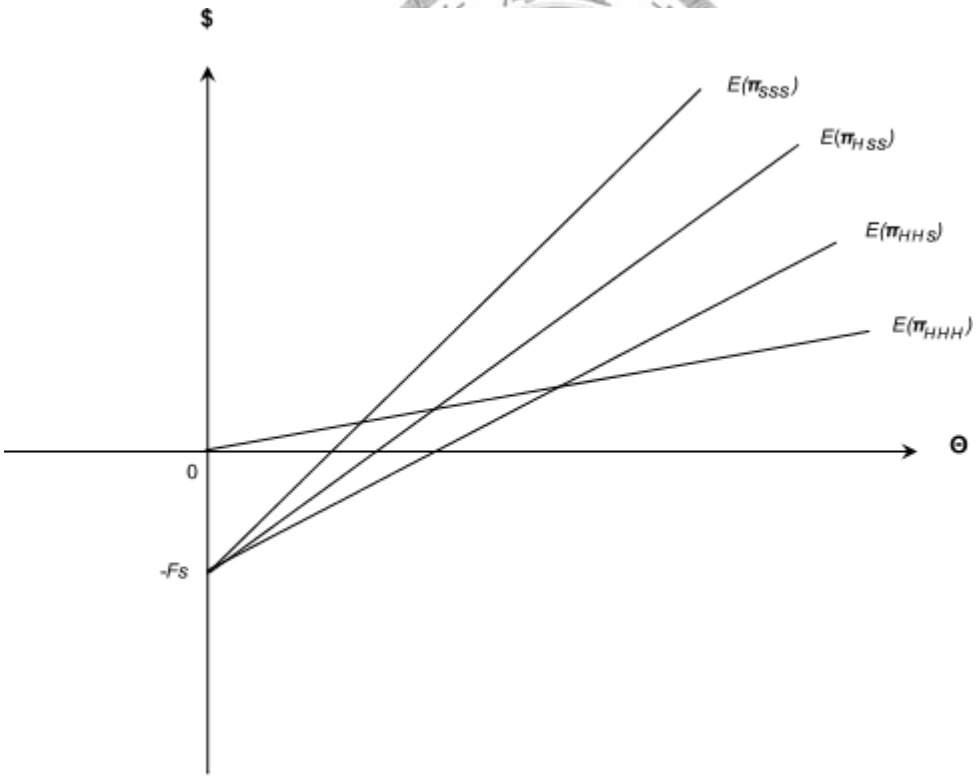

Fig. 7. Expected profit of different strategies.

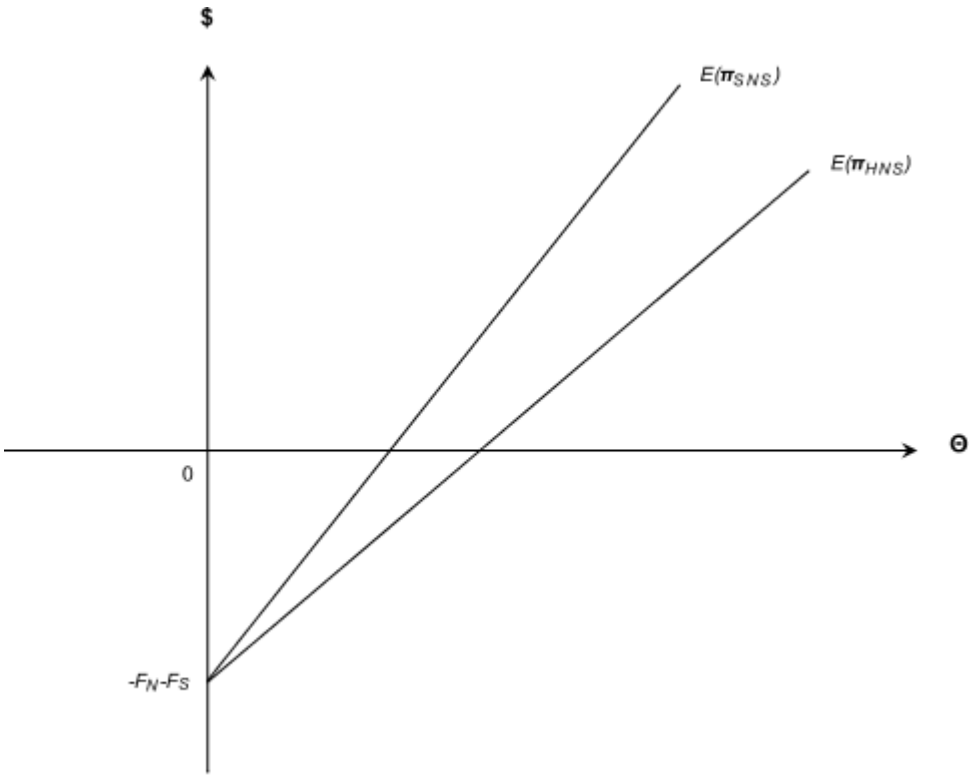

Fig. 8. Expected profit of different strategies.

The relative profitability of the remaining strategies also depends on the odds ratio between South and North. While the odds ratio is high, i.e., $(1-\Omega_N) W_N^{1-\sigma} > (1-\Omega_S) (W_S t)^{1-\sigma}$, $E(\pi_{SNS})$ is steeper than $E(\pi_{SSS})$. Accordingly, it is more gainful for firms with the most productivity to choose strategy (S, N, S) rather than (S, S, S). However, under the assumption of Eq. (15), it is impossible to satisfy this inequality, $(1-\Omega_N) W_N^{1-\sigma} > (1-\Omega_S) (W_S t)^{1-\sigma} > 1$, due to the condition of the "sandwiched" wage rate in Home. In comparison, as the odds ration between South and North is low, i.e., $(1-\Omega_N) W_N^{1-\sigma} < (1-\Omega_S) (W_S t)^{1-\sigma}$, strategy (S, S, S) will always be more profitable than strategy (S, N, S) in the presence of an additional set-up cost for locating production in North, and then (S, N, S) will not be the optimal choice for firms as depicted in Fig. 9. Under the above assumptions, it must be true that $E(\pi_{SSS})$ is steeper than $E(\pi_{HNH})$. If $F_N > F_S$, strategy (H, N, H) will not be the optimal choice for firms which is shown in Fig. 10, and hence there are only two possible strategies,

(H, H, H) and (S, S, S), in equilibrium as depicted in Fig. 11. On the other hand, while the set-up cost in South is sufficiently larger than that in North, firms with less productivity would be forced to move their production units from South to both Home and North. In Fig. 12, it is clear that firms with less productivity will locating production in Home, those with more productivity will locate production in both Home and North, and those with the most productivity will locate only in South.

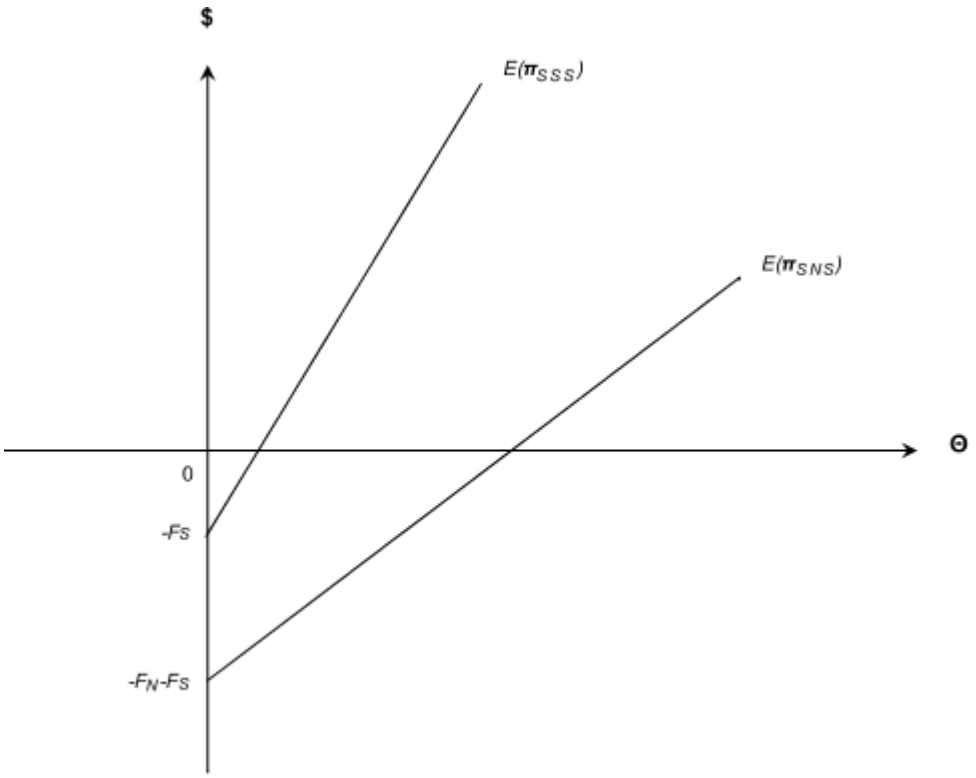

Fig. 9. Expected profit of different strategies.

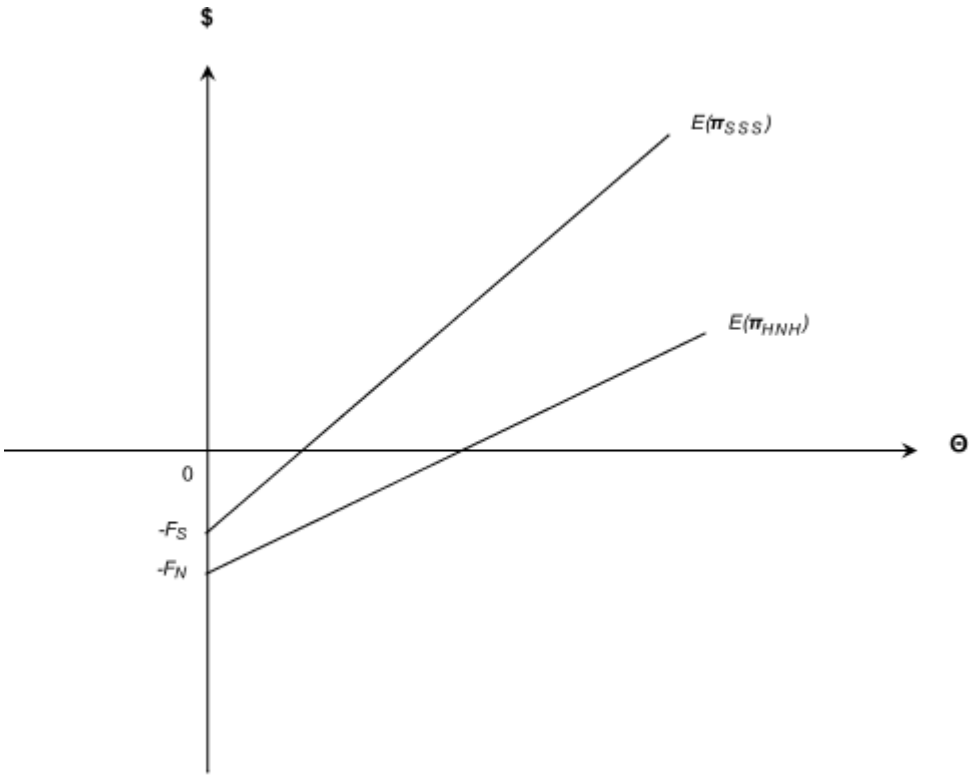

Fig. 10. Expected profit of different strategies.

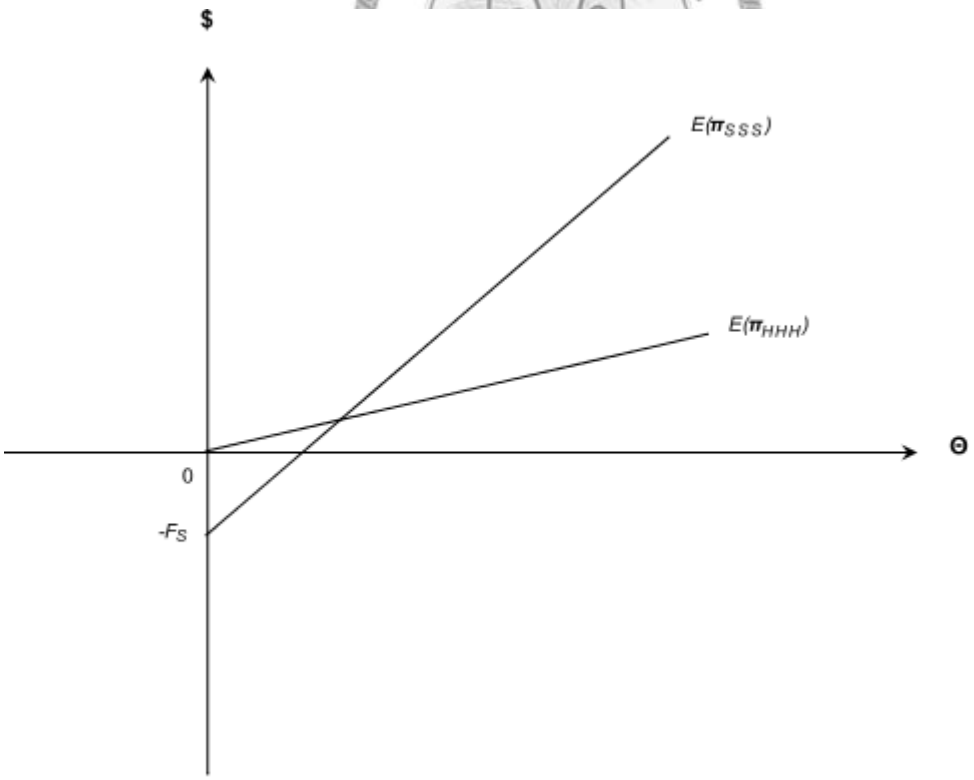

Fig. 11. Expected profit of different strategies.

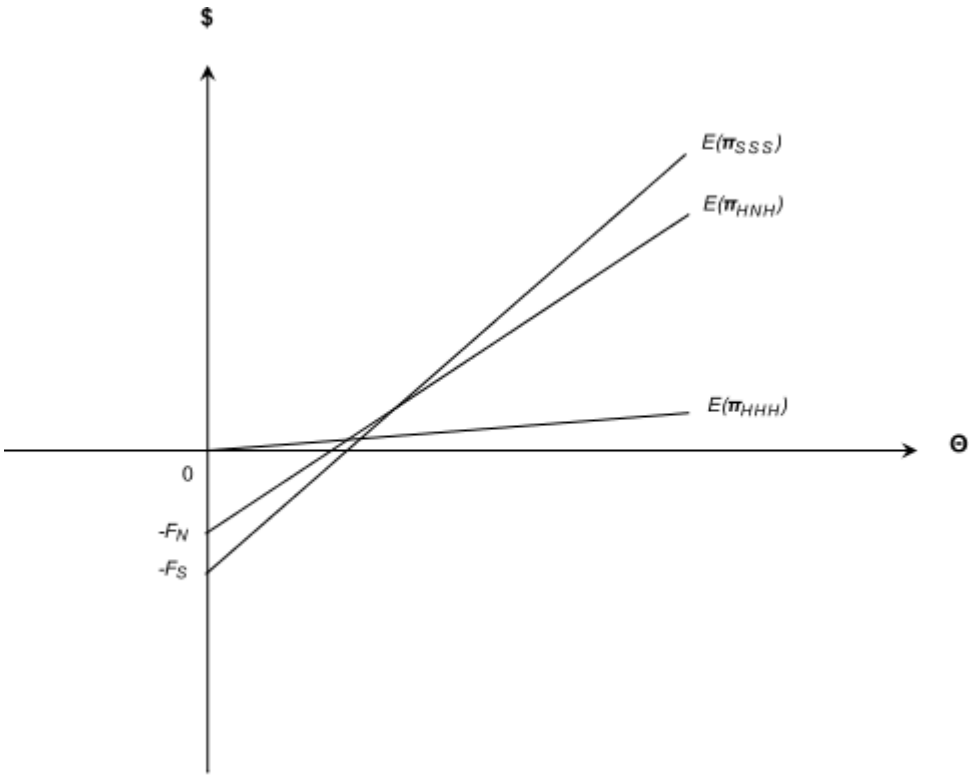

Fig.12. Expected profit of different strategies.

Case 2-1 High uncertainty in South and high transportation cost[7]

Our concern in this paper is to investigate the role of uncertainty on the relative profitability among different production location choices. Uncertainty plays an important role in emerging countries which are characterized by much greater volatility than OECD countries.[8] Further, these emerging countries are the potential destinations of most FDI outflows due to their relatively abundant factor endowments and their booming local markets. Accordingly, if greater uncertainty discourages firms to locate their manufacturing units overseas, the observed FDI patterns might somewhat reflect the tradeoff between volatility and abundant resources.

[7] Case 2-2, where there is high uncertainty in South but it doesn't cost much to ship the final goods, is not taken into account in our theoretical analysis due to our interest in firms engaging in FDI. In our theoretical framework, firms prefer serving foreign markets via exporting from the parent country to locating production overseas when encountering high sovereign risks and low transportation cost as well.

[8] See Hausmann and Gavin (1995).

In this case, we allow for high volatility in South and costly shipping costs; in particular, we assume that

$$(1-\Omega_S)\, W_S^{1-\sigma} < 1 \qquad (16)$$

When Eq. (16) is satisfied, the production cost is minimized by producing in Home country though there are relatively cheap labor forces in South. Also, the inequality ensures that $(1-\Omega_S)\,(W_S t)^{1-\sigma} < 1$. Under such an assumption, strategy (H, S, S) and strategy (S, S, S) are ruled out by strategy (H, H, S). Since the sovereign volatility is great enough to offset the relative advantage of producing in South, we can rule out strategy (S, N, S) by (H, N, S) as well. Fig. 13 and Fig. 14 show the optimal strategies for firms locating production in South and those locating production in both North and South respectively.

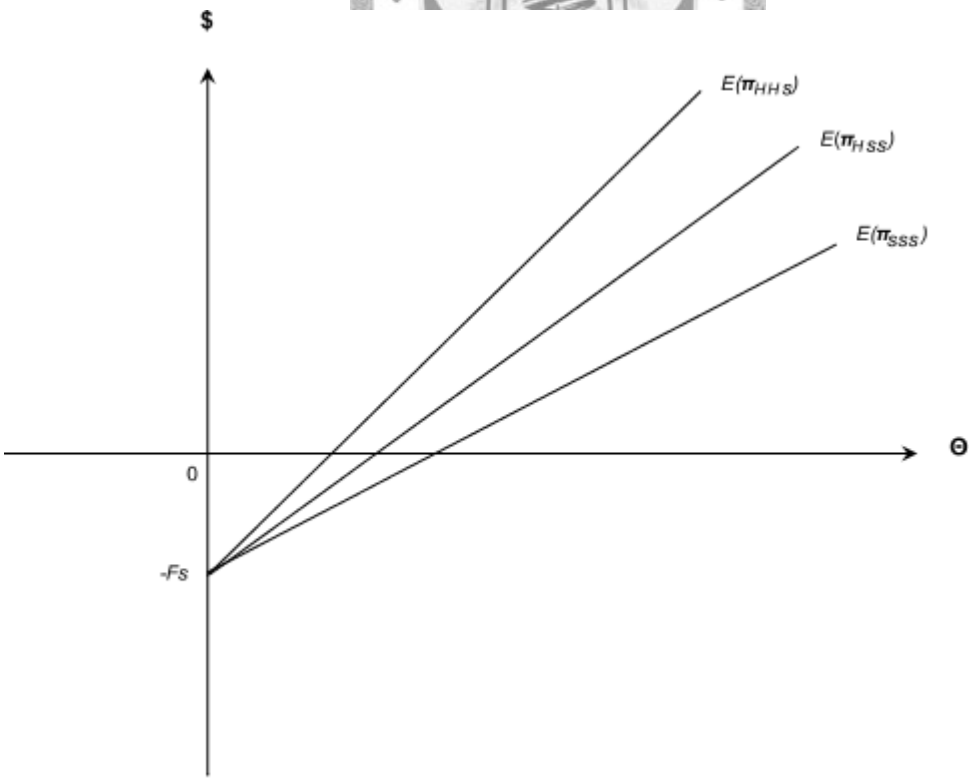

Fig. 13 . Expected profit of different strategies.

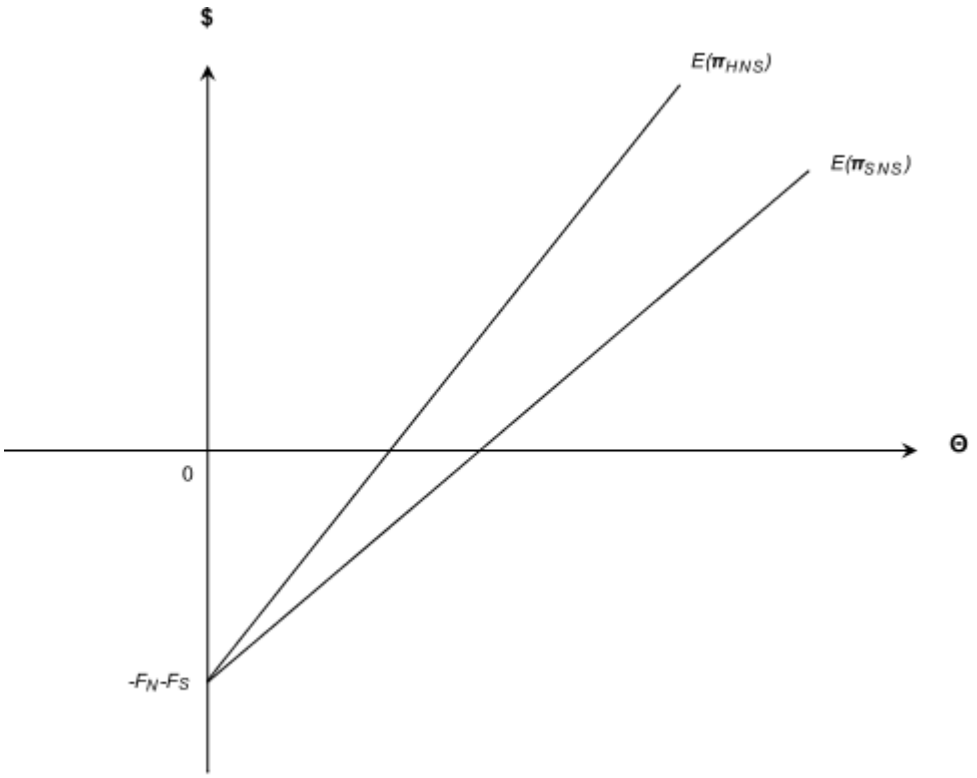

Fig. 14 . Expected profit of different strategies.

Under the circumstance of quite costly shipping costs, the most productive firms which have already established plants in South are motivated to locate additional plants in North in order to save transportation costs. If the shipping cost is large enough to satisfy

$$(1-\Omega_N)\, W_N^{1-\sigma} > t^{1-\sigma} \tag{17}$$

Firms with the most productivity will choose to locate their foreign manufacturing units in both North and South rather than only in South as shown in Fig. 15.[9] Similarly, for strategy (H, N, S) to be more profitable than strategy (H, N, H), we also assume that the shipping cost is quite large such that

$$(1-\Omega_S)\, W_S^{1-\sigma} > t^{1-\sigma} \tag{18}$$

Although there is exceedingly large volatility in South, firms with the most

[9] If the shipping cost is insufficiently large, i.e., $(1-\Omega_N)\, W_N^{1-\sigma} < t^{1-\sigma}$, strategy (H, N, S) is less profitable than strategy (H, H, S) at all productivity levels, and it would not be the optimal outcome for firms.

productivity will still switch from strategy (H, N, H) to (H, N, S) when the transportation cost is sufficiently high: the most productive firms will serve the South market via FDI rather than exporting.[10] This outcome is depicted in Fig. 16. In addition, Eq. (18) indicates that it is more beneficial for firms with more productivity to serve the South market via locating manufacturing units in South rather than exporting from Home. In Fig. 17, it is clear that the more productive firms will tend to serve the overseas markets through engaging in FDI rather than through exporting in order to save the stiff shipping costs.

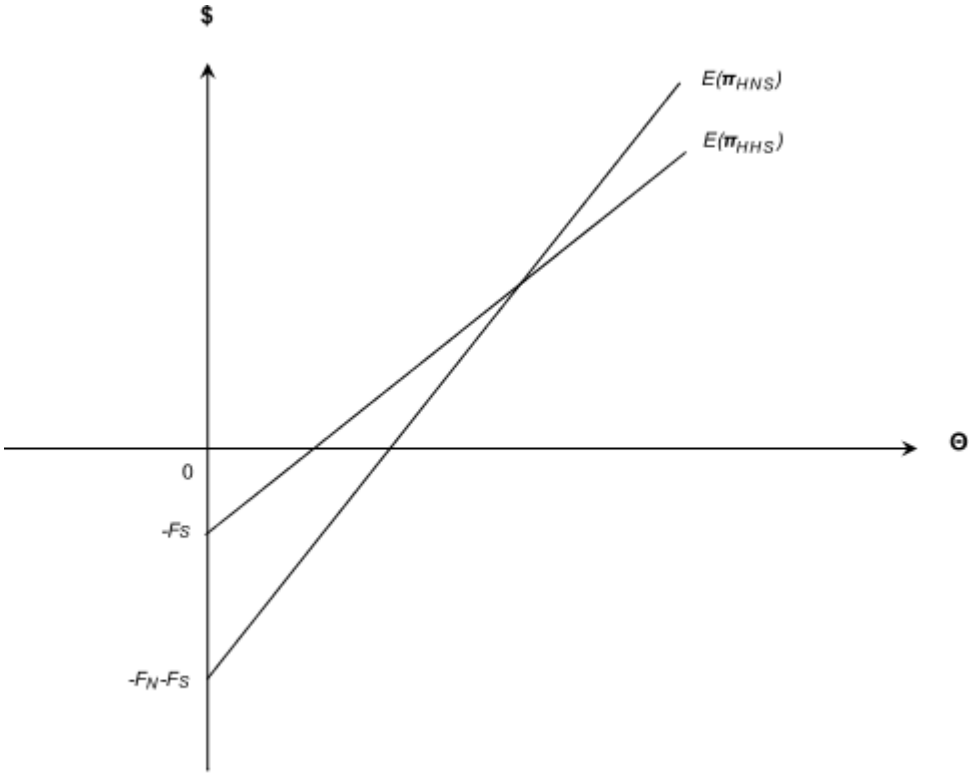

Fig. 15. Expected profit of different strategies.

[10] If it is more profitable to serve the South market via exporting from Home than producing in South, i.e., $(1-\Omega_S)\ W_S^{1-\sigma} < t^{1-\sigma}$, strategy (H, N, S) is less profitable than strategy (H, N, H) at all productivity levels, and it would not be the optimal outcome for firms.

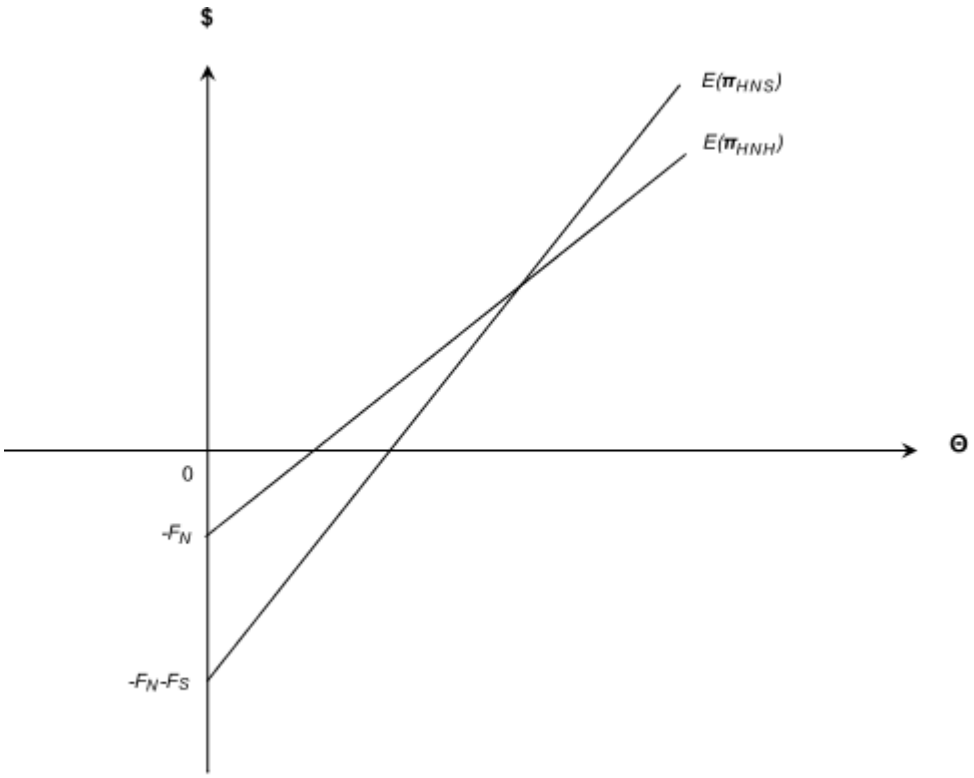

Fig. 16. Expected profit of different strategies.

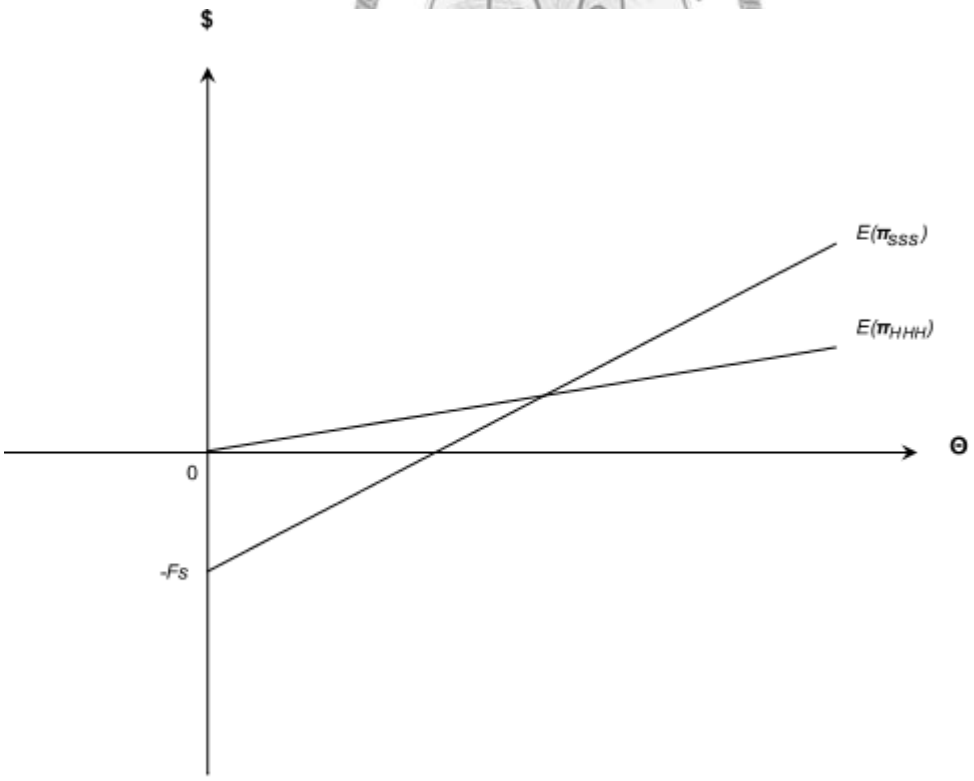

Fig. 17. Expected profit of different strategies.

Again, it is not sufficient to determine the relative profitability reflected in Eq. (9) and Eq. (10), so that there should be some more restrictions here. For strategy (H, N, H) to be more profitable than strategy (H, H, S), the relative market size between South and North, $\lambda = \lambda_S / \lambda_N$, must be less than a threshold value, $\bar{\lambda} = [(1-\Omega_N) W_N^{1-\sigma} - t^{1-\sigma}] / [(1-\Omega_S) W_S^{1-\sigma} - t^{1-\sigma}]$. That is, as long as the South market is either much smaller or much more risky relative to the North one or both, firms with more productivity will prefer strategy (H, N, H) to (H, H, S). In contrast, if $\lambda > \bar{\lambda}$, i.e., the South market is either sufficiently large or sufficiently safe relative to the North one or both, it is more profitable for firms with more productivity to locate their plants in South than in North. It is true that whether to locate production in North or South depends on the relative market size of these two countries even when, as here, the sovereign uncertainty in South is quite high.

While the market in South is sufficiently smaller than that in North, i.e., $\lambda < \bar{\lambda}$, $F_N > F_S$ must be satisfied to ensure the whole four strategies to co-exist.[11] On the other hand, when South market is large enough compared to North, $\lambda > \bar{\lambda}$, $F_N < F_S$ must be the case for the co-existence of all four strategies.[12] We will show these outcomes respectively in Fig. 18 and Fig. 19.

[11] If $F_N < F_S$, strategy (H, H, S) would be ruled out by (H, N, H), and there are only three outcomes, (H, H, H), (H, N, H) and (H, N, S) in equilibrium.
[12] If $F_N > F_S$, strategy (H, N, H) would be ruled out by (H, H, S), and there are only three outcomes, (H, H, H), (H, H, S) and (H, N, S) in equilibrium.

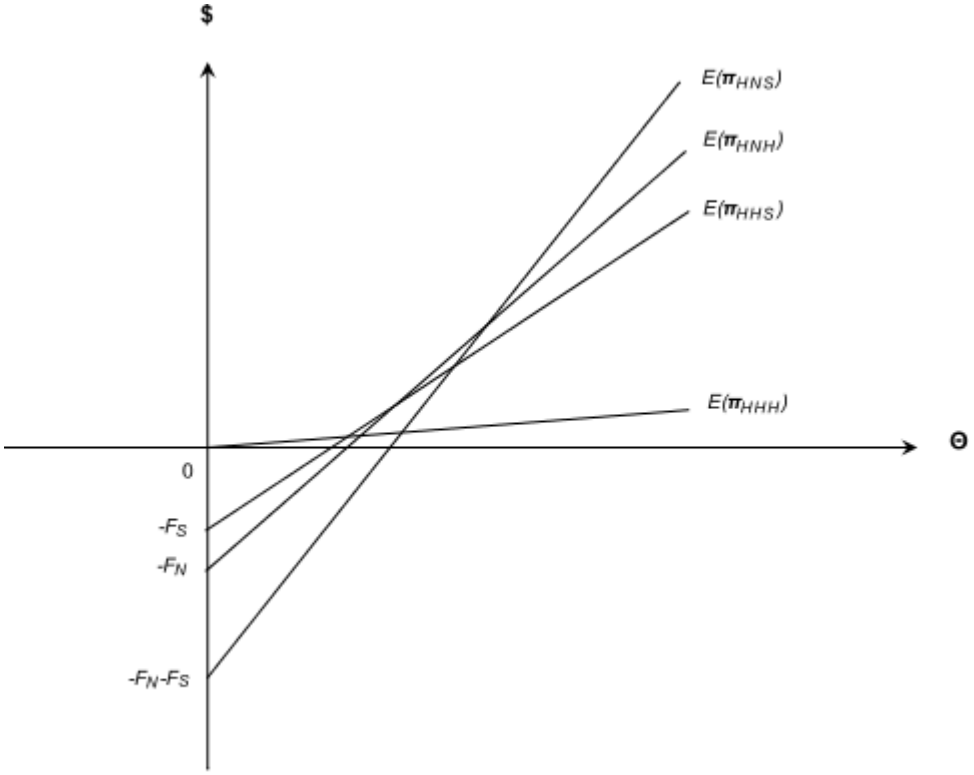

Fig. 18. Expected profit of different strategies.

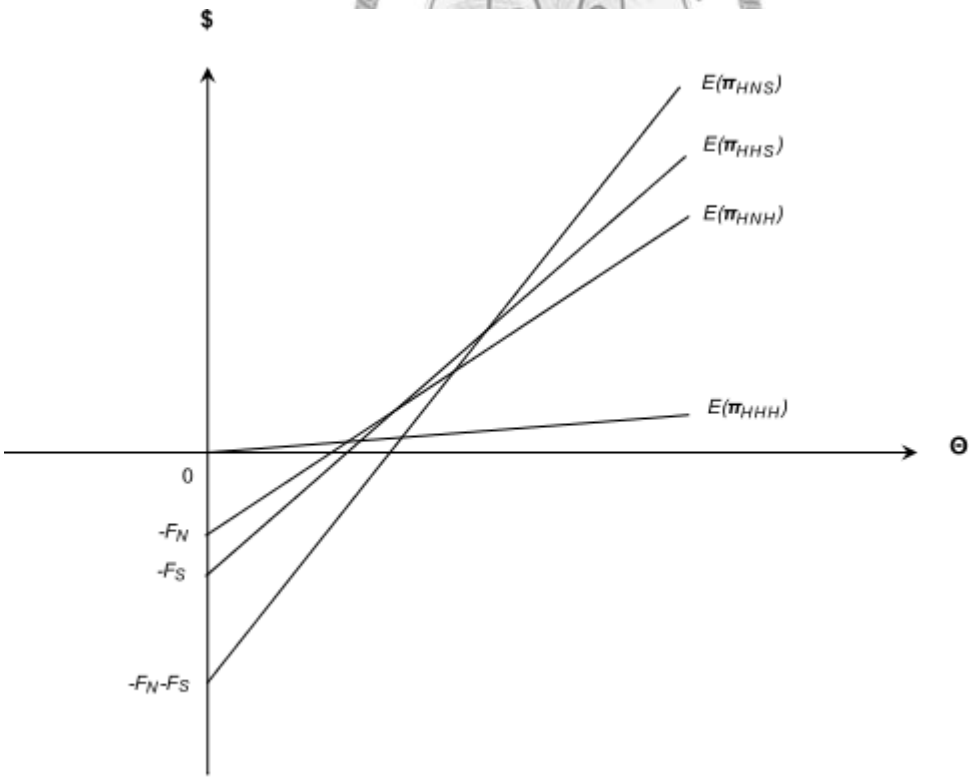

Fig. 19. Expected profit of different strategies.

5. Empirical specifications

Our theoretical framework bases its analysis on three cases, but in the domestic plant-level data, only the multinationals locating their manufacturing units domestically are observable. Due to the data limitation, we develop the empirical connection between the observable data and our theoretical model, excluding Case 1-2. In both Case 1-1 and Case 2-1, the firms with higher productivity levels would tend to engage in FDI activities. Among the firms engaging in FDI activities, the most productive ones would locate their plants in both North and South while those with productivity levels in the intermediate range would locate production only in North and those with the least productivity levels would locate production only in South. Moreover, when taking the sovereign risk into account, we would go one step further to make our model more complete than existing ones. Given low uncertainties in South and high transportation costs, firms locate manufacturing units in South to serve not only the South market but the North market. In contrast, when firms encounter high uncertainties in South and high transportation costs, it might be more profitable to serve the North market through exporting from Home than form South although firms have decided to locate factories in South where labor costs are low relative to Home.

Given the response variable takes on more than two outcomes and the outcomes have no natural ordering, one of the appropriate models is the multinomial logistic model[13]. Suppose that firm i, which engages in FDI activities, faces four alternatives of integration strategies, and Pr ($Y_i = a \mid X_i$) is the probability that firm i chooses

[13] The multinomial logistic model assumes that the ratio of any pair alternatives' likelihoods is independent from the other alternatives (IIA). By using Hausman test, we can't reject the IIA assumption.

strategy a given our explanatory variables. The multinomial logistic model is used to estimated the probability that a firm chooses one of the four integration strategies, South firms without export platform (H, H, S), South firms with export platform (H, S, S), North firms (H, N, H), Global firms (H, N, S):

$$P_i^a = \Pr(Y_i = a \mid X_i) = \exp(\pi_i^a) / \sum_{a=1}^{4} \exp(\pi_i^a) \quad (19)$$

where a= 1, 2, 3, 4, and P_i^1, P_i^2, P_i^3 and P_i^4 represent the probabilities that firm i chooses strategy (H, H, S), (H, S, S), (H, N, H) and (H, N, S) respectively. We then define a profit function of firm i for each strategy as $\Psi_i^a = \pi_i^a + \varepsilon_i^a$ and $\pi_i^a = \alpha^a + X_i \beta^a$ depending on the type specific parameter, α^a, and a vector consisting of firm characteristics, X_i, and random elements, ε_i^a. The firm characteristics included in X_i are labor productivity, local dependency, size, RD intensity, FTP intensity, FDI experience and U. Besides, the firm i would choose the integration strategy a if and only if the profit is the greatest for the strategy.

The logistic model pairs each response category with a baseline category. If the first strategy (H, H, S) were set as the reference category, we normalize the profit for (H, H, S) to zero in order to identify the parameters. Therefore the multinomial logistic model then has the form as follows,

$$\log(P_i^a / P_i^1) = \Pi_i^a = \bar{\alpha}^a + X_i \bar{\beta}^a \quad (20)$$

where a = 2, 3, 4, and $\bar{\alpha}^a = (\alpha^a - \alpha^1)$ and $\bar{\beta}^a = (\beta^a - \beta^1)$. In our analysis, labor productivity are used to measure a firm's productivity level rather than total factor productivity due to the lack of a firm's capital stock in our data. Chen and Chen (1998a) find network linkages matter in small firms' choice of FDI location so that we

include local dependency as a measure of the degree to which a multinational relies on local external linkages. Besides, we include a number of controls used in Aw and Lee (2008), such as size, RD intensity and FTP intensity to assess the relationship between multinationals' FDI location choices and their productivity levels. Since we use data of Taiwanese multinationals in a large number of industries, industry dummy variables are included in all regressions to control for specific industry effects. In addition to emphasizing multinationals' productivity levels as a determinant of their FDI location choices, we examine the impact of uncertainty on firms' location decision. However, uncertainty is categorized as external uncertainty caused by volatility in the host country and internal uncertainty due to the lack of knowledge of host countries in the international business literature.[14] It is well known that internal uncertainty arises from the firm's lack of the international experience, i.e., the differences between countries' cultures, languages and business practices. Therefore, FDI experience is used here as an indicator for firms' capacities to overcome internal uncertainty given that internal uncertainty also manifests itself in a firm's deficient experience or knowledge of foreign markets.[15] On the other hand, we generate another indicator, U, to be a proxy for the firm-specific sovereign risk while including firms' FDI experiences to distinguish the effect of internal uncertainty from the firm-specific sovereign uncertainty.

[14] Anderson and Gatignon (1986) provide thorough reviews of literatures of existing entry mode explanations within the transaction cost economics framework.

[15] Zhao et al. (2004) find that firms lacking international experience are hesitant to pursue foreign market entry aggressively.

6. Empirical results

The empirical results of our multinomial logistic models are shown in Table 5. The first three columns of Table 5 present the effect and the significance of each variable on the probability relative to the base group, South firm without export platform (H, H, S) due to our interest in not only the impact of sovereign risks on multinationals' decisions of integration strategies but the relationship between their productivity levels and their FDI location choices given high sovereign risks in South. Moreover, the differences in the coefficients of any two of the groups, excluding the base group, (H, H, S), are shown in the last three columns of Table 5 in order to examine the rankings which mirror the relationship between firms' productivity levels and their FDI location choices given low sovereign risks in South. Similarly, the coefficients in the last three columns reflect the effect and the significance of each variable on the probability relative to each reference group.

The first column of Table 5 presents the change of each variable on the likelihood of South firm with export platform, (H, S, S), compared with South firm without export platform, (H, H, S). With the exceptions of labor productivity, size and FTP intensity, the other variables here are statistically significant. These estimated results point to South firms with export platform are more locally dependent and less R&D intensive than South firms without export platform, which imply whether to build export platforms in South or not depends on the extent to which firms rely on the support from local suppliers in South, and firms with high R&D engagements tend to locate export platforms in their parent countries. A more interesting question, however, is how the uncertainty in South influences multinationals' decisions of their integration strategies. To address this question, we

decompose the uncertainty into two parts, namely the sovereign risk and the internal uncertainty. Since it is difficult to observe multinationals' individual knowledge about both sovereign risk and internal uncertainty from our data, we construct an indicator, U, to describe sovereign risks encountered by multinationals while FDI experience is used as an inverse proxy for their firm-specific internal uncertainty. Both the negative coefficient on U (-0.239) and the positive one on FDI experience (0.0955) in the first column of Table 4 indicate that the more uncertainty firms encounter in South, the more likely their plants in South are used to serve the local market only but not the third country. In other words, firms would tend to locate both their manufacturing units and their export platforms in South as the sovereign risk faced by them declines. This result is consistent with our theoretical prediction showing that the strategy of South firm with export platform is less profitable than that of South firm without export platform in a setting where the uncertainty faced by firms is sufficiently high.

We now turn to results regarding the relationship between multinationals' labor productivity and their location choices. As Table 4 shows, compared with South firm without export platform (H, H, S), the coefficient on labor productivity is positive and significant for Global firm (H, N, S), and so are those on size and FTP intensity, which are another indicators for firms' capacities. That is, the more productive, bigger and more FTP intensive the firm is, the more likely it chooses to locate production in both North and South. Besides, FDI experience responds positively and significantly to Global firm (0.204) as well as South firm with export platform (0.0955), which implies that either firms investing in both North and South or those locating both manufacturing units and export platforms in South need more FDI experiences to overcome the internal uncertainty than South firm without export

platform does. Local dependency is also one of our concerns in investigating the relationship between firms' FDI location decisions and their heterogeneities. The second column of Table 4 presents that the coefficient on local dependency (-0.0299) is significantly negative for North firm, and this result is consistent with that reported by Chen and Chen (1998a), showing that the construction of relational networks are proven to be more robust in South than in North. Besides, our study takes their paper one step further by examining the effect of local dependency on not only firms' decisions of FDI locations but also the destinations of their goods. We find that local dependency (0.00503) responds positively and significantly to South firm with export platform relative to South firm without export platform. Our empirical finding suggests that the more Taiwanese multinationals rely on the resources from local suppliers in South, the more likely they locate both their manufacturing units and their export platforms in South.

In both the fourth and fifth columns of Table 5, we used South firm with export platform (H, S, S) as the base group in order to examine the significance of firms' labor productivity on their FDI location choices between North and South given the uncertainty in South is sufficiently low. Theoretically, multinationals headquartered in a middle-income country would decide to serve both the local market and the third country through FDI in South in the presence of low sovereign risks. Furthermore, consistent with the theoretical prediction of Aw and Lee (2008), the most productive multinationals would locate production in both North and South, followed by those locating only in North, and the least productive ones would locate plants only in South. Our finding shows that relative to South firm with export platform, labor productivity (0.539), size (0.4), RD intensity (6.198), FTP intensity (53.51) and FDI experience (0.109) respond positively and significantly to Global firm (H, N, S).

These empirical results appear that labor productivity is an important determinant of investing in both North and South, and so are size, RD intensity, FTP intensity and FDI experience, which are other indicators of a firm's capacity. Also, it implies that firms, which are more productive, bigger and with more engagements in R&D, foreign technology purchases and FDI activities, would rather invest in both North and South than in South only. However, only RD intensity (6.137) responds positively and significantly to North firm while the coefficients of labor productivity, size and FTP intensity are positive but statistically insignificant. It is found that firms with more engagements in R&D are more likely to locate production in North than in South. Precisely speaking, engaging in R&D activities matters in the FDI location choice between North and South while the sovereign risk in South is low enough for multinationals.

As for the effect of local dependency under low levels of uncertainty in South, it responds negatively and significantly (-0.0349) in the fourth column of Table 5 and so does it (-0.00881) in the fifth column of Table 5. It seems that North firm is not as keen as South firm with export platform on making external linkages, and neither is Global firm, which implies that local network linkages for either firms investing in North or those investing in both North and South are not as crucial as those for multinationals locating both plants and export platforms in South. In the fourth and fifth columns of Table 5, it is found that FDI experience responds negatively (-0.191) to North firm but positively (0.109) to Global firm. These results may be due to that the internal uncertainty is lower for North firm but higher for Global firm relative to South firm with export platform, indicate that the internal uncertainty is the highest for firms to locate production in both North and South, intermediate for those to locate both manufacturing units and export platforms in South and the lowest for

those to locate production in North only. Moreover, the significance of sovereign risks on a firm's location choice between North and South is manifest in the fourth column of Table 5, where U responds positively and significantly (0.839) to North firm relative to South firm with export platform. According to our theoretical model, one explanation may be that the relative market size between North and South plays an important role on whether to locate production in North or South. As the sovereign risk increases, the relatively large market size in North motivates multinationals to locate production there even though the sovereign risk in South is low. Since the coefficients on both local dependency (0.0261) and FDI experience (0.3) are significantly positive in the last column of Table 5, we also find that relative to North firm, either local network linkages or FDI experiences facilitate multinationals to invest in both North and South.

It is known that major destinations of Taiwanese FDI are the United States, China and Southeast Asia. Chen and Chen (1998b) emphasize that firms with the most firm-specific assets tend to locate production in the United States, followed by those investing in Southeast Asia, and those with the fewest firm-specific assets tend to locate plants in China. In order to assess the robustness of our empirical results, we exclude all countries in South except for China and Hong Kong. Table 6 presents the estimation results of the multinomial logistic regression, which are consistent with those shown in Table 5. Furthermore, the impact of sovereign risks on the difference between Global firm and North firm is significant in the last column of Table 6 where the coefficient on U is significantly negative (-0.695). In sum, the more uncertainties firms encounter, the more likely they locate plants in North rather than in both North and South. This finding may be due to the difficulty of resource integration when firms locate their production in both North and South.

All in all, our empirical results support the relationship between FDI location choices of multinationals, their levels of productivity and sovereign risks they encountered, which is indicated in our theoretical model. The most productive multinationals tend to invest in both North and South regardless of sovereign risks in South. Multinationals with more concern about sovereign risks in South would rather serve the local market than serve both the local market and the third country through FDI in South. The relative market size between North and South is crucial for multinationals to decide whether to locate production in North or South, especially when they encounter fewer sovereign risks in South. The findings mentioned above are consistent with our theoretical predictions given that there are high symmetric transportation cost and type-specific fixed cost, which is the highest for investing in both North and South, intermediate for investing in North and the lowest for investing in South.

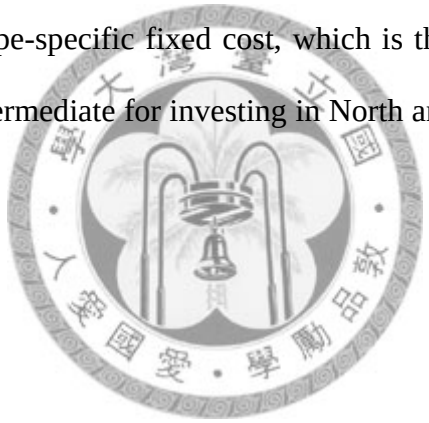

Table 5

Multinomial logistic regression

Independent Variables	(H, S, S)	(H, N, H)	(H, N, S)	Difference between (H, N, H) and (H, S, S)	Difference between (H, N, S) and (H, S, S)	Difference between (H, N, S) and (H, N, H)
Labor Productivity	0.0775	0.418	0.616***	0.340	0.539***	0.198
	(0.71)	(1.22)	(3.91)	(1.00)	(3.57)	(0.56)
Local Dependency	0.00503**	-0.0299**	-0.00378	-0.0349***	-0.00881***	0.0261**
	(2.19)	(-2.64)	(-1.20)	(-3.09)	(-2.93)	(2.28)
Size	-0.0978	0.0401	0.303***	0.138	0.400***	0.262
	(-1.39)	(0.20)	(3.27)	(0.69)	(4.49)	(1.28)
RD Intensity	-5.539**	0.598	0.659	6.137**	6.198**	0.0610
	(-2.01)	(0.74)	(0.52)	(2.15)	(2.19)	(0.04)
FTP Intensity	5.873	46.30	59.39**	40.43	53.51**	13.09
	(0.23)	(1.30)	(2.49)	(1.15)	(2.32)	(0.47)
FDI Experience	0.0955***	-0.0959	0.204***	-0.191**	0.109***	0.300***
	(4.25)	(-1.06)	(7.82)	(-2.12)	(5.12)	(3.30)
U	-0.239*	0.599	0.0171	0.839**	0.256	-0.582
	(-1.64)	(1.45)	(0.10)	(2.03)	(1.49)	(-1.41)
Constant	-1.522**	-25.23***	-5.955***	-23.70***	-4.433***	19.27***
	(-3.07)	(-14.93)	(-6.64)	(-12.64)	(-4.98)	(9.47)
Observations	887					

Notes: *t* statistics are in parentheses. * represents significance at the 0.05 level, ** represents significance at the 0.01 level, *** represents significance at the 0.001.

Table 6

Multinomial logistic regression

Independent Variables	(H, S, S)	(H, N, H)	(H, N, S)	Difference between (H, N, N) and (H, S, S)	Difference between (H, N, S) and (H, S, S)	Difference between (H, N, S) and (H, N, H)
Labor Productivity	-0.0161	0.348	0.566***	0.364	0.582***	0.218
	(-0.14)	(1.02)	(3.50)	(1.07)	(3.75)	(0.62)
Local Dependency	0.00519**	-0.0347***	-0.00437	-0.0399***	-0.00956***	0.0303**
	(2.18)	(-2.69)	(-1.34)	(-3.10)	(-3.04)	(2.34)
Size	-0.111	0.0598	0.330***	0.170	0.440***	0.270
	(-1.52)	(0.28)	(3.45)	(0.80)	(4.76)	(1.24)
RD Intensity	-5.439*	0.748	0.600	6.187**	6.039**	-0.148
	(-1.90)	(0.95)	(0.42)	(2.10)	(2.05)	(-0.09)
FTP Intensity	11.92	46.56	61.08**	34.64	49.16**	14.52
	(0.47)	(1.26)	(2.47)	(0.97)	(2.16)	(0.50)
FDI Experience	0.0925***	-0.128	0.208***	-0.221**	0.115***	0.336***
	(3.98)	(-1.36)	(7.64)	(-2.35)	(5.10)	(3.56)
U	-0.280*	0.657	-0.0376	0.937**	0.242	-0.695*
	(-1.88)	(1.61)	(-0.21)	(2.29)	(1.37)	(-1.69)
Constant	-1.403***	-24.46***	-5.712***	-23.06***	-4.309***	18.75***
	(-2.74)	(-12.61)	(-6.53)	(-10.53)	(-4.96)	(8.09)
Observations	843					

Notes: *t* statistics are in parentheses. * represents significance at the 0.05 level, ** represents significance at the 0.01 level, *** represents significance at the 0.001.

7. Conclusions

This paper has introduced a firm's heterogeneity in his individual knowledge about sovereign risks to explain the observation that the share of "pure" horizontal FDI in developing countries still amounts to over one fourths of the outward FDI stock in Taiwanese manufacturing sector. Taking firm-level sovereign risks into account can interpret the data better in the sense that for firms headquartered in a middle-income country, whether to locate the export platform in South (developing countries) depends on more concerns than just the relatively low wage rate in developing countries: in the presence of high uncertainty in South, firms would rather serve the third country through exporting from Home even though they have already located production in South where the labor force is cheap. Compared with the theoretical model of Aw and Lee (2008), a "pure" horizontal FDI in developing countries is not ruled out in our analysis and would be the optimal integration strategy for multinationals headquartered in a middle-income country in some given situations. Similarly, we construct the three-country theoretical model based on the trade-off in the transportation cost incurred by export versus the set-up cost incurred by FDI.

The key of our theoretical framework is that the expected profit function is applied in a firm's FDI decision making. The expected profit of each integration strategy is interpreted as its long-run average profit. Conceptually, it is understandable that each firm face a different probability of taking a severe toll while locating production overseas. In our analysis, the optimal production location of multinationals depends on their own productivity levels and their individual knowledge about sovereign risks of FDI locations as well in a setting where fixed set-up costs, labor costs, symmetric transportation costs and the relative market size

between North and South are also determinants of FDI location choices. Given this framework, when the transportation cost is stiff and sovereign risks in South are low, firms tend to serve not only the South market but the North market via FDI in South. On the other hand, even though the wage rate in South is relatively low, locating production in South to serve the local market only is more profitable when firms face high sovereign risks in South. However, multinationals would choose to shut down the domestic plants and to locate production in South to serve all of the markets in the world in a setting where the transport of final goods is not so costly and their concerns with sovereign risks in South are low as well. Consistent with other existing models, we also find that the least productive firms prefer serving foreign markets via exporting from domestic plants to serving them via FDI. Given the fixed investment cost is higher in North than in South, the most productive firms among those engaging in FDI would locate production in both North and South, followed by those investing in North, and the least productive ones tend to locate plants in South.

We use multinomial logistic model to examine not only the significance of the relationship between FDI location choices and firms' productivity levels but the impact of uncertainty on their decisions of integration strategies. The more productive firms are, the more likely they invest in both North and South than in South. However, the coefficient of labor productivity on North firm is insignificant in our empirical model so that our data is unable to reflect the ranking of multinationals' productivity levels, which is predicted in our theoretical model. Besides, in our empirical analysis, network linkages are proven to have an impact on multinationals' decision-makings, which includes either FDI locations or goods destinations. According to our empirical findings, the more firms rely on the resource from local suppliers, the more likely they locate both their plants and export

platforms in South in order to serve either the local market or the third country. With the increase of sovereign risks in South, firms tend to locate manufacturing units in South in order to serve the local market only. In other words, the market-access incentive is crucial for firms to invest in South in the presence of high uncertainty. Moreover, whether to locate production in North or South depends on the relative market size between North and South, which might be proved by the significantly positive coefficient on U for the difference between North firm and South firm with export platform. In particular, we distinguish the effect of internal uncertainty from sovereign risks by including the inverse proxy, FDI experience, in our empirical model. The significance of the coefficient on FDI experience provides us a robust result, which is consistent with our theoretical prediction. It will be helpful to yield more robust empirical results in the future if there would be some characteristics which could be used as the measures of the firm-specific FDI risks. Although our empirical analysis focuses on firms' decisions of FDI location choices, our theoretical model could also be used to analyze firm's behaviors of the international trade. It would be more interesting to take both the international trade and the foreign direct investment into account in the empirical model to examine the relationship between firms' decision making and their specific characteristics once the appropriate data is available.

Appendix A

Correlations of variables

	a	b	c	d	e	f	g
Labor Productivity	1.000						
Local Dependency	-0.057	1.000					
Size	0.199	-0.115	1.000				
RD intensity	-0.044	-0.064	-0.038	1.000			
FTP intensity	0.036	-0.068	0.176	0.018	1.000		
FDI Experience	0.132	0.061	0.048	-0.044	-0.022	1.000	
U	-0.052	0.116	-0.053	0.086	-0.048	0.008	1.000

Note: ‘a’ represents ‘Labor Productivity’, ‘b’ for ‘Local Dependency’, ‘c’ for ‘Size’, ‘d’ for ‘RD intensity, ‘e’ for ‘FTP intensity’, ‘f’ for ‘FDI Experience’, ‘g’ for ‘U’.

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