行政院國家科學委員會補助專題研究計畫 ■ **成 果 報 告**
□**期中進度報告**

創新研發與匯率波動對廠商海外擴張策略之影響

計畫類別：■ 個別型計畫　　□ 整合型計畫
計畫編號：NSC 96－2415－H－035－012－
執行期間：96 年 8 月 1 日至 97 年 7 月 31 日

計畫主持人：許鈺珮
共同主持人：
計畫參與人員：王國任、曾馨瑩、陳智偉、張振嘉、莊雅評

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中　華　民　國　九　十　七　年　十　月　三　十　日

NSC 96-2415-H-035-012 Brief Project Report

How Do Innovation and Exchange Rate Changes affect Firms' Mode of Foreign Expansion?

Principle Investigator: Yu-Pei Hsu
Department of International Trade, Feng Chia University

Abstract

This paper uses a two-country two-firm imperfect competition model where each firm is located in a different country. We study the effects of firms' innovation and exchange rate change on their international expansion choices. As in Petit and Sanna-Randaccio (2000), the market structure is endogenously determined by the subgame perfect Nash Equilibrium of a three-stage game that involves three different decisions by the firms: how to expand abroad, how much to invest in R&D, and how much to sell in each country under different market configurations. Since the price of output is directly affected by the exchange rate, we carefully include the impact of an anticipated exchange rate change in the future on firms' current decisions. The results show that an increase in R&D productivity leads firms towards multinational expansion. Furthermore, home currency appreciation also raises the likelihood of FDI by firms. Compared to results of P-S (2000), mixed duopoly is more likely to arise under exchange rate fluctuation in our model.

JEL classification: F23; L10; O34
Keywords: Innovation; Exchange rate changes; Mode of foreign expansion

1. Introduction

Technological innovation plays the most important role of firms' and countries' growth. The multinational expansion of firms, especially via foreign direct investment (FDI), not only account for a large share of world trade, but also are the major producers of research and development and transferors of technology in the world economy in recent decades. A strong relationship between technological innovation and international expansion of multinational enterprises (MNEs) has been noted by the United Nations Conference on Trade and Development (UNCTAD) in its yearly World Investment Report, and several empirical studies (e.g., Grubaugh, 1987; Cantwell and Hodson, 1991; and Neven and Siotis, 1996) also point out that investing abroad encourages technological competence and how their international strategies affect their innovative activities. The theory of Vernon (1996) and Caves (1996) show that FDI innovation causes multinational expansion has also helped shape the view that MNEs invest in the foreign production so that they can use the technological benefits developed in their home market.

Despite what emerges from the empirical evidence, existing theoretical studies in the literature have mostly dealt with technological innovation and the mode of foreign expansion separately. One group of papers studies the R&D competition between oligopolies, and ignores any problems relating to firms' foreign expansion since the oligopolistic firms considered only produce within a single country (e.g., Spence, 1984; D'Aspremont and Jacquemin, 1988; Kamien et al., 1992; Petit and Tolwinski, 1996, 1998). A second group of studies looks at the choices of foreign expansion between exporting and FDI as the solution of a two-stage game between international oligopolies (e.g., Dei, 1990; Rowthorn, 1992; Helpman et al., 2004). However, it does

not take into account the possible effects of technological innovation. A third group of studies considers both the role of firms' R&D investment and their choice of international expansion scheme, but examines only one of the two decisions. Horstmann and Markusen (1992) and Ethier and Markusen (1996) discuss the effect of R&D expenditure on firms' mode of foreign expansion, but ignore the R&D decision. They only consider a MNE as a transferor of technology instead of a producer of technological innovations in their models. Furthermore, the studies by Veugelers and Vanden Houte (1990) and Wang and Blomstorm (1992) consider firms' R&D decision in an international setting, but their models ignore firms' choices of the mode of foreign expansion. A forth group of literature presents the first attempt to provide a formal model analyzing firms' decisions on whether to expand abroad through exporting or FDI, and also on both R&D investment and the level of output. (e.g., Petit and Sanna-Randaccio, 2000; Sanna-Randaccio, 2002). Petit and Sanna-Randaccio (P-S) considers a two-firm two-country model where each firm is located in a different country, and firms' R&D investments and mode of foreign expansion are determined endogenously. Their model is structured as a three-stage game where firms make three different decisions: how to expand abroad, how much to invest in R&D activities, and how much to sell in each market.

Although the interaction between firms' innovation and international expansion has been studied as mentioned above, the formal literature ignores any problems relating to the impact of exchange rate changes. With the breakdown of the Bretton Woods Agreement, there has been a large increase in exchange rate volatility. In the international market, the exchange rate movement matters since it affects financial markets, the price of traded goods, and the trade balance. In theory, a home currency

depreciation allows exporters o decrease the local currency price in the foreign market and to sell more products, holding everything else constant. At the same time, it makes the foreign exporters charge higher home currency price in the domestic market, and helps domestic consumers buy fewer imports. As a result, the home currency depreciation improves the trade balance for the home country. Besides, the impact of exchange rate movements on the international location of economic activities has long been a subject of interest. Extant studies show that the level and volatility of exchange rate can have significant effect on FDI (e.g., Cushman, 1985, Campa, 1993, Stokman and Vlaar, 1996; De Ménil, 1999; Ricci, 1998; Lafrance and Tessier, 2001, Görg and Wakelin, 2002). However, the impact of currency movements can be expected to differ across multinational firms according to the type of activity undertaken in different locations, the sources of intermediate inputs and the destination of the finished product.

This present paper is closely related to the works by Petit and Sanna-Randaccio by considering the effect of an anticipated exchange rate change in the future on firms' current foreign expansion decisions. The paper is concerned with the following two issues: the effect of R&D activities and technological spillovers on firms' international expansion, and the effect of exchange rate changes on the mode of foreign expansion. As in the P-S model, these issues are studied here using a three-stage game. The major difference between our model and P-S's model would be that the exchange rate effect is considered here.

Our results show that an increase in R&D productivity leads firms towards multinational expansion. Furthermore, home currency appreciation also raises the

likelihood of FDI by firms. Compared to results of P-S (2000), mixed duopoly is more likely to arise under exchange rate fluctuation in our model.

The rest of the paper is organized as follows. Section 2 presents the basic model setup. Sections 3 and 4 analyze the effects of firm's innovation and exchange rate changes on the mode of foreign expansion. Section 5 concludes the paper.

2. Model setup

We consider two countries (A and B) with linear demand equations for a homogeneous product that is produced by two firms (1 and 2). Firm 1 is located in country A, and firm two is located in country B. Both firms choose among three possible strategies: no expansion abroad (NE), which implies that the firm is inactive, export to the other country (EXP), or manufacture the product in other country through FDI (FDI). Firms charge the local-currency price in the foreign market. The consumers in both countries have the same preferences for the goods. The exchange rate is given exogenously. These two firms maximize their own currency value of the profits. The (inverse) demand equations take the following linear form:

$$P_A = a - b(q_{1A} + q_{2A}), \quad P_B = a - b(q_{1B} + q_{2B}), \tag{1}$$

where p_A and P_B denote prices in country A and country B respectively, and q_{ij} represents sales of firm i in country j (i =1, 2, j=A, B). The demand parameters a and b are both positive, and 1/b measures the size of the market in each country.

Let I_i denote the level of R&D investment by firm i. Firm i's marginal (unit) cost of production $m_i(I)$ is a function of I = (I_1, I_2) and is given by,

$$m_i(I) = A - \theta(I_i + \alpha I_j), \quad \text{i, j = 1, 2, i} \neq \text{j} \tag{2}$$

In (2), A is the initial marginal cost of production of both firms (the cost that would exist when neither firm engages in any R&D activities); θ ($\theta > 0$) denotes the productivity of firms' research efforts, it measures how fast firms' marginal costs decrease as their R&D levels increase; $\alpha \in [0,1]$ is the spillover parameter, for $\alpha > 0$ a firm's marginal cost is affected both by its own R&D effort and by the R&D effort of the other firm. The cost of R&D investment for each firm is given by $rI_i^2/2$, $r > 0$, implying diminishing returns to R&D efforts. Our model specifications imply that the firms are initially equal and face the same opportunities of choices.

For simplicity, the plant specific cost is assumed to be the same in both countries as G. Each firm has three possible expansion strategies: no expansion abroad (NE), implying that the firm is inactive, export (EXP) – producing in home country and exporting abroad, and foreign direct investment (FDI) – producing in both countries and becoming a MNE. While exporting implies additional marginal (and unit) transportation costs, s, MNE involves additional plant specific fixed cost, G, and each firm has an exogenous cost component that captures all other firm-specific activities, F. Therefore, FDI has higher fixed cost and lower marginal cost while exporting involves higher marginal cost and lower fixed cost.

We also define the nominal exchange rate by e, which represents the units of country A's currency per unit of country B's currency: e = (country A's currency) / (country B's currency). We focus on the case where only the price of output is affected by the exchange rate since costs are incurred before the good is produced and sold. We are looking at the effect of an anticipated exchange rate change in the future on current decisions. Firms maximize their own currency value of the profits.

Since profits of the two firms are different depending on the market configuration considered, five different conditions need to be considered as follows:

Case A (MNE Duopoly): Both firms serve the other country by creating a production subsidiary in the other country. In this case, the firms' profits are given by

$$\Pi_1^{DD} = (a - b(q_{1A} + q_{2A}))q_{1A} + e(a - b(q_{1B} + q_{2B}))q_{1B} - (A - \theta(I_1 + \alpha I_2))(q_{1A} + q_{1B}) - \frac{rI_1^2}{2} - F - 2G \qquad (3)$$

$$\Pi_2^{DD} = (\frac{1}{e})(a - b(q_{1A} + q_{2A}))q_{2A} + (a - b(q_{1B} + q_{2B}))q_{2B} - (A - \theta(\alpha I_1 + I_2))(q_{2A} + q_{2B}) - \frac{rI_2^2}{2} - F - 2G \qquad (4)$$

In (3) and (4), superscript DD denotes the case where both firms adopt the FDI expansion path. The first two terms represent revenue from home and abroad respectively. Since firms charge the local-currency price in the foreign market, we consider the exchange rate effect while calculating the final profit of each firm. The third term is total variable production cost, the fourth term is R&D cost, the fifth term F is an exogenous cost component that captures all other firm-specific activities (P-S, 2000), and the last term is the total plant specific fixed cost incurred.

Case B (Exporting Duopoly): Both firms serve the other country by exporting. Their profits in this case are

$$\Pi_1^{EE} = (a - b(q_{1A} + q_{2A}))q_{1A} + e(a - b(q_{1B} + q_{2B}))q_{1B} - (A - \theta(I_1 + \alpha I_2))q_{1A} - (A - \theta(I_1 + \alpha I_2) + s)q_{1B} - \frac{rI_1^2}{2} - F - G \quad (5)$$

$$\Pi_2^{EE} = (\frac{1}{e})(a - b(q_{1A} + q_{2A}))q_{2A} + (a - b(q_{1B} + q_{2B}))q_{2B} - (A - \theta(\alpha I_1 + I_2))q_{2B} - (A - \theta(\alpha I_1 + I_2) + s)q_{2A} - \frac{rI_2^2}{2} - F - G \quad (6)$$

In (5) and (6), superscript EE denotes the case of an exporting duopoly.

Case C (Mixed Duopoly): One firm is an MNE, the other is an exporter. As in P-S (2002), we first assume in our analysis of this case that firm 1 is an exporter and firm 2 is an MNE. The firms' profits in this case are given by

$$\Pi_1^{ED} = (a - b(q_{1A} + q_{2A}))q_{1A} + e(a - b(q_{1B} + q_{2B}))q_{1B} - (A - \theta(I_1 + \alpha I_2))q_{1A} - (A - \theta(I_1 + \alpha I_2) + s)q_{1B} - \frac{rI_1^2}{2} - F - G \quad (7)$$

$$\Pi_2^{ED} = (\frac{1}{e})(a - b(q_{1A} + q_{2A}))q_{2A} + (a - b(q_{1B} + q_{2B}))q_{2B} - (A - \theta(\alpha I_1 + I_2))(q_{2A} + q_{2B}) - \frac{rI_2^2}{2} - F - 2G \quad (8)$$

In (7) and (8), superscript ED denotes the mixed duopoly case with firm 1 as an exporting firm and firm 2 an MNE firm. If Firm 1 is an MNE and firm 2 is an exporter, their profits in this case are

$$\Pi_1^{DE} = (a - b(q_{1A} + q_{2A}))q_{1A} + e(a - b(q_{1B} + q_{2B}))q_{1B} - (A - \theta(I_1 + \alpha I_2))(q_{1A} + q_{1B}) - \frac{rI_1^2}{2} - F - 2G$$

$$\Pi_2^{DE} = (\frac{1}{e})(a - b(q_{1A} + q_{2A}))q_{2A} + (a - b(q_{1B} + q_{2B}))q_{2B} - (A - \theta(\alpha I_1 + I_2))q_{2B} - (A - \theta(\alpha I_1 + I_2) + s)q_{2A} - \frac{rI_2^2}{2} - F - G$$

Case D (MNE Monopoly): One of the two firms is inactive. The active firm then becomes a monopolist and creates a production subsidiary in the foreign country. If firm 1 is the active firm, its profit is given by

$$\pi_1^D = (a - bq_{1A})q_{1A} + e(a - bq_{1B})q_{1B} - (A - \theta I)(q_{1A} + q_{1B}) - \frac{rI^2}{2} - F - 2G \quad (9)$$

If firm 2 is the active firm, its profit is given by

$$\pi_2^D = (\frac{1}{e})(a - bq_{2A})q_{2A} + (a - bq_{2B})q_{2B} - (A - \theta I)(q_{2A} + q_{2B}) - \frac{rI^2}{2} - F - 2G \quad (10)$$

Case E (Exporting Monopoly): One of the two firms is inactive. The active firm only has one plant and exports to the other country. If firm 1 is the active firm, then its profit is

$$\Pi_1^E = (a - bq_{1A})q_{1A} + e(a - bq_{1B})q_{1B} - (A - \theta I)q_{1A} - (A - \theta I + s)q_{1B} - \frac{rI^2}{2} - F - G \quad (11)$$

If firm 2 is the active firm, then its profit is

$$\Pi_2^E = (\frac{1}{e})(a - bq_{2A})q_{sA} + (a - bq_{2B})q_{2B} - (A - \theta I)q_{2B} - (A - \theta I + s)q_{2A} - \frac{rI^2}{2} - F - G \quad (12)$$

The three-stage game unfolds as follows: First, the two firms choose simultaneously and noncooperatively how to expand abroad among NE, EXP, FDI. Second, they decide how much to invest in R&D. Finally, they choose simultaneously and noncooperatively how much to sell in each country. The R&D levels determine their third stage unit costs of production. The price of output is affected by the exchange rate. The game is solved backwards to find the subgame Nash equilibrium. First, the Nash equilibrium for sales in the third stage is computed as functions of the

R&D investment of both firms, the exchange rate, and their expansion strategies. Second, the levels of R&D investment in the second stage are found for each market configuration. Finally, the first-stage game is solved to obtain the equilibrium market

structure. We focus on the case where only the price of output is affected by the exchange rate since costs are incurred before the good is produced and sold. As long as the exchange rate is not equal to one, firms' innovation investment and international expansion strategies are influenced, and the results have different implications from those in P-S model.

3. The effect of innovation on the mode of foreign expansion

In this section, we endogenize the firms' foreign expansion decisions to examine the solution to the full three-stage game played by the two firms. In the first stage of the three-stage game, the firms independently and simultaneously make their expansion choices among inactive, FDI and exporting. There are nine possible outcomes from this stage, corresponding to the five different market configurations, namely both choose FDI, both choose exporting, one chooses FDI while the other chooses exporting, one chooses inactive while the other chooses FDI, and one chooses inactive while the other chooses exporting. Our focus here is on firms' equilibrium choices in the first stage of the game.

The multiplicity of choice variables and parameters in the model makes analytical determination of the Nash equilibrium in the first stage too complex to be very revealing. In the following we rely on numerical analysis. For all of our numerical analyses in this subsection, a = 36, b = 2, A = 5, s = 2, γ = 1, θ =0.3, G = 15, and F = 10. For each example, we consider three levels of R&D spillover, they

are α = 0, α = 0.5, and α = 1.0. These parameter values are chosen to be the same as those in P-S (2000) so that it is easier to examine the differences between our model and the P-S model. By computing optimal profits for each of the two

monopoly cases (D and E), and Nash equilibrium profits for each of the three duopoly cases (DD, EE and ED), we obtain the matrices reported in Tables 1 to 6, and discuss how changes in some of the R&D parameters (e.g. θ increase to 0.7; different levels of α) and exchange rate parameter (e = 1, 0.5, or 2) affect the equilibrium market structure. In all tables, the cells denoted by asterisks correspond to the Nash equilibrium.

Table 1 and Table 4 illustrate how R&D productivity θ affects firms' equilibrium choices of foreign expansion. While the exchange rate is fixed at 1, Table 1 and Table 4 show that both firms choose exporting when R&D investment has low efficiency, and both firms choose FDI when R&D investment is highly efficient for any value of the spillover parameter α. The results are exactly the same as those in the P-S model since the exchange rate is set at 1.

When country A's currency depreciates relative to country B's currency (e = 0.5), Table 2 and Table 5 indicate that an increase in the R&D productivity parameter θ might have different impacts on firms' mode of foreign expansion. A higher efficiency in research and innovation pushes the firms from the Export-FDI to the FDI-FDI equilibrium. By comparing Table 3 and Table 6, when country A's currency appreciates relative to country B's currency (e = 2), an increase in R&D productivity pushes the firms from the FDI-Export to the FDI-FDI equilibrium. However, an increase in the value of the spillover parameter α does not demonstrate a certain

effect on the equilibrium mode of foreign expansion when all other parameters being fixed.

Therefore, these results show that a higher efficiency in the innovative process pushes the firms to the FDI choice. A given increase in R&D results in a greater decline in the firms' unit variable cost, and thus in a more powerful positive effect on variable profits.

4. The effect of exchange rate changes on the mode of foreign expansion

In the previous section we have dealt with the effect of innovation on firms' foreign expansion. Here we discuss how exchange rate changes affect the equilibrium solutions.

In Tables 1 to 3, a firm with home currency appreciation tends to choose its mode of foreign expansion from exporting to FDI. By contrast, a firm with home currency depreciation seems to choose its international strategy from FDI to exporting. These results are consistent with the general idea that home currency appreciation deters exporting, and home currency depreciation improves exporting. Furthermore, under exchange rate fluctuation, mixed duopoly is more likely to arise in our model.

5. Conclusion

Using a two-country two-firm imperfect competition model where each firm is located in a different country, this paper studies the effects of firms' innovation and exchange rate change on their international expansion choices. As in Petit and

Sanna-Randaccio (2000), the market structure is endogenously determined by the subgame perfect Nash Equilibrium of a three-stage game that involves three different decisions by the firms: how to expand abroad, how much to invest in R&D, and how much to sell in each country under different market configurations. Since the price of output is directly affected by the exchange rate, we carefully include the impact of an anticipated exchange rate change in the future on firms' current decisions. The results show that a higher efficiency in the innovative process leads firms towards multinational expansion. Furthermore, home currency appreciation also raises the likelihood of FDI by firms. Compared to results of P-S (2000), mixed duopoly is more likely to arise under exchange rate fluctuation in our model.

Table 1 θ = 0.3, e = 1

		Firm 2		
		NE	EXP	FDI
α = 0.0				
	NE	0, 0	0, 210.8	0, 211.6
Firm 1	EXP	210.8, 0	75.8*, 75.8*	67.8, 74.7
	FDI	211.6, 0	74.7, 67.8	66.6, 66.6
α = 0.5				
	NE	0, 0	0, 210.8	0, 211.6
Firm 1	EXP	210.8, 0	80.7*, 80.7*	73.3, 79.2
	FDI	211.6, 0	79.2, 73.3	71.8, 71.8
α = 1.0				
	NE	0, 0	0, 210.8	0, 211.6
Firm 1	EXP	210.8, 0	82.3*, 82.3*	75.2, 80.6
	FDI	211.6, 0	80.6, 75.2	73.5, 73.5

Table 2 θ = 0.3, e = 0.5

		Firm 2		
		NE	EXP	FDI
α = 0.0				
	NE	0, 0	0, 370.9	0, 372.8
Firm 1	EXP	133.8, 0	31.2, 188.7	25.2*, 190.8*
	FDI	132.2, 0	22.6, 169.3	19.1, 170.4
α = 0.5				
	NE	0, 0	0, 370.9	0, 372.8
Firm 1	EXP	133.8, 0	35.6, 188.6	30*, 189.2*
	FDI	132.2, 0	27.5, 170.4	24.2, 171.1
α = 1.0				
	NE	0, 0	0, 370.9	0, 372.8
Firm 1	EXP	133.8, 0	32.5*, 192.9*	27.1, 192.8
	FDI	132.2, 0	24.0, 175.4	20.7, 176

Table 3 θ = 0.3, e = 2

		Firm 2		
		NE	EXP	FDI
α = 0.0				
	NE	0, 0	0, 133.8	0, 132.2
Firm 1	EXP	370.9, 0	188.7, 31.2	169.3, 22.6
	FDI	372.8, 0	190.8*, 25.2*	170.4, 19.1
α = 0.5				
	NE	0, 0	0, 133.8	0, 132.2
Firm 1	EXP	370.9, 0	188.6, 35.6	170.4, 27.5
	FDI	372.8, 0	189*, 30*	171.1, 24.2
α = 1.0				
	NE	0, 0	0, 133.8	0, 132.2
Firm 1	EXP	370.9, 0	192.9*, 32.5*	175.4, 24
	FDI	372.8, 0	192.8, 27.1	176, 20.7

Table 4 θ = 0.7, e = 1

		Firm 2		
		NE	EXP	FDI
α = 0.0				
	NE	0, 0	0, 273.3	0, 278.2
Firm 1	EXP	273.3, 0	68.2, 68.2	50.8, 77.8
	FDI	278.2, 0	77.8, 50.8	58.5*, 58.5*
α = 0.5				
	NE	0, 0	0, 273.3	0, 278.2
Firm 1	EXP	273.3, 0	108.4, 108.4	99.2, 110.8
	FDI	278.2, 0	110.8, 99.2	101.4*, 101.4*
α = 1.0				
	NE	0, 0	0, 273.3	0, 278.2
Firm 1	EXP	273.3, 0	121.6, 121.6	114.6, 122.4
	FDI	278.2, 0	122.4, 114.6	115.5*, 115.5*

Table 5 θ = 0.7, e = 0.5

		Firm 2		
		NE	EXP	FDI
α = 0.0				
	NE	0, 0	0, 434.8	0, 438.7
Firm 1	EXP	193.4, 0	72.9, 50.7	40.7, 104.8
	FDI	201, 0	74.2, 40.4	64.1*, 43.4*
α = 0.5				
	NE	0, 0	0, 434.8	0, 438.7
Firm 1	EXP	193.4, 0	85, 123.2	75, 136.7
	FDI	201, 0	86.8*, 112.4*	82.1, 112.3
α = 1.0				
	NE	0, 0	0, 434.8	0, 438.7
Firm 1	EXP	193.4, 0	49.2, 183.2	43.4, 192.9
	FDI	201, 0	48, 175.4	43.7*, 176*

Table 6 θ = 0.7, e = 2

		Firm 2		
		NE	EXP	FDI
α = 0.0				
	NE	0, 0	0, 193.4	0, 201
Firm 1	EXP	434.8, 0	50.7, 72.9	40.4, 74.2
	FDI	438.7, 0	104.8, 40.7	43.4*, 64.1*
α = 0.5				
	NE	0, 0	0, 193.4	0, 201
Firm 1	EXP	434.8, 0	123.2, 85	112.4*, 86.8*
	FDI	438.7, 0	136.7, 75	112.3, 82.1
α = 1.0				
	NE	0, 0	0, 193.4	0, 201
Firm 1	EXP	434.8, 0	183.2, 49.2	175.4, 48
	FDI	438.7, 0	192.9, 43.4	176*, 43.7*

References

Campa, J. M. (1993), "Entry by Foreign Firms in the United States under Exchange Rate Uncertainty," *Review of Economics and Statistics*, 75, 614-22.

Cantwell, J. A. and C. Hodson (1991), "Global R&D and UK Competitiveness," In: Casson, M. (Ed.), *Global Research Strategy and International Competitiveness*. Basil Blackwell, Oxford: 133-182.

Caves, R. E. (1996), *Multinational Enterprise and Economic Analysis*. Cambridge University Press, Cambridge.

Cushman, D. O. (1985), "Real Exchange Rate Risk, Expectations and the Level of Direct Investment," *Review of Economics and Statistics*, 67, 297-308.

D'Aspremont, C. and A. Jacquemin (1988), "Cooperative and Noncooperative R&D in Duopoly with Spillovers," *American Economic Review*, 78, 1133-1138.

Dei, F. (1990), "A Note on Multinational Corporations in a Model of Reciprocal Dumping," *Journal of International Economics*, 29, 161-171.

DeMénil, G. (1999), "Real Capital Market Integration," *Economic Policy*, 28, 165-201.

Either, W. J., and J. R. Markusen (1996), "Multinational Firms, Technology Diffusion and Trade," *Journal of International Economics*, 41, 1-28.

Görg, H. and K. Wakelin (2002), "The Impact of Exchange Rate Volatility on US Investment," *Manchester School*, 70, 380-397.

Grubaugh, S. J. (1987), "Determinants of Direct Foreign Investment," *Review of Economics and Statistics*, 69, 149-152.

Helpman, E., M. Melitz and S. Yeaple (2004), "Export versus FDI with Heterogeneous Firms," *American Economic Review*, 94, 300-316.

Horstmann, I. J. and J. R. Markusen (1992), "Endogenous Market Structures in International Trade," *Journal of International Economics*, 32, 109-129.

Kamien, M. I., E. Muller, and I. Zang (1992), "Research Joint Ventures and R&D Cartels," *American Economic Review*, 82, 1293-1307.

Lafrance, R. and D. Tessier (2001), "Exchange Rate Variability and Investment in Canada," *Revisiting The Case For Flexible Exchange Rates*, Bank of Canada Conference Proceedings, Bank of Canada.

Neven, D. and G. Siotis (1996), "Technology Sourcing and FDI in the EC: An Empirical Evaluation,"*International Journal of Industrial Organization*, 14, 543-560.

Petit, M. L. and F. Sanna-Randaccio (2000), "Endogeneous R&D and Foreign Direct Investment in International Oligopolies," *International Journal of Industrial Organization*, 18, 339-367.

Petit, M. L. and B. Tolwinski (1996), "Technology Sharing Cartels and Industrial Structure," *International Journal of Industrial Organization*, 15, 77-101.

Petit, M. L. and B. Tolwinski (1998), "R&D Cooperation or Competition?," *European Economic Review*, forthcoming.

Ricci, L. A. (1998), "Uncertainty, Flexible Exchange Rates and Agglomeration," IMF Working Paper No. WP/98/9.

Rowthorn, R. E. (1992), "Intra-Industry Trade and Investment under Oligopoly: The Role of Market Size," *Economic Journal*, 102, 402-414.

Sanna-Randaccio, F. (2002), "The Impact of Foreign Direct Investment on Home and Host Countries with Endogenous R&D," *Review of International Economics*, 10, 278-298.

Spence, M. (1984), "Cost Reduction, Competition, and Industry Performance," *Econometrica*, 52, 101-121.

Stokman, A. C. and P. Vlaar (1996), "Volatility, International Trade and Capital Flows," in Bruni, F., D. Fair and R. O'Brien (eds) *Risk Management in Volatile Financial Markets* (Amsterdam: Kluwer).

Vernon, R. (1996), "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics*, 80, 190-207.

Veugelers, R. and P. Vanden Houte (1990), "Domestic R&D in the Presence of Multinational Enterprises,"*International Journal of Industrial Organization*, 8, 1-15.

Wang, J. and M. Blomstrom (1992), "Foreign Investment and Technology Transfer," *European Economic Review*, 36, 137-155.