RISKY BUSINESS:
INTRA-FIRM TRADE WITH FOREIGN COMMERCIAL RISK AND ASYMMETRIC INSURANCE

by

Gerda Dewit*

University of Glasgow

March 1998

Abstract: A partial equilibrium model is used to examine the international production allocation of a two-plant risk averse multinational firm which is confronted with uncertainty with respect to foreign sales. The firm has price-discriminating monopoly power in both markets and uses specific factors in both plants, producing an identical good. We focus on the question how unequal insurance facilities in the firm's home and host market influence the firm's international production decision and its level of intra-firm trade.

Key words: Multinationals, uncertainty, export insurance, intra-firm trade.

I am indebted to Dermot Leahy and Heinrich Ursprung for their constructive comments on a previous draft. In addition, I thank Filip Abraham, Richard Baldwin, Joseph Francois and the seminar participants of the economics department at the University of Glasgow for helpful suggestions.

Correspondence: Gerda Dewit, Department of Economics, University of Glasgow, Adam Smith Building, Glasgow G12 8RT, UK; tel.: (+44)-(0)141-330 4659; fax: (+44)-(0)141-330 4940; e-mail: G.Dewit@socsci.gla.ac.uk

Introduction

The transformed economies in Eastern Europe the rapidly growing tiger economies in South East Asia have been attracting increasing investment from Western economies. Many multinational enterprises (MNEs) have opened or expanded foreign plants in those new markets, a phenomenon exacerbated by agglomeration powers (as described by the new economic geography models; Krugman, 1991; Venables, 1994; Krugman and Venables, 1995) emerging in these markets. However, apart from their large growth potential, these popular investment areas, unlike Western economies, often still have relatively poorly developed capital and credit markets. In addition, business financing institutions which are important for companies' risk management, such as private or public insurance institutions, are practically non-existent. Therefore, these new economic regions are particularly attractive to MNEs, who can be present in those markets through a local plant, while still continuing production in the home plant, thereby limiting their exposure to risk in the foreign market.

This paper examines how the absence or incompleteness of credit and insurance markets in the host country influences the international production allocation and sales decision of a two-plant MNE which faces uncertainty in the form of commercial risk with respect to its sales in the foreign market. Commercial risk is related to the use of export credits, which grant the foreign buyer defer of payment. Because of the inherent risk of default, firms usually desire to insure these contracts. While insurance is typically unavailable in the new investment zones, most OECD-countries offer export insurance covering against the risk of default. What is more, these insurance schemes are also provided and supported by the government. As a result, these programmes often are subject to considerable lobbying from domestic vested interest groups, especially because this potential channel of protection remains fairly hidden (Abraham, Couwenberg and Dewit, 1992; Dewit, 1996). Meanwhile, the use of export credits has become increasingly important in trade relations with these specific economies (Kuhn, Horvath and Jarvis, 1995).

Our analysis will also focus on how this asymmetry in insurance facilities between the MNE's home and host market will affect inter-subsidiary trade. Inter-affiliate

trade is extensively researched in the literature (Caves, 1996, p.33) and is estimated to account for one third of total trade (UNCTC, 1988, p.92). A general finding in the literature is that there exists a complementarity between intra-firm trade and the size of the foreign plant (e.g. van den Bulcke, 1985; MacCharles, 1987; Willmore, 1992, as mentioned by Caves, 1996, p.33). For instance, if the home plant is exporting to the foreign plant, the export volume is likely to increase as the size of the foreign plant expands.

It will be argued that, without insurance in the foreign market and efficient insurance in the domestic economy, the foreign commercial risk augments the size of the domestic plant beyond its certainty-equivalent, while the opposite is true for the foreign plant. However, with official insurance schemes in the home country being subsidised, the foreign plant may expand as well, and even surpass its certainty-equivalent size. It will be shown that the latter effect will prevail if the MNE's degree of risk aversion is sufficiently small. These results will shed light on some important political economy issues.

The first section of the paper addresses the production and sales decisions of a price-discriminating monopolistic two-plant MNE facing commercial risk in the foreign market. The analytical set-up is akin to partial-equilibrium models addressing the connection between MNEs' financial and production decisions on the one hand and imperfections in capital markets on the other hand (Calderon-Rossell, 1985; Itagaki, 1991; Broll and Zilcha, 1992). The effects of domestic coverage facilities on the MNE's distribution of production and sales decisions are examined in section two. Section three focuses on how empirically observed features of official export risk management institutions may co-determine the respective sizes of the domestic and foreign plant and the level of trade between a MNE's subsidiaries. Section four incorporates a moral hazard element into the MNE-framework and investigates how operating in two markets with unequally developed insurance markets affects firms' own efforts in risk management. The final section summarises the main conclusions.

1. The multinational firm and commercial risk in the host market

Consider a monopolistic MNE with a domestic and a foreign plant, exercising price discriminating power in both markets. Both plants are producing a (non-zero quantity of an) identical good. Production requires a single specific factor, formally captured by increasing marginal costs. In spite of the additional costs incurred by setting up a foreign plant, demand in the foreign market is sufficiently large, allowing the firm to limit the high costs associated with an otherwise larger-scale domestic plant. Attention is focused on the production and sales allocation between the two markets, with the difference between local production and local sales determining the level of intra-firm trade within the MNE. Depending on the relative cost and demand differences between the markets, the home plant is a net-exporter to or a net-importer from the foreign subsidiary.

The assumption of both plants producing an identical good is not crucial. It merely implies that there will only be one-way trade in the model, while differentiated products are likely to create two-way trade between subsidiaries. The qualitative results regarding the MNE's output and sales decisions under uncertainty and asymmetrically developed insurance in both markets remain valid. In addition, production may also involve non-specific factors. As long as the firm uses at least one specific factor, thereby generating increasing marginal costs of production, the results of the model will hold.

The firm's sales contracts with foreign buyers stipulate a credit term, thereby allowing the buyer to defer payment for the period specified. Such type of contracts are especially essential when operating in newly emerging markets, since capital markets there often are underdeveloped, inefficient or even totally absent. However, this particular mode of payment implies that the firm is confronted with commercial risk in the foreign market, implying that its foreign sales revenues will be potentially reduced due to (partial or complete) default by the foreign customer. The defaulted fraction of the contract is represented by the stochastic variable l (with $0 < a \leq l \leq b \leq 1$).

With probability a the firm loses part of the value of its foreign contract as a result of its exposure to commercial risk. The MNE's local presence in the foreign market is likely to reduce the probability of default it is facing, since it may have more information about the creditworthiness of individual buyers by its direct inclusion in the local business network. Yet, given the firm's location, we assume for now that this probability is exogenously given to the MNE[1]. The MNE's total expected profits (Ep) are equal to:

$$Ep = (1-a)p_0 + a\int_a^b p_l f_l dl \qquad (1)$$

with $p_0 = R(q) + R^*(q^*) - C(x) - C^*(x^*)$ (2a)

$p_l = R(q) + (1-l)R^*(q^*) - C(x) - C^*(x^*)$ (2b)

and $x + x^* = q + q^*$ (3)

p_0 stands for the firm's total profits if the foreign customer pays the sum contracted when the credit term expires, while p_l represents profits when the foreign buyer defaults. The discount factor is set equal to one. x and x^* respectively reflect production in the domestic and the foreign plant, whereas q and q^* are denoting sales in those markets. $R(q)$ is the price discriminating MNE's revenue function in the domestic market, and $C(x)$ is the production cost function of the domestic plant (with $C'(x) > 0$ and $C''(x) > 0$)[2]. The starred functions reflect the equivalent functions for the foreign plant. There is no uncertainty with respect to domestic revenue, nor is there any other source of uncertainty included in the model.

2. Foreign commercial risk and the international production and sales allocation

Before discussing the effects of the existence of unbalanced risk management facilities between the MNE's home and host market, we examine the effect of foreign payment uncertainty on a risk averse MNE's decisions. In other words, the impact of

[1] This assumption will be altered in section 4, where moral hazard will be discussed.
[2] Since the location decision itself is given, we ignore the costs of setting up a plant.

foreign commercial risk on production, sales and hence intra-firm trade is assessed when turning to risk management institutions for insurance is impossible.

A risk averse MNE maximises its expected utility accruing from profits. Its utility function is of the von Neumann-Morgenstern type, with $U'(p) > 0$ and $U''(p) < 0$. Given that total sales have to equal total output ($q + q^* = x + x^*$), sales and output levels under uncertainty (symbolised by subscript r) are optimally distributed across markets, or

$$\max_{x_r, x_r^*, q_r^*} EU = (1-a)U(p_0) + aEU(p_l) \qquad \text{with } q_r = x_r + x_r^* - q_r^* \qquad (4)$$

$$\text{and } EU(p_l) = \int_a^b U(p_l) f_l \, dl$$

The first order conditions obtained from the maximisation procedure reduce to:

$$R'(q_r) = C'(x_r) \qquad (5a)$$

$$R'(q_r) = C^{*\prime}(x_r^*) \qquad (5b)$$

$$R'(q_r) = \left(1 - a\,\frac{EU'(p_l)El + \operatorname{cov}(U'(p_l), l)}{EU'(p)}\right) R^{*\prime}(q_r^*) \qquad (5c)$$

with $EU'(p_l) = \int_a^b U'(p_l) f_l \, dl$ and $EU'(p) = (1-a)U'(p_0) + aEU'(p_l)$

The MNE's optimal production decision implies that the marginal costs of production in the two plants are equal (which follows from combining expressions (5a) and (5b)), while equalisation of marginal revenues in both markets guarantees an optimal sales decision (expression (5c)). Optimal values for x_r, x_r^* and q_r^* are determined by (5a-c) and the value for q_r follows from the sales-production equality.

As a benchmark, we derive the certainty-equivalent production and sales values (symbolised by subscript c), with aEl representing the certainty-equivalent payment-loss. Then, the two-plant MNE maximises certainty-equivalent profits (Ep), or

$$\max_{x_c, x_c^*, q_c^*} Ep = R(q) + (1 - aEl)R^*(q^*) - C(x) - C^*(x^*) \qquad (6)$$

$$\text{with } q_c = x_c + x_c^* - q_c^*$$

Solving the optimisation problem in (6) yields the following (rearranged) first order conditions:

$$R'(q_c) = C'(x_c) \quad (7a)$$

$$R'(q_c) = C^{*\prime}(x_c^*) \quad (7b)$$

$$R'(q_c) = (1 - aEl)R^{*\prime}(q_c^*) \quad (7c)$$

Proposition 1: *With foreign commercial risk, a two-plant risk averse MNE using a specific factor, (i) sells more in the domestic market, (ii) sells less in the foreign market and (iii) produces less in both locations than under the certainty-equivalent.*

Proof:

Suppose $x_r \geq x_c$. Then, from (5a) and (7a), we know that $q_r \leq q_c$ and hence $x_r^* \geq x_c^*$ (from (5b) and (7b)). Since $\frac{EU'(p_l)}{EU'(p)} > 1$ and $\text{cov}(U'(p_l), l) > 0$, we know from (5c) and (7c) that $q_r \leq q_c$ implies that $q_r^* < q_c^*$. However, the sales-production equality ($q + q^* = x + x^*$) implies $q_r^* > q_c^*$. Hence, $x_r \geq x_c$ is violated and $x_r < x_c$ has to be true. Therefore, $x_r^* < x_c^*$, $q_r > q_c$ and $q_r^* < q_c^*$.

Corollary: *With foreign commercial risk, a risk averse MNE's foreign plant will be a net-exporter (net-importer) to (from) the home plant at smaller (larger) differences in production costs and local demand between both markets than under the certainty-equivalent.*

Proof:

(i) Suppose production costs and local demand in the two markets imply that the equilibrium certainty-equivalent level of local production is equal to the level of local sales in both markets ($x_c = q_c$, $x_c^* = q_c^*$). From proposition 1, we then know $x_r - q_r = q_r^* - x_r^* < q_c^* - x_c^* = x_c - q_c = 0$. Hence, $x_r^* > q_r^*$.

(ii) Suppose $x_r = q_r$ and $x_r^* = q_r^*$. By a similar reasoning to *(i)*, we then know $x_c^* < q_c^*$.

Suppose that the home plant initially is a net-exporter of the good produced by the MNE. Then, a positive technology or negative local demand shock in the foreign market is more likely to lead to a trade pattern reversal under uncertainty than in the

certainty-equivalent case. Unlike under certainty, the MNE discounts its 'uncertain' foreign sales revenues by its degree of risk aversion while no risk is incurred on domestic sales revenues. Consequently, foreign sales are smaller than under certainty. It also implies that the uncertainty suppresses the risk-adjusted foreign price below the price prevailing in the domestic market, inducing the MNE to export to the domestic market from its foreign subsidiary, thereby equalising marginal revenues across markets. Thus, the uncertainty raises the volume of intra-firm trade from the foreign to the domestic plant[3].

Alternatively, if no exogenous shocks occur and the domestic plant remains a net-exporter, uncertainty in the foreign market reduces the level of intra-firm trade. When the risk averse MNE sells less than the certainty-equivalent in the foreign market, this does not only mean that it produces less locally, but also that the part of the production in the domestic plant intended for export to the foreign market decreases. Conversely, the firm prefers to make up for its loss in foreign sales by selling more in the risk-free domestic market.

The absence of insurance implies that the first-best risk allocation cannot be obtained, indicating that total welfare is smaller than under certainty. The uncertainty does not only reduce economic rents but also redistributes these across groups of economic agents. First, domestic consumers would benefit from the absence of insurance facilities as the domestic price falls with the additional output directed to local demand. The uncertainty in the foreign market reduces the domestic market power of the MNE, which is reflected in the domestic price and sales level moving closer towards the certainty-equivalent perfectly competitive values. In that respect, the absence of insurance has a positive effect on domestic welfare, *seemingly* rendering the domestic industry more competitive. Second, unlike home consumers, domestic specific factors are harmed by the uncertainty in the foreign market. Since "certain" home sales are valued higher by a risk averse MNE than "risky" foreign sales, the higher level of home sales will not compensate for the foreign sales reduction. So, the

[3] If the foreign market is sufficiently large and has no relative cost advantage, firms using specific factors, having constant marginal costs of production, will either produce total output in the foreign (single) plant and export to the domestic market, or, if the domestic market is sufficiently large, produce the sales for each market in a local plant (i.e., intra-firm trade is zero).

risk in the foreign market spills over into the home market via a downsizing of the domestic plant. As a result, employment and returns of specific factors are being diminished. Third, with the uncertainty in the foreign market reducing the total size of the MNE, both the interests of corporate leadership and specific factors are negatively affected. Finally, consumers and specific factors in the foreign market are worse off as well, with foreign sales and production levels remaining well below the certainty-equivalent values.

So far we assumed that the firm had no access to risk management instruments or institutions. Most transitional economies as well as the new Asian tiger economies indeed exhibit a striking lack of a whole range of insurance and hedging mechanisms. Conversely, insurance facilities usually are in abundance in Western highly developed market economies. The next section addresses the question how the asymmetric availability of coverage institutions in both locations affects the MNE's international production and sales allocation, and hence the different interest groups in both markets.

3. The MNE with foreign commercial risk and domestic insurance

In most OECD-countries, exporters facing commercial risk of default can purchase insurance against this type of risk. Private insurance companies only insure relatively safe contracts[4], yet firms with risky export contracts can turn to the public domestic export insurance for coverage. If the default risk is linked to the export activity of the firm, an export insurance contract will remove (at least part of) this uncertainty. Such policies are offered both by private and official companies, although in most countries the latter mainly account for insurance contracts covering the most risky export markets. We examine how and to what extent the MNE's decisions in terms of risk management on the one hand and its output and sales choices on the other hand interact.

[4] Insurance markets for foreign commercial risk are usually absent or incomplete due to moral hazard problems.

Assume the domestic plant is a net-exporter to the foreign subsidiary. With th availability of domestic export insurance, profits include the costs and benefits of acquiring risk coverage and are given by

$$p_0 = R(q) + R^*(q^*) - C(x) - C^*(x^*) - rI \quad (8a)$$

$$p_l = R(q) + (1-l)R^*(q^*) - C(x) - C^*(x^*) + (l-r)I \quad (8b)$$

r symbolises the export insurance premium per currency unit insured, and I is the sum covered by insurance. If the foreign importer defaults (and p_l is realised), the fraction of the export contract which remained unpaid will be reimbursed by the domestic insurance company to the extent that coverage is taken (i.e., lI). Evidently, if full payment is received when the credit expires (and p_0 is realised), no claim payment will be made. Only foreign sales which are exported from the domestic economy are eligible for coverage by export insurance. Hence, the following constraint needs to be added to the utility maximisation problem formulated in (4):

$$I \le R^*(q^*) - p^*(q^*)x^* \quad (9)$$

p^* stands for the price in the foreign market and the right hand side of (9) is equal to the value of the MNE's exports to the foreign market. Since firms are legally prohibited to buy more than a hundred percentage insurance, the insured amount cannot exceed the sum stipulated in the export contract. In addition to sales and output variables, the firm now also maximises its utility with respect to the risk management variable, I , which ultimately yields the following first order conditions:

$$R'(q_I) = C'(x_I) \quad (10a)$$

$$R'(q_I) = C^{*\prime}(x_I^*) + \frac{j}{EU'(p)}p^*(q_I^*) \quad (10b)$$

$$R'(q_I) = (1 - a\frac{EU'(p_l)El + \mathrm{cov}(U'(p_l), l) + j}{EU'(p)})R^{*\prime}(q_I^*) + \frac{j}{EU'(p)}\left[R^{*\prime}(q_I^*) - p^{*\prime}(q_I^*)x^*\right] \quad (10c)$$

and

$$\text{if } j = 0, \quad \text{then } r = a\frac{EU'(p_l)El + \mathrm{cov}(U'(p_l), l)}{EU'(p)} \quad (10d)$$

$$\text{and } I < R^*(q^*) - p^*(q^*)x^*; \quad (10e)$$

$$\text{if } j = aEU'(p_l)El + a\,\mathrm{cov}(U'(p_l), l) - rEU'(p) > 0, \quad (10f)$$

then $I = R^*(q^*) - p^*(q^*)x^*$ (10g)

j is the Lagrange multiplier associated with the coverage constraint in (9). Naturally, the cost of insurance, represented by the premium rate r, is crucial in the firm's insurance decision and hence essential to the output and sales allocation between its two plants.

Figure 1 depicts what happens to the risk averse MNE's output and sales variables (x_I, x_I^*, q_I and q_I^*) with domestic export insurance for different premium rates. Both the certainty-equivalent values (x_c, x_c^*, q_c and q_c^*) as the levels when the risk averse MNE bears the full extent of the foreign commercial risk (x_r, x_r^*, q_r and q_r^*) are indicated in the graphs. Premium rate values for which the export insurance constraint is not binding range within the interval $]\, r_{j\to 0}, \; r_{I=0}\,[$.

$r_{I=0}$ symbolises the prohibitive premium rate, entailing a tax which is too high for the MNE to buy insurance. In that case, the output and sales decisions of the MNE evidently take precisely the same values as without the availability of risk management mechanisms ($x_{I=0} = x_r \;, x_{I=0}{}^* = x_r{}^*, q_{I=0} = q_r \;, q_{I=0}{}^* = q_r{}^*$).

Proposition 2: *When insurance is absent in the host country but available in the domestic market, an intra-MNE trade reversal with the home plant becoming a net-importer instead of a net-exporter requires larger relative cost and demand differences than under uncertainty.*

Proof:

Suppose $x_r = q_r$. Then, from (7a-c) and (9a-c) we know $x_I > x_r$ and $q_I < q_r$. Hence $x_I - q_I > x_r - q_r$, implying $x_I > q_I$.

Export insurance in the home market will augment the risk averse firm's valuation of foreign sales which are produced, and therefore at least partially insured, in the home market. Hence, even when there are no cost or demand differences between the

markets, the firm will prefer to serve part of the host market through export from the home plant.

3.1. Multinationals with domestic insurance and the separation theorem

Traditionally, a separation theorem holds between an insured firm's coverage on the one hand and its output and sales decision on the other hand[5]. The theorem states that a risk averse firm's output (sales) decisions are independent from its degree of risk aversion and the distribution characteristics of the stochastic variable. Output decisions are merely determined by the prevailing insurance premium rate. Still, this is no longer unambiguously true for a MNE operating in two markets with asymmetrically developed insurance markets.

Proposition 3: *When insurance is absent in the host country but available in the domestic market, (i) there exists a critical premium rate ($\bar{r}$) in the domestic market below which the separation theorem breaks down for a two-plant risk averse MNE with specific factors and (ii) this critical premium rate entails an insurance tax.*

Proof:

(i) Let $r = aEl + k$, $k > 0$ with $aEl + k = a\,\dfrac{EU'(p_l)El + \mathrm{cov}(U'(p_l), l)}{EU'(p)}$ (see (10d)). Then, $j = 0$ and expressions (10a-c) are independent of the utility function and the distribution features of the default variable. However, at $k = 0$, the left hand side of (10d) is smaller than the right hand side, implying $j > 0$. Substituting (10f) into (10a-c) shows that the utility function and the distribution features of the default variable now determine the firm's output and sales decisions.

(ii) From *(i)* we know $j > 0$ at $k = 0$ and $j = 0$ for some $k > 0$. Hence, $\exists\ \bar{k} > 0$, determining $\bar{r}$ at which $j \to 0$.

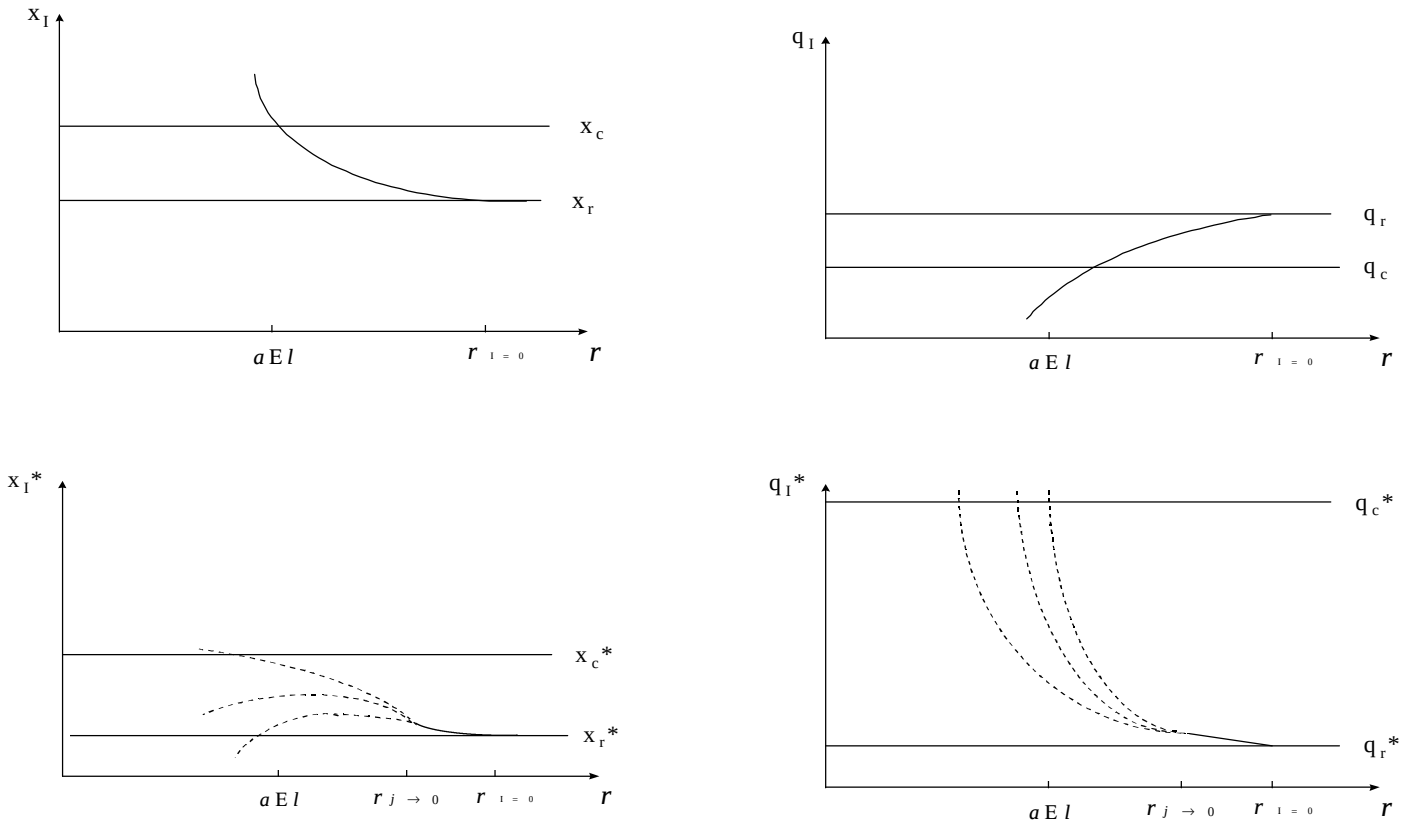
[5] This result has been established in several different set-ups of decision making under uncertainty, among others by Holthausen, 1979; Katz en Paroush, 1979; Feder, Just en Schmitz, 1980; Funatsu, 1986; Viaene en de Vries, 1992; Broll en Zilcha, 1992; Dewit, 1996.

In Figure 1 the full export credit coverage constraint is not binding ($j = 0$), for premium rates in the interval $]r_{j\to 0},\ r_{I=0}[$, implying that for those values the separation theorem holds. As the premium rate decreases below the prohibitive rate, the firm purchases insurance but does not cover its export contract completely ($I < R^*(q_I^*) - p^*(q_I^*)x_I^*$). Then, the MNE's optimal decisions are implied by first order conditions (10a-e). We know that in the range considered the premium rate charged is higher than the fair rate at which premium income is equal to expected claim payments ($r = aEl$). Intuitively, since for the range of premium rates involved the separation theorem holds, the insurance decision affects output and sales through the premium rate only. Since the latter is higher that the certainty-equivalent payment-loss and lower than the prohibitive rate, output and sales with non-binding insurance necessarily take values between the certainty and uncertainty outcomes. Comparing (10a-c with $j = 0$) to (5a-c) and (7a-c) shows that this is true at a premium which is sufficiently high but smaller than the no-insurance premium level. This effect will be labelled henceforth as the *direct* insurance effect.

Yet, this does no longer hold unambiguously at premium rates for which the insurance constraint does become binding ($j > 0$). Then, any risk averse MNE chooses to fully cover against the uncertainty incurred on foreign sales, but can only do so for the fraction of foreign sales produced in the domestic subsidiary and exported to the foreign plant. As a result, the MNE is induced to shift back part of the production from the foreign to the domestic plant, which allows the firm to cover more of the foreign sales by export insurance available in the domestic market. We refer to the latter mechanism as the *indirect* insurance effect. As the firm is more risk averse and the uncertainty with respect to foreign default increases (e.g., reflected by an mean-preserving spread of the distribution), this effect is stronger. It is entirely generated by the breakdown of the separation theorem, caused in turn by the asymmetric insurance facilities between the MNE's home and the host market[6].

[6] If the firm relies on non-specific inputs and has constant marginal costs, output and sales decisions will depend on its degree of risk aversion and the features of the default distribution only if the firm has a foreign plant, simply because insurance in the foreign market is not available. The availability of

Figure 1: Production and sales of a MNE with domestic export insurance at different premium rates



Corollary : *With efficient insurance (i.e.,* $r = aEl$ *) in the home country and no insurance in the host country, a risk averse MNE with specific factors will (i) produce more and sell less in its domestic plant, (ii) produce less in its foreign plant and (iii) trade more between its subsidiaries than under the certainty-equivalent.*

Proof:

From proof *(ii)* of proposition 3, we know that $j > 0$ at $r = aEl$.

(i) Suppose $x_I \leq x_c$ at $r = aEl$. This implies that $q_I \geq q_c$ (see (10a) and (7a)), $x_I^* < x_c^*$ (see (10b) and (7b), and $q_I^* > q_c^*$ (see (10c) and (7c)). Again, this violates the sales-production identity according to which $q_I < q_c$. Hence, $x_I > x_c$ and $q_I < q_c$.

(ii) Suppose $x_I^* \geq x_c^*$. This implies that $q_I^* < q_c^*$ (see (10b-c) and (7b-c)) and that $x_I > x_c$ (see (10a-b) and (7a-b)), implying $q_I < q_c$ (see (10a) and (7a)). Yet, this violates the sales-production identity according to which $q_I > q_c$ if $x_I^* \geq x_c^*$, $q_I^* < q_c^*$ and $x_I > x_c$. Hence, $x_I^* < x_c^*$.

(iii) Since $x_I > x_c$ and $q_I < q_c$ (see *(i)*), $x_I - q_I > x_c - q_c$.

Efficient risk management institutions provide insurance at a premium which matches the expected loss, which is generally referred to as a fair premium. At that rate, output in the domestic subsidiary exceeds the certainty level. While the direct insurance effect brings the domestic output up to the certainty-equivalent, the indirect effect guarantees that the former exceeds the latter. Hence, domestic specific interests will prefer uncertainty in the foreign market with asymmetric insurance facilities to the certainty case. The converse is true for local domestic consumers. While they obviously gained from the uncertainty in the foreign market compared to certainty, they will lose out in a situation where insurance markets are unequally developed with efficient insurance in the home market. Compared to the latter case, they are better of under certainty. Since marginal costs of production in the domestic plant have

increased beyond the certainty level, the MNE reduces its sales in the local domestic market below the certainty-equivalent.

The combination of these two effects implies that at a fair domestic export insurance premium, the MNE's intra-firm trade volume rises above the certainty-equivalent. Alternatively, intra-firm trade of a risk averse MNE with export insurance facilities equals intra-firm trade under certainty at a premium exceeding the fair rate.

The direct and indirect insurance effect of the availability of risk management options in the domestic market affect the production level in the foreign plant in opposite ways. Directly, the reduction in uncertainty carried by the MNE generates a positive spill-over on production in the foreign subsidiary. This explains why the level of the MNE's foreign production is situated above the level without any coverage facilities in the domestic market ($x_I^* > x_r^*$). However, since the uncertainty cannot be transferred completely and because of the MNE's tendency to reallocate part of the foreign production to the home market (i.e., the indirect insurance effect), foreign production remains below the certainty level ($x_I^* < x_c^*$). Clearly, with fairly rated domestic export insurance, specific factors in the foreign market will prefer the certainty case to a situation where insurance facilities between the countries are unequal.

The preferences of the MNE are in line with the interests of specific factors in the home plant insofar that the firm prefers asymmetric regional insurance facilities with efficient insurance at home to the symmetric case where insurance is unavailable in both markets. Yet, the fact that no insurance is available in the host market makes this situation still inferior to the certainty case in the MNE's ranking, while the converse is true for domestic specific factors.

With intra-firm export to the foreign market rising and local production in the foreign plant moving in the opposite direction, the total effect of an efficient insurance market in the home country on total foreign sales is ambiguous. Yet, if marginal costs in the home plant are increasing sharply with an expansion of production, the latter will be

limited and the increase in the MNE's exports to the foreign market is likely to be more than compensated by the cut-down in foreign production (implying $q_I^* < q_c^*$). Hence, it is a priori unclear whether local consumers in the host market will gain or suffer from this particular asymmetry in insurance facilities.

The trajectory followed by the risk averse decision variables with domestic insurance programmes which are at least break-even is reflected in Figure 1 between the premium rate values of r_{aEl} and $r_{I=0}$. Note that, for this premium range, although production in the foreign plant is unmistakably smaller than the certainty-equivalent level, this does not necessarily mean that it is a negative function of the risk coverage cost, r. The latter is only true as long as the coverage constraint is not binding ($j = 0$). Once the firm is constrained in its insurance decision ($j > 0$), foreign production may either increase or decrease with the premium rate, depending on the relative magnitudes of the direct versus the indirect insurance effect. However, for the entire premium range, total foreign sales will unambiguously increase as the premium rate goes down.

3.2. Multinationals, regional asymmetries in insurance and insurance subsidisation

In this section, we examine how a determinant of a risk averse MNE's production and sales allocation between two markets is affected if insurance is provided in the domestic market at a rate below the fair premium. The fact that the zero-profit premium rate often is no longer a lower bound if public risk management institutions enter into the picture is well documented in empirical studies (Abraham, 1992; Kuhn, Horvath and Jarvis, 1995; Dewit, 1996). The latter reveal that these officially supported institutions are often operating with a loss. The WTO's Subsidy-Code explicitly prohibits this practice and defines it as export credit insurance subsidisation. Technically, it refers to the fact that the agencies' premium income is insufficient to match the claims resulting from the underwritten contracts (i.e., $r < aEl$).

The fact that export credits to Eastern Europe and the new Asian tiger economies have drastically risen both in absolute value and in terms of the fraction of total officially insured contracts mounts the question how the use of official credits at extremely favourable rates affects the MNE's decisions. Although it probably does not affect the location decision itself[7], this type of subsidisation will clearly affect the export decision of a MNE, and also the output allocation between its two plants.

Officially subsidised insurance schemes do not only relieve the MNE entirely from the commercial risk on its exported products but also grant an extra monetary benefit to the insured MNE. Hence, if the subsidy is sufficiently high, the insured MNE's utility level reaches or even surpasses its certainty-equivalent. Since its expected claims exceed the insurance costs incurred for purchasing risk coverage, a risk averse MNE now increases its domestic production targeted to the export market ($x_s - q_s$) even more than with an efficient private insurance market ($x_s - q_s > x_{r=aEl} - q_{r=aEl}$). Alternatively, the direct and indirect insurance effect are now being reinforced by the *subsidy* effect.

Proposition 4: *With subsidised official insurance in the home market and no insurance facilities in the host market, a risk averse MNE using specific factors*

(i) always expands its domestic plant beyond the certainty-equivalent;

(ii) expands its foreign plant beyond the certainty-equivalent if its degree of risk aversion is sufficiently low.

Proof:

(i) $x_{I,r<aEl} > x_c$. Proof analogous to proof *(i)* of corrolary of proposition 3.

(ii) $x^*_{I,r<aEl} > x^*_c$ implies $C^{*\prime}(x^*_{I,r<aEl}) > C^{*\prime}(x^*_c)$. From (10a-b) and (7a-b) we obtain, after rearranging terms, that for $x^*_{I,r<aEl} > x^*_c$, the following condition has to hold: $C'(x_{I,r<aEl}) - C'(x_c) > \frac{j}{EU'(p)} p^*(q^*_{I,r<aEl})$. As $\frac{j}{EU'(p)}$ increases with the degree of risk aversion (see (10f)), this condition is more likely to be violated if the

[7] This is the reason why the location decision is not endogenous in the model.

MNE is highly risk averse, thereby augmenting the right hand side of the inequality.

If the asymmetry in insurance facilities between the two markets increases as a result of the subsidisation of official insurance schemes in the home economy, it is not unambiguous how the size of the foreign plant is affected. The MNE is more likely to expand its foreign plant if the increase in production costs generated by its expanding domestic plant is too large to compensate for the benefit associated with more insurance. The latter scenario is highly probable if the MNE 's risk aversion is relatively low. Assuming decreasing risk aversion, this outcome is most relevant for large MNEs. Conversely for relatively small MNEs, the power of attraction of newly developing market economies may be mitigated by Western European governments through the use of this type of official insurance schemes. In particular, if the benefits of risk management available in the home country exceed the marginal production cost differential between the home and the foreign location, the MNE may even shut down its foreign plant ($x_I^* = 0$ if $\frac{j}{EU'(p)} p^*(q_I^*) > C'(x_I) - C^{*'}(x_I^*)$)[8]. However, given that it is usually the former type of MNE which will be located in newly emerging but risky markets, we conclude that the size of the foreign plant may well increase as a result of the export insurance subsidy in the domestic economy. In that case, both foreign consumers and foreign specific factors would welcome this policy.

4. Export risk management and moral hazard

In general, the availability of insurance facilities usually is welfare improving since it allows for a better risk allocation across economic agents, especially if the insurance system is efficient. However, while providing full insurance at fair premium rates is the first-best scenario with symmetric information, this is no longer true if the insurance market is plagued by problems of asymmetric information. In the case of export credit insurance and commercial risk, the problem of moral hazard is claimed

[8] This condition assumes set-up costs are zero.

to be particularly relevant[9], especially since it prevents the existence of an efficient market for export insurance.

In this section, the implications of moral hazard on a MNE with uninsurable commercial risk on its foreign production is examined. In particular, attention is focused on its implications with an unequally developed insurance market in the home and host economy. Up to now, we have assumed that the probability of commercial default is exogenously given to the firm. Suppose that this is not the case, but that the firm can, by activities of its own, reduce this probability, while the actual loss in the case of default remains unaffected by the firm's actions. These actions are called "self-protection" activities (Winter, 1990), and entail, for instance, making sure that foreign customers are creditworthy by, among other activities, checking the reputation of the latter's guarantees. Such investments will decrease the probability of occurrence of default (or, $a'(e) < 0$; in addition it is assumed that $a''(e) > 0$). Since investing in these activities (represented by e) are costly, the firm will avoid these when possible. Thus, the moral hazard problem here refers to the disincentive the insured has to keep the probability of default down. For simplicity, we assume that the marginal cost of self-protection activities is constant and equal to one.

Profits of the firm if full-payment is received and if default occurs are respectively given by

$$p_0 = R(q) + R^*(q^*) - C(x) - C^*(x^*) - e \qquad (11a)$$

$$p_l = R(q) + (1-l)R^*(q^*) - C(x) - C^*(x^*) - e \qquad (11b)$$

The fact that firms can affect the probability of default by investing in self-protection activities may confront risk management institutions, if unable to monitor the self-protection of insured firms, with a problem of moral hazard.

This is clarified by examining self-protection of a two-plant MNE with specific factors which can rely on well developed insurance markets both in the home *and* host

[9] For this reason, several official export insurance agencies only offer partial coverage, although the deductible or uninsurable fraction of the contract usually is quite low.

market[10]. With insurance options now available in the host market, the MNE's optimisation problem changes into:

$$\max_{x_I, x_I^*, q_I^*, I, I^*, e} EU = (1-a(e))U(p_0) + a(e)EU(p_l) \quad \text{with } q_I = x_I + x_I^* - q_I^* \qquad (12)$$

s.t. *(i)* $I \le R^*(q^*) - p^*(q^*)x^*$

(ii) $I^* \le p^*(q^*)x^*$

(iii) $x_I \ge 0; q_I \ge 0; q_I^* \ge 0; e \ge 0$

where *(ii)* stands for the full foreign coverage constraint, with I^* denoting the coverage sum taken in the foreign insurance market.

At fair premium rating, this would mean that first order conditions are equal to (10a-c) with $I = R^*(q^*) - p^*(q^*)x^*$, $I^* = p^*(q^*)x^*$ and the first order condition for e is equal to

$$-a'(e)[U(p_0) - EU(p_l)] = (1-a(e))U'(p_0) + a(e)EU'(p_l) \qquad (13)$$

At fair premium rating expression (13) reduces to $0 < U'(p_0)$, hence $e_f = 0$, where e_f denotes the value for e with full insurance coverage. Alternatively, if premium rates are fair, firms will take full insurance against foreign commercial risk, in the domestic market for their exports and in the host market for the locally produced sales. The insurance facilities in the home and host market not only relieve the MNE completely from the uncertainty burden, but also induce the firm not to invest in precautionary actions to abate commercial risk. As they will be reimbursed for any potential payment loss, the firm loses the incentive to reduce the probability of a default occurrence.

It is a well established result in the insurance literature (first pointed out by Shavell, 1979; Arnott, 1990; Arnott and Stiglitz, 1990) that this problem is partly alleviated if the risk averse firm is left to some extent with uncertainty, which enforces some care-taking behaviour by the (partially) insured. Geographically asymmetrically developed insurance facilities may generate this positive side-effect.

[10] This is not as much a real-life scenario as a mere benchmark for comparing the MNE's investment in self-protection with insurance opportunities in the host market being absent.

Proposition 5: *With MNEs of the home economy facing commercial risk in the foreign host market, the absence of insurance markets in the host country mitigates moral hazard problems in export insurance for insurance companies in the domestic economy.*

Proof:

Because of the absence of insurance facilities in the host market, we know that $U(p_0) > EU(p_1)$ (for $x_I^* = 0$). Hence, expression (13) implies that $e_p > e_f = 0$, where subscript p refers to the fact that only part of the uncertainty can be transferred. Therefore, since $a'(e) < 0$, we have $a(e_p) < a(e_f)$.

The non-insurable uncertainty associated with foreign sales produced in the host market induces the firm to exercise caution and hence to invest in self-protection activities before concluding contracts with customers in the foreign market. Meanwhile, insurance companies in the home market know that the insured MNE is not able to take full cover against the foreign commercial risk. So, they also know the MNE will invest in self-protection, whereas this would not be true for a single-plant fully insured domestic firm. Hence, the mere absence of an insurance market in the MNE's host market my reduce the need of domestic insurance companies for designing insurance contracts for MNEs which are incentive compatible with self-protection behaviour. Hence, since moral hazard problems often limit insurance to partial coverage, the absence of insurance facilities in the foreign market should provide the MNE with more favourable export insurance contracts in the domestic market.

5. Conclusion

This paper assesses how sales and output decisions of a multinational with specific factors are determined by unequally developed insurance facilities between its home and host market, and thereby affect different economic interest groups in the domestic and the foreign market. The conclusions that emerge from the analysis are particularly

relevant for trade relations of Western economies with Eastern Europe and South East Asia, both regions for which uncertainty is an essential issue, even more for its lack of insurance markets. The uncertainty in the model is caused by commercial risk with respect to foreign sales, i.e., the risk of default when the foreign customer is allowed a credit term.

The analysis suggests that in the complete absence of insurance, the uncertainty in the foreign market would make domestic specific factors more vulnerable compared to the case where the MNE operates in a safe foreign market. More specifically, compared to the certainty case, the MNE is more likely to choose its foreign plant instead of its domestic one as its net-exporting basis. However, if domestic export insurance is available whereas no insurance facilities are available in the host market, this intra-firm pattern of net-trade is likely to be the reverse. Then, the commercial risk in the foreign market generates an implicit subsidy for domestic production factors, even if the MNE takes insurance at a fair premium rate.

This result hinges on the fact that for a wide range of domestic export insurance premium rates, the traditional separation theorem regarding a risk averse firm's insurance decisions and its actions in the product market does not hold. This has important implications for the different interest groups in the MNE's home and the host economy.

First, if export insurance is available at fair premium rates in the domestic market, domestic factors of production prefer a situation of uncertainty with respect to foreign sales to the certainty equivalent case. With the absence of insurance facilities in the host market, the size of the domestic subsidiary increases beyond its certainty-equivalent level, and the same is true for the level of intra-firm trade. The latter implies that under these circumstances a trade pattern reversal with the domestic plant becoming a net-importer instead of remaining a net-exporter is less likely to happen with uncertainty about foreign sales than under certainty. The importance of the asymmetry in insurance provision is highlighted by the fact that the converse is true when insurance is unavailable in both markets.

Second, both domestic consumers and corporate leadership prefer certainty with respect to foreign sales to efficient insurance in the home market only. The expansion of the domestic plant is reflected into higher exports while at the same time production for the domestic market is reduced, which is translated into a higher price for home consumers. At the same time, the firm is worse off than under certainty and would require an export insurance subsidy to reach the certainty-equivalent profit level. Hence, unlike domestic specific factors, both groups would welcome the development of insurance markets in the foreign economy. However, from a welfare point of view, given that the MNE has price-setting power in the domestic market the domestic economy would benefit from a small export insurance tax, even though such a policy would merely rank as a third-best policy. Alternatively, if insurance facilities would be absent in the domestic economy as well, the uncertainty in the foreign market would bring down prices in the domestic market. This welfare effect is reversed with efficient export insurance at home and no insurance facilities in the host market.

Third, because export insurance is often provided by the government or an insurance agency operating for the state, firms are likely to defend their vested interests by lobbying for export insurance subsidisation. This lobby tends to be strong, especially as its power would be reinforced by the labour unions representing domestic factors of production. The domestic lobby may even be strengthened by the support of foreign governments. This happens because, while foreign consumers would gain from a subsidy-induced price reduction, even foreign specific factors may benefit from the subsidies insurance schemes in the domestic market. The latter effect will prevail if the foreign market has a relatively large cost advantage and the uncertainty is not excessive. In that case, most economic groups in both markets would safeguard their vested interests by preserving the currently existing asymmetry in insurance markets.

Finally, if the degree of uncertainty in the foreign market is (partly) endogenously determined by the MNE's behaviour, an undeveloped insurance market in the host country reduces the moral hazard problem, which often lies at the core of thin or even absent private export insurance markets.

REFERENCES

Abraham, F., Couwenberg, I. and Dewit, G. (1992), "Towards an EC policy on export financing subsidies: Lessons from the 1980s and prospects for future reform", *The World Economy*, 15, nº 3, 389-405.

Arnott, R. and Stiglitz, J. (1990), "The welfare economics of moral hazard", in Louberge, H. (1990), *Risk, Information and Insurance: Essays in the memory of Karl Borch*, Kluwer Academic Publishers.

Arnott, R. (1990), "Moral hazard and competitive insurance markets", in DIONNE, G. (1990), *Contributions in insurance economics*, Kluwer Academic Publishers.

Broll, U. and Zilcha, I. (1992), "Exchange rate uncertainty, futures markets and the multinational firm", *European Economic Review*, 36, 815-826.

Calderon-Rossell, J.R. (1985), "Towards the theory of foreign direct investment", *Oxford Economic Papers*, 37, 282-291.

Caves, R.E. (1996), *Multinational enterprise and economic analysis*, Cambridge University Press, second edition.

Dewit, G. (1996), *Essays on Export Insurance Subsidization*, KU Leuven, Unpublished manuscript.

Feder, G., Just, R. and Schmitz, A. (1980), "Futures markets and the theory of the firm under price uncertainty", *Quarterly Journal of Economics*, 94, 317-328.

Holthausen, D.M. (1979), "Hedging and the competitive firm under price uncertainty", *American Economic Review*, 69, nº 5, 989-995.

Horstmann, I. and Markusen, J. (1987), "Strategic investments and the development of multinationals", *International Economic Review*, 28, 109-121.

Horstmann, I. and Markusen, J. (1989), "Firm-specific assets and the gains from direct foreign investment", *Economica*, 56, 41-48.

Itagaki, T. (1991), "A two-step decision model of the multinational enterprise under foreign demand uncertainty", *Journal of International Economics*, 30, 185-190.

Katz, E., Paroush, J. and Kahana, N. (1982), "Price uncertainty and the price discriminating firm in international trade", *International Economic Review*, 23, 389-400.

Kawai, M. and Zilcha, I. (1986), "International trade with forward-futures markets under exchange rate and price uncertainty", *Journal of International Economics*, 20, 83-98.

Krugman, P. (1991), "Increasing returns and economic geography", *Journal of Political Economy*, 99, 483-499.

Krugman, P. and Venables, T. (1995), "Globalization and the inequality of nations", *Quarterly Journal of Economics*, 110, 857-880

Kuhn, M., Horvath, B. and Jarvis, C. (1995), *Officially Supported Export Credits. Recent Developments and Prospects*, World Economic and Financial Surveys, International Monetary Fund, March 1995.

MacCharles, D. (1987), *Trade among Multinationals: Intra-Industry Trade and National Competitiveness*, London: Croom Helm.

United Nations, Centre on Transnational Corporations (UNCTC) (1988), *Transnational Corporations in World Development: Trends and Prospects*, New York.

Van den Bulcke, D. (1985), "Belgium", in Dunning, J. (ed.), *Multinational Enterprises, Economic Structure and International Competitiveness*, Chichester:Wiley.

Venables, T. (1994), "Economic integration and industrial agglomeration", *Economic and Social Review*, 26, 1-17.

Willmore, L. (1992), ”Transnationals and Foreign Trade: Evidence from Brazil”, *Journal of Development Studies*, 28, 314-335.

Winter, R.A. (1990), "Moral hazard in insurance contracts", in DIONNE, G. (1990), *Contributions to insurance economics*, Kluwer Academic publishers, 61-96.