Economic exposure and debt financing choice

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Abstract

In recent years, firms in several industrialized economies have globalized. In this paper, it is shown that the economic exposure of such non-financial firms plays an important role in their long-term debt financing choice. When firms face positive economic exposure, eurocurrency debt denominated in foreign currency dominates foreign debt as well as domestic debt. However, when firms face negative economic exposure, foreign debt dominates other forms of debt financing as the value-maximizing choice for the shareholders of the firm. If firms are not exposed, domestic debt, foreign-currency debt, and eurocurrency debt are equivalent financing alternatives, in the absence of bankruptcy costs. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

Non-financial firms looking for external financing sources primarily use debt or bond financing rather than equity financing. This is the case for both domestic and multinational enterprises across different industrialized economies of the world.2

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2 See the recent studies on financing by Mayer (1990), Rajan and Zingales (1995) and an extensive review of the recent literature in Schmidt and Tyrell (1997).
Expansion of productive activities in foreign countries gives multinational firms the choice of financing with debt in international capital markets. In recent years, globalization has also led to significant foreign competition resulting in firms’ economic exposure. In this paper one examines how the economic exposure of non-financial firms affects their choice of long-term debt financing in mildly segmented international capital markets.

Economic exposure, that is, long-term sensitivity of the firm’s cash flows to exchange rate changes, is defined to be positive (negative) if a(n) depreciation (appreciation) of the home currency results in an increase (decrease) in the firm’s cash flows. Firms face economic exposure due to imperfect competition in global product-markets. Imperfect competition and consequent price elasticity of demand effects cause the cashflows of the firm to be sensitive to exchange rate changes. Marston (1996) shows, for example, that imperfect competition between an exporting firm and local firms requires the exporting firm to know the price elasticity of its product demand and its marginal cost in order to assess its exposure to exchange rates. Hekman (1985), Choi (1986), Von Ungern-Sternberg and von Weizsacker (1990), and Levi (1994) investigate exchange-rate exposure in theoretical models of firm behavior.

To illustrate, Hekman (1985) outlines a model of foreign exchange exposure, where changes in the value of outstanding debt as a result of unexpected changes in exchange rates are considered. Choi (1986) develops a model of the firm’s exchange exposure and its effect on the market value of the firm. The model explicitly treats the firm’s economic exposure in terms of output and input demand elasticities. However, such current theoretical contributions on economic exposure, at most, consider effects on overall debt value of the firm but do not analyze the link between economic exposure and the debt financing choice of the firm. This paper fills this gap in the literature.


Measuring foreign exchange exposure and economic exposure has thus become a central issue in the academic literature on international financial management. Recent research also indicates that firms’ economic exposure to exchange rate

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3 An imperfectly competitive environment where a local exporting firm competes against a foreign import-substituting firm is studied by Bodnar et al. (1997).
changes is highly significant at long horizons (see Allayannis, 1996). Given this empirical evidence, a theoretical link is now developed between economic exposure and long-term debt-financing choice. In doing so, positive and negative economic exposure in the sense of a negative and positive correlation between cash flows and exchange rates are modeled.5

The various determinants of long-term debt financing choice for a non-financial, multinational firm with domestic equity are: (a) market-based factors, such as domestic and foreign interest rates and exchange rates; and (b) firm-specific factors, such as shareholders’ attitude to risk and the economic exposure of the firm (see Aliber, 1993). In this paper, only firm-specific factors are focussed on. It is assumed that shareholders are risk-neutral and study the impact of the economic exposure of the firm on its debt financing choice. The firm operates in an environment of mildly segmented international capital markets.

Mildly segmented international capital markets imply that there are no market imperfections (i.e. no taxes, no transaction costs) and that investors have unrestricted access to risk free securities but their access is restricted for investment in risky securities. For example, domestic investors cannot invest in risky foreign securities, but foreign investors can invest in risky domestic securities. Since all investors have unrestricted access to risk free securities, long-term uncovered interest rate parity (UIRP) holds. Empirical evidence supports mildly segmented international capital markets. For example, Errunza et al. (1992) tested the competing hypotheses of integration, mild segmentation and complete segmentation and found strong evidence that world capital markets are neither fully integrated nor completely segmented. Thus, the case for mildly segmented international capital markets is well established.

Consider the three debt financing alternatives of a firm having only domestic equity in the context of the following example: suppose a US multinational is financing a risky project in Brazil. It can either choose to finance the project using US$ denominated long-term debt, or finance the project using Brazilian real denominated long-term debt. The third financing alternative is long-term debt denominated in Brazilian real in the eurocurrency market. The domestic US$ denominated debt is priced based on default probability due to unexpected exchange rate changes. In the case of Brazilian real denominated debt, there is no exchange rate uncertainty to consider since cashflows from the project are denominated in the same currency as the debt. In the last financing alternative using eurocurrency markets, there is no default probability due to unexpected exchange rate changes since the debt is denominated in Brazilian real. It is shown, that in

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4 Chow et al. (1997) also find that the economic exposure of individual firms increases with the return horizon. Shin and Soenen (1999) revisit the measurement of exchange rate risk exposure and find that it is positive for some industries and negative for others.

5 For detailed insights into the definition and measurement of exposure to currency risk see Adler and Dumas (1984). For a recent empirical study of positive and negative exposure to currency risk see Bartov and Bodnar (1994).

6 As illustrative examples, see Errunza and Losq (1985), Eun and Janakiramanan (1986), and Gultekin et al. (1989) for different ways of modeling and testing market segmentation.
such situations, economic exposure is a major determinant of long-term debt financing choice for the multinational firm.

Domestic debt differs from foreign currency debt as well as eurocurrency debt as it may not be repaid even if foreign currency cash flow is generated from the risky project. Exchange rate shocks can diminish the domestic debt repayment ability of the firm severely enough to lead to bankruptcy when its cash flows are being earned in foreign currency. Thus, firms with foreign currency denominated cashflows can be faced with the possibility of bankruptcy when they finance their projects with domestic debt. The domestic debt alternative is rendered more expensive due to the cost of reorganization in the event of financial distress or bankruptcy. Bankruptcy related costs have been considered by Smith and Stulz (1985) earlier as a rationale for hedging by risk-neutral firms. Alternately, when the firm faces the probability of insolvency, it can lead to the loss of non-assignable control rents for the shareholders if they lose control of the firm, as Diamond (1991) has shown earlier. By using foreign currency debt financing or eurocurrency debt financing, multinational firms protect themselves against the expected costs of bankruptcy or loss of non-assignable control rents.

Conventional explanations for the choice of different currency denominations for long-term debt financing are based on capital market imperfections. For example, Shapiro (1984) demonstrated that two such capital market imperfections, corporate income taxes and flotation costs, yield decision rules for the choice of debt financing in different currency denominations. Mildly segmented international capital markets, however, are characterized by the absence of these market imperfections. Nevertheless, imperfections in product markets manifested as economic exposure do play a role in the choice of long-term debt financing by the firm. Foreign project-based investments undertaken by multinational firms have either positive or negative economic exposure. It is shown that the types of economic exposure, resulting from such investment decisions of the firm, determine which debt financing alternative is value maximizing for the shareholders of the firm.

For firms facing positive economic exposure, it is shown that eurocurrency debt dominates both foreign debt and domestic debt as financing alternatives. However, when firms face negative economic exposure, foreign currency debt financing dominates other forms of debt financing as the value-maximizing alternative. The theoretical analysis together with the empirical evidence in Bartov and Bodnar (1994), that firms with positive exchange rate exposures substantially exceed the number of firms with negative exchange rate exposures, implies that eurocurrency debt will be the preferred long-term financing alternative. It is also demonstrated that, if there are no bankruptcy costs or non-assignable control rents and if firms are not exposed, domestic debt, foreign-currency debt, and eurocurrency debt are equivalent financing alternatives.7

7 This is an assumption made to demonstrate the significance and relevance of economic exposure. In reality, it is observed that even purely domestic firms such as utilities could be facing economic exposure in the presence of foreign competition.
In Section 2, a model of economic exposure is presented for the firm. In Section 3, the domestic currency and foreign currency debt financing alternatives are compared for the firm indicating the preference of the firm under different conditions. In Section 4, it is shown that a firm with positive (negative) economic exposure will prefer using eurocurrency debt (foreign currency debt) to foreign currency borrowing (eurocurrency borrowing). Conditions under which the firm will be indifferent between the long-term debt-financing alternatives are also demonstrated. Section 5 concludes after a discussion of the empirical implications.

2. A model for economic exposure

A one-period, two-date world with date $t = 0, 1$ is considered. At time $t = 0$, the parent firm of a multinational corporation has access to a positive net positive value (NPV) project in a foreign country. The project generates uncertain cash flows $X$ or 0, denominated in foreign currency, at $t = 1$. The firm needs to borrow $I$ foreign currency (FC) units or equivalent home currency (HC) units to finance the positive NPV project. For the sake of simplicity, the initial ($t = 0$) exchange rate was set at $HC = FC$. After $t = 0$, an exogenous exchange rate shock is a finite probability event in this economy. The nature of the shock is such that the home currency significantly appreciates or depreciates from the initial exchange rate. There is a large probability $(1 - \theta)$ that the exchange rate will remain the same (i.e. $HC = FC$) and a very small probability $\theta$ [$\theta > 0$, $\theta \ll 1$] that the shock occurs. The probability of exchange rate shock is the sum of $s\theta$, probability that the home currency depreciates, and $(1 - s)\theta$, the probability that the home currency appreciates. The home currency depreciation (appreciation) leads to the new exchange rate denoted by $HC(1 - r)$: $FC$ (resp., $HC(1 + r)$: $FC$). $r$ is a parameter ($0 < r < 1$) with its magnitude capturing the size of the exchange rate shock.\(^8\)

The exchange rate process is also characterized by a trend-factor, $s$. It is a random walk if $s = 1/2$ and a random walk with a trend if $s \neq 1/2$. The case $s > 1/2$ ($s < 1/2$) corresponds to an expected depreciation (appreciation) of the home currency. While the analysis in the paper pertains to the case $s = 1/2$, the results can be extended, without loss of generality, to the other cases, when $s \neq 1/2$. The expected future exchange rate defined as $E(S)$ and equal to the initial exchange rate of $HC/FC$ 1 is computed as:

$$E(S) = [s\theta(1 + r) + (1 - s)\theta(1 - r) + (1 - \theta)1]$$

(1)

The discrete-time exchange rate process used here is an analog of the mixed jump-diffusion process for exchange rates [see Akgiray and Booth (1988) and

\(^8\)The exchange rate shock is large enough that the firm cannot pay back its home currency debt. The exchange rate process could permit smaller exchange rate shocks. However, since they are not material for the discussion, one abstracts away from them in modeling the exchange rate process.
Jorion (1988)]. Such a process seems to explain the data on real world exchange rates better than other theoretical constructs. Only large shocks (like large jumps) which affect the pricing of the debt financing alternatives are considered. In general, such a process includes smaller shocks or changes around the initial value along with the large shocks that can lead to the bankruptcy of such a firm.

The parent firm’s uncertain foreign currency cash flows are sensitive to future exchange rate shocks. This sensitivity is defined as economic exposure, resulting, for example, from indirect price elasticity of demand effects due to imperfect competition in product-markets. For example, the firm’s cash flows may increase, decrease, or remain unchanged in response to a depreciation of the home currency. Accordingly, three types of projects are defined: the project is defined as type $e$ when the home currency depreciates relative to the foreign currency the expected cash flows of the firm increase. The type $m$ project is exposed to exchange rate changes such that when the home currency depreciates relative to the foreign currency the expected cash flows of the firm decrease. It is easy to see that there could be projects of type $n$ where the expected cash flows of the firm do not change when the home currency depreciates relative to the foreign currency. Since even a purely domestic firm is either positively or negatively exposed, the type $n$ firm is just a benchmark.

In a one period set-up, the uncertain cash flows generated by the project at $t = 1$ are distributed with two-point support, $X$ and 0. For a type $e$ project, the cash flow $X$ is realized with a probability of $(p + \varepsilon)$ in the case of a home currency depreciation and by $(p - \varepsilon)$ in the case of a home currency appreciation. For a type $m$ project, the cash flow $X$ is realized with a probability of $(p - \varepsilon)$ in the case of a home currency depreciation and by $(p + \varepsilon)$ in the case of a home currency appreciation. For a type $n$ project, however, the cash flow $X$ in FC is realized with probability $p$, irrespective of appreciation or depreciation of the HC. A suitable measure for the level of economic exposure is the proportionate change in the probability of the cash flow given by $\varepsilon / p$.

Let one consider the firm’s debt financing alternatives for the risky project. The firm issues risky zero coupon debt denominated in either home or foreign currency to finance the positive NPV project. The firm can finance the project by borrowing in foreign currency (alternative $F$), or by borrowing in home currency (alternative $H$). In alternative $F$, the cash flows as well as the debt are denominated in foreign currency. $X$ in FC units is assumed large enough to make any payments

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9 For the origins and development of economic exposure in the finance literature see, for example, Dufey (1972), Flood and Lessard (1986) and Lessard (1990). More recently, the measurement of economic exposure has been classified by O’Brien (1994) as the measurement of economic determinants of operating revenue and cost exposures, operating cash-flow exposure, and equity exposure.

10 The type $e$ firm corresponds to firms with negative correlation between firm value and the trade-weighted US dollar exchange rate in Bartov and Bodnar (1994).

11 Zero coupon debt is assumed in a one period model to simplify the exposition. In a multi-period model with coupon debt, the results remain the same as long as the coupons are riskless.
on debt denominated in foreign currency. In alternative $H$, the firm borrows in home currency and repays the debt in home currency. In the event that there is an exchange rate shock causing a home currency appreciation, the firm fails to repay the debt even if it realizes cash flow $X$ (FC units) from the risky project.

Irrespective of the financing alternative, the firm defaults on its debt if it realizes a cash flow of zero from its risky project. Foreign currency debt always enables the firm to repay the debt when it receives $X$ in FC units from the project. However, home currency debt financing carries the additional risk that the firm may not repay the debt even if the project yields $X$ in FC units. This risk arises from the small probability of a large exchange rate shock. In the event of an unfavorable exchange rate shock (the case of currency appreciation), the project revenues when translated into home currency units are insufficient to repay the home currency debt.

All agents in this economy are risk-neutral. A perfectly competitive securities market ensures that the projects are financed at zero expected profits. Whenever the firm receives a cash flow $X$ in FC units from the risky project, the shareholders collect non-assignable rents, $C$ in HC units as long as they retain control over the firm. In the case of default on the risky debt, the debtholders gain control of the firm through bankruptcy procedures and the non-assignable rents, $C$, are lost by the shareholders of the firm. The valuation of the firm’s project financing alternatives $F$ and $H$ are now considered. Let these alternatives be denoted by $a = \{F, H\}$. The firm chooses the financing alternative, which maximizes the shareholders’ wealth. In this risk-neutral setting, the value of the outstanding equity claim of the firm is equal to the expected value of the project cash flows less the value of the debt and any other dead-weight losses.

Let the face value of the zero coupon debt be denoted by $K(a)$. In the case of financing alternative $F$, the face value of debt, $K(F)$, is determined in foreign currency terms. International capital markets linking the home country and foreign country are mildly segmented. The national capital markets in the two countries are perfect and frictionless (no taxes, no transaction costs). Each investor in the two countries can freely lend and borrow at the same real risk-free rate of interest. The investors from the home country cannot invest in the risky debt issued in the foreign country. However, the investors from the foreign country can invest in the risky debts issued in the home country. Since the project revenues are denominated in foreign currency, the foreign debt held by investors will be priced like any local debt. Moreover, since the investors from the home country cannot participate in the risky debt issued in the foreign country, the pricing is determined from the perspective of debt holders in the foreign country. In the case of financing

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12 Such non-assignable control rent or bankruptcy costs are common in the finance literature. For example, see Diamond (1991) or Smith and Stulz (1985).

13 For the multinational, the effect on firm value provides the main incentive for innovation in the choosing of the financing alternative. The idea of choosing securities to issue to maximize firm value has been extensively developed in Allen and Gale (1994).
alternative $H$, the face value of debt, $K(H)$, is determined in home currency terms, representing the shareholders’ perspective. Since project revenues are denominated in foreign currency, the valuation of home currency debt is based on assessment of the impact of economic exposure on the ability of the firm to repay the debt.

Let $V(a)$ represent the market’s expected payoff from the debt. Given that the capital market is competitive and the agents are risk-neutral, the investors break even whenever they finance the project. Therefore, the investors choose the face-values of the debt for each of the alternatives such that the expected value of the debt equals either $IR^f$ or $IR^h$ where $R^f = (1 + r^f)$ and $R^h = (1 + r^h)$, and $r^f$ and $r^h$ are the foreign currency and home currency riskfree interest rates. The expected payoff to the shareholders of the firm is denoted by $U(a)$. $U(a)$ is computed as the expected cash flows net of debt payments and any losses denominated in home currency. The shareholders’ expected payoff in the case of all financing alternatives consists of two distinct parts. The first part gives the future value of the cash flows from the project. The expected future value of the cash flows is denoted as $FVCF$ (in home currency units).

\[
FVCF(e) = [s\theta(p + \varepsilon)(1 + \rho) + (1 - \theta)p + (1 - s)\theta(p - \varepsilon)(1 - \rho)]X
\]

\[
FVCF(m) = [s\theta(p - \varepsilon)(1 + \rho) + (1 - \theta)p + (1 - s)\theta(p + \varepsilon)(1 - \rho)]X
\]

\[
FVCF(n) = [s\theta p(1 + \rho) + (1 - \theta)p + (1 - s)\theta p(1 - \rho)]X
\]

The second part is the expected value (or cost) of the debt denoted by $V(q, a)$. In case there is a loss of non-assignable control rent $C$, it needs to be accounted for in $U(q, a)$. The intrinsic value of the firm in this risk neutral setting is, therefore, given by:

\[
U(q, a) = FVCF(q) - V(q, a) - f_{q,a}(C)
\]

$FVCF(q)$ is independent of the choice of financing alternative. The firm, therefore, needs to minimize $V(q, a)$ to maximize shareholders’ wealth. The non-assignable control rent, $f_{q,a}(C) > 0$ if and only if the firm finances the foreign project using home currency debt and the bankruptcy state occurs. A definition of the bankruptcy state follows. In all other cases, $f_{q,a}(C) = 0$. The restrictions on parametric values for the exchange rate process are stated here as conditions, which formalize the framework for the firm’s choice between financing alternatives.

**Condition 1** (Bankruptcy state ($B$)). It is assumed that the level of exchange rate change given by the parameter value $\rho$ is large enough that when the home currency appreciates, the foreign currency cash flows from the project are not sufficient to pay off the debtholders. In other words, in case of an appreciation of home currency any firm (irrespective of its type) borrowing home currency debt defaults on its debt and the managers lose the control rent $C$. The conditions under which bankruptcy or the default state occurs is given by:

(i) $X > K(F)$ for all $q$ in FC units

(ii) $X(1 + \rho)$ or $X > K(H) > X(1 - \rho)$ for all $q$ in HC units
Condition 2 (UIRP deviations ($\text{UIRP}_{\text{dev}}$)). The firm chooses from among the debt financing alternatives such that the shareholders’ expected payoff is maximized. In the set-up, there are no deviations from uncovered interest rate parity ($\text{UIRP}$) in the long-term.\(^{14}\) This is a direct implication of mildly segmented international capital markets since there is no restrictions across countries on trading in riskfree securities.

**Definition 1.** Deviations from UIRP are defined as:

\[ \text{UIRP}_{\text{dev}} = [R^h - E(S)R^f] \]

where

\[ E(S) = [s \theta (1 + \rho) + (1 - \theta) + (1 - s) \theta (1 - \rho)] \tag{5} \]

When $\text{UIRP}_{\text{dev}} > (<) 0$, it is called a positive (negative) deviation from UIRP. Condition 2 can, therefore, be stated as

\[ \text{UIRP}_{\text{dev}} = [R^h - E(S)R^f] = 0 \tag{6} \]

The interest rates in home and foreign countries denoted by $r^h$ and $r^f$, respectively, are determined by the different economic conditions in each country. This difference in economic conditions leads to an interest rate differential across the two countries. The equilibrium condition linking this interest rate differential with the exchange rate change in any period is given by uncovered interest rate parity.

3. Financing choices: foreign debt versus domestic debt

Consider the valuation of each financing alternative. The shareholders of the parent firm are in the home country and wish to maximize their wealth in home currency terms. The default risk on the debt in the case of financing alternative $F$ is assessed in foreign currency terms because both the debt as well as the cash flows of the firm are denominated in foreign currency. Thus, the face value of debt, $K(F)$, is determined in foreign currency units. To ensure that the firm will be able to borrow $I$ FC units, the expected value of the cash flows in foreign currency terms must be at least as large as the principal and riskfree interest payment on the debt, that is, $pX \geq IR^f$. It is also assumed that the cash flows $X$ in FC units are large enough to pay $K(F)$ whenever it is realized (i.e. Condition 1 is satisfied). To maximize shareholders’ wealth in home currency, the cash flows net of debt payments, $[X - K(F)]$, are converted to home currency using the expected value of the future exchange rate.

\(^{14}\) In contrast to previous empirical studies, Meredith and Chinn (1998) test UIRP using interest rates on longer-maturity bonds. These long-horizon regressions yield much stronger support for UIRP than that of short-horizon studies.
In the case of the financing alternative $H$, the face value of debt, $K(H)$, is determined in home currency units. To ensure that the firm will be able to borrow $I$ FC units, the expected value of the cash flows in home currency terms must be at least as large as the principal and riskfree interest payment on the debt (i.e. Condition 1 is satisfied). It is also assumed that the cash flows translated from $X$ FC units are large enough to pay $K(H)$ if the exchange rate shock does not lead to an appreciation of home currency. In the case of appreciation of the home currency to $HC\ (1 - \rho)/FC$, the translated cash flows, $[X(1 - \rho)]\ HC$ units, are not enough to meet debt repayment, $K(H)$, and debtholders force bankruptcy procedures on the firm. In the case of such bankruptcy procedures, the shareholders lose the non-assignable rents, $C$. The expected cash flows in $HC$ units net of the expected market value of debt payments and the expected loss of non-assignable rents are the shareholders’ wealth.

In the case of foreign borrowing ($F$), given mildly segmented international capital markets, the domestic investors cannot invest in foreign currency debt. This is consistent with the model of international market segmentation in Errunza and Losq (1985). Since the foreign currency debt will be held only by foreign investors, it will reflect the value placed on it by them. The face value of the debt, denoted in foreign currency, can be simplified to $IR_f^e$, and is given by the following equation:

$$K(e, F) = \frac{IR_f^e}{s\theta(p + \varepsilon) + (1 - \theta)p + (1 - s)\theta(p - \varepsilon)}$$  \hspace{1cm} (7)

The shareholders’ expected payoff is computed by converting the expected cash flows net of the cost of debt to the home currency using the expected future exchange rate:

$$U(e, F) = [s\theta(p + \varepsilon)(1 + \rho) + (1 - \theta)p + (1 - s)\theta(p - \varepsilon)(1 - \rho)]\{X - K(F)\}$$

$$= \frac{s\theta(p + \varepsilon) + (1 - \theta)p + (1 - s)\theta(p - \varepsilon)}{1 + (2s - 1)\theta\frac{s\theta(p + \varepsilon)}{p} + (2s - 1)\theta\rho + (2s - 1)\rho\frac{s\theta(p + \varepsilon)}{p}}$$  \hspace{1cm} (9)

When the face value of foreign currency debt is calculated from the perspective of the foreign investors, it increases the expected value of foreign currency debt, thereby reducing the shareholders’ wealth. The magnitude of this increase is given by the third term on the right-hand side (RHS) of Eq. (9), is what is called the exposure effect on foreign debt. It depends upon the magnitude of the exchange rate shock, change in exchange rates due to the shock, and the level of economic exposure of the firm. The exposure effect is the interaction between the level of exposure and the exchange rate change.
In the case of financing alternative $H$ the face value of the debt denoted in home currency is computed considering the fact that when the exchange rate shock leads to a depreciation of the home currency, the firm will default on its home currency debt. When debtholders force bankruptcy procedures on the firm, in this state alone, the residual cash flows go to the bondholders. However, the shareholders also lose the non-assignable rent because they lose control of the firm before the end of period 1. The face value of such domestic currency debt is determined by the firm after considering the default state in which the bankruptcy occurs.

$$K(e, H) = \frac{IR^h - (1-s)\theta(1-\rho)(p-\varepsilon)X}{s(\theta(p+\varepsilon)+(1-\theta)p)}$$

(10)

The shareholders’ wealth is then computed as follows:

$$U(e, H) = FVCF(e) - IR^h - (1-s)\theta(p-\varepsilon)C$$

(11)

where $C$ is the non-assignable rent being lost by the shareholders when they lose control (see Diamond, 1991), or the cost of bankruptcy (see Smith and Stulz, 1985).

In borrowing home currency debt a firm with foreign currency inflows reduces the expected future payoffs of the shareholders to the extent of the expected costs of bankruptcy. The use of home currency debt results in a positive probability of bankruptcy and loss of non-assignable rent due to loss of shareholders’ control of the firm.

**Proposition 1:** When firms are faced with positive economic exposure ($e > 0$), and $C > 0$, home currency debt $(H)$ will be the preferred financing alternative to foreign currency debt $(F)$, if and only if, $C < 3R^eE(S)$.

Proof: See Appendix A.

So far a type $e$ firm has been dealt with for which the expected cash flows from the risky project increase when the home currency depreciates relative to the foreign currency. The condition in Proposition 1 above implies that for a small enough bankruptcy cost, the type $e$ firm will prefer to use home currency debt rather than foreign currency debt. Alternately, it has been shown in Proposition 1 that such a positively exposed firm will choose the foreign currency debt in preference to home currency debt if the expected bankruptcy cost exceeds the exposure effect related loss from borrowing in foreign currency. This exposure effect arises from the covariance between the cash flows and the exchange rates.\(^\text{15}\)

The analysis presented above for the type $e$ firm applies to the type $m$ firm in the converse. The firm will now have an exposure effect, which renders the expected value of foreign currency debt lower compared to the expected value of home currency debt. Foreign currency debt gives the firm’s shareholders higher expected cash flows due to a favorable exposure effect. Thus, the type $m$ firm has an incentive

\(^{15}\)See Adler and Dumas (1984) for an elaboration and the significance of economic exposure for multinationals.
to choose foreign currency debt as its financing alternative rather than choosing home currency debt.

**Proposition 2:** When firms are faced with negative economic exposure \( (\varepsilon < 0) \), and \( C > 0 \), foreign currency debt \( (F) \) will be preferred to home currency debt \( (H) \).

Proof: See Appendix A.

In the case of positively exposed firms, the choice between domestic currency debt and foreign currency debt is guided by whether the loss due to bankruptcy is worse than the loss due to the exposure effect. As shown in Proposition 1, if bankruptcy cost is small enough, the firm prefers domestic currency debt. In the case of negatively exposed firms, however, there is a benefit from the exposure effect in the case of foreign currency debt, and a loss due to bankruptcy in the case of domestic currency debt. The firm will, therefore, always prefer foreign currency debt to home currency debt.

To summarize, if the firm is faced with negative economic exposure, the debt financing choice is very clear. The firm prefers foreign currency debt to home currency debt. However, if the firm is faced with positive economic exposure, the exposure effect reduces the expected value of the foreign currency debt, and the bankruptcy cost or non-assignable rent reduces the expected value of the home currency debt-financing alternative for the shareholders. Therefore, such firms will certainly benefit from any other debt-financing alternative, which increases the shareholders’ wealth more than either foreign currency debt or home currency debt. For multinational firms facing economic exposure, eurocurrency markets provide such an additional debt-financing alternative.

4. Economic exposure and eurocurrency debt

The firm may also issue a eurocurrency debt denominated in foreign currency as an alternative to borrowing in the domestic or foreign debt markets. The eurocurrency debt-financing alternative \( (E) \) requires that the principal and risk-free interest payments, \( IR^f \), be paid in foreign currency. The future cash flows of the firm are foreign currency denominated and so is the face value of the eurocurrency debt. To determine the face value of eurodebt the default risk must be estimated, using all available information, from the point of view of the domestic debtholder. To ensure that the firm can repay the eurocurrency debt with \( I FC \) units, \( pX \geq IR^f \) is a necessary condition. It is also assumed that the cash flows \( X \) in \( FC \) units are large enough to pay \( K(E) \) whenever they are realized.

Investors from the foreign country may invest in the eurocurrency debt. This is because international capital markets are only mildly segmented restricting access in the foreign country for home country investors but not for foreign investors investing in international markets. If eurocurrency debt is priced for the foreign investors, its face value, \( K(E) \), cannot be different from the face value of foreign
currency debt, $K(F)$. Consequently, $V(E)$, the expected value of eurocurrency debt cannot be different from $V(F)$, the expected value of foreign currency debt. However, such valuation does not take into account the fact that domestic investors can also invest in eurocurrency debt. If the firm prices the eurocurrency debt for the domestic investors, then, the face value of the debt will be given by:

$$K(E) = \frac{IR^E(S)}{s\theta(1 + \rho)(\rho + \varepsilon) + (1 - \theta)p + (1 - s)\theta(1 - \rho)(\rho - \varepsilon)}$$  \hspace{1cm} (12)$$

The value of the eurocurrency debt is $V(E) = IR^E(S)$. Consequently, the value of the firm is:

$$U(e, E) = FVCF(e) - IR^E(S)$$  \hspace{1cm} (13)$$

This $V(E)$ will be less than $V(F)$. Therefore, the firm will choose the pricing scheme, $K(E)$ above for eurocurrency debt.

The cost of financing is compared for the firm when it chooses between the two financing alternatives, $F$ and $E$. The shareholders' expected value Eqs. (9) and (13) give payoffs for a firm with a type $e$ project for the two financing alternatives respectively. Comparing financing alternatives $F$ and $E$ from Eqs. (9) and (13) above, foreign borrowing ($F$) generates a lesser payoff than eurocurrency borrowing ($E$). Essentially, the cost of the foreign currency debt financing alternative in home currency terms is higher than that of the eurocurrency debt financing alternative because of the exposure effect.

**Proposition 3:** When firms are faced with positive economic exposure ($\varepsilon > 0$), and $C > 0$, eurocurrency debt ($E$) dominates other financing alternatives: foreign currency debt ($F$), as well as home currency debt ($H$).

**Proof:** See Appendix A.

The Proposition above suggests that eurocurrency debt will be correctly priced for the domestic investors. Since the firm issues only domestic equity, it is only appropriate that all debt be priced to maximize value of the firm from the domestic equityholders’ perspective. Consequently, one has the result that for firms faced with positive economic exposure, eurocurrency debt dominates home currency borrowing as well as foreign currency borrowing. It is also concluded, that for firms faced with positive economic exposure, either home currency borrowing dominates or will be dominated by foreign currency borrowing as indicated in Proposition 1. In contrast, there is just one unique preference ordering for firms faced with negative economic exposure as indicated in Proposition 4 below.

**Proposition 4:** When firms are faced with negative economic exposure ($\varepsilon < 0$), foreign currency debt ($F$) dominates eurocurrency debt ($E$). For $C > 0$, eurocurrency debt ($E$) dominates home currency debt ($H$).

**Proof:** See Appendix A.
For firms faced with negative economic exposure, the exposure effect reduces the expected value of foreign currency debt compared to the expected value of eurocurrency debt. This results in higher expected cashflows to the shareholders of the firm, if it issues foreign currency debt than if it issues eurocurrency debt. Thus firms faced with negative economic exposure will prefer foreign currency debt to eurocurrency debt. On the other hand, eurocurrency debt rather than home currency debt will be the preferred debt financing alternative for the firm. Bankruptcy cost or non-assignable control rents increase the expected value of domestic currency debt compared to that of eurocurrency debt. Thus, for firms with negative economic exposure there is a unique preference ordering over the debt-financing alternatives: foreign currency debt dominates eurocurrency debt which in turn dominates home currency debt.

To provide a benchmark against which to evaluate the preference orderings over the long-term debt financing alternatives of a multinational firm, a base-case where firms have no economic exposure and no bankruptcy costs or non-assignable control rents is looked at.

**Proposition 5:** Firms with no economic exposure \((c = 0)\) are indifferent between foreign currency debt and eurocurrency debt. Home currency debt is dominated by other financing alternatives when non-pecuniary control rents or bankruptcy costs, \(C < 0\). In case \(C = 0\), the firm will be indifferent between the three debt financing alternatives.

**Proof:** See Appendix A.

Proposition 5 provides an indifference result for the debt financing choice of global, non-financial firms. For these firms operating in mildly segmented international capital markets, absence of economic exposure and bankruptcy costs is a sufficient condition for indifference between the long-term debt financing alternatives. Thus, given no economic exposure, bankruptcy costs, or non-assignable control rents, it follows that the firm will be indifferent between home currency, foreign currency, and eurocurrency debt financing alternatives.

### 5. Conclusions

This paper shows that the economic exposure of firms can be a guiding factor in choosing between different debt financing alternatives. In summary, the dominant debt financing alternative for firms faced with positive economic exposure is eurocurrency debt, while the dominant debt-financing alternative for firms faced with negative economic exposure is foreign currency debt. Unanticipated exchange rate changes can have two effects on risk-neutral, multinational firms: economic exposure and bankruptcy. The type and level of economic exposure as well as the cost of bankruptcy or loss of non-assignable rents, result in different preference orderings for the firm on home currency, foreign currency, and eurocurrency debt.
In the absence of bankruptcy costs, it is demonstrated that, if firms are not exposed, domestic debt, foreign-currency debt, and eurocurrency debt are equivalent financing alternatives.

It is plausible that the outside investor may not have sufficient information to be able to differentiate between firms with different levels of economic exposure. As Bartov and Bodnar (1994) point out, the level of economic exposure may be misestimated by outside investors due to the complex set of issues involved. If this is so, positively and negatively exposed firms undertaking projects with cashflows that are sensitive to exchange rate changes will suffer a mispricing loss or gain because their long-term debt claims are priced on average. The results extend to this scenario: all positively exposed firms will choose to use eurocurrency debt while all negatively exposed firms choose to use foreign currency debt.

In fact, Levi and Sercu (1991) identify bankruptcy costs and better internal information as two potentially valid reasons for hedging foreign exchange exposure. Allayannis and Ofek (1997) observe that firms may use foreign debt to hedge foreign exchange exposure but to a smaller extent than the use of foreign currency derivatives. In this set-up, firms use long-term foreign debt to hedge economic exposure over long horizons, because of bankruptcy costs. Foreign currency derivatives are routinely employed by firms to hedge short-term foreign exchange exposure.

Recent literature, however, has focused primarily on short-term foreign exchange exposure hedging strategies. For example, the cross-sectional evidence on the exchange rate exposure of US and Japanese banking institutions in Chamberlain et al. (1997) is consistent with the use of foreign currency derivatives for the purpose of hedging short-term exposure. Kanas (1996) proposes that a currency call option can perfectly hedge asymmetric economic exposure and cross-hedge business exposure by appropriately adjusting the hedge ratio. Thus, there is need to investigate the role of foreign debt or eurocurrency debt in firms’ long-term economic exposure hedging strategies. The paper makes a beginning along this dimension of theoretical research.

The empirically testable implications are firstly, that multinationals use eurocurrency debt when they have positive economic exposure and secondly, that multinationals use foreign currency debt when they face negative economic exposure. Recent empirical studies have investigated the time-varying nature of economic exposure. A multi-period extension of the model could potentially examine the impact of time-varying economic exposure on debt financing choice of the multinational firm.

The interpretation of debt financing choice excludes the treatment of currency swaps, which are often used in conjunction with foreign bond or eurobond-based debt financing by non-financial firms. The impact of economic exposure on debt

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16 For a detailed empirical investigation of how firms choose from among different types of currency derivatives and their rationale for using currency derivatives see Geczy et al. (1997).

17 The most general way in which multinationals exercise this choice is by combining eurobond transactions with currency swaps (see Walter and Smith (1989) and the HBS case study: ‘The Walt Disney Company’s Yen Financing’ (1983)).
financing choice and swap markets as international capital markets become more integrated awaits future research.

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Appendix A

Proposition 1: When firms are faced with positive economic exposure \( \epsilon > 0 \), and \( C > 0 \), home currency debt \( H \) will be the preferred financing alternative to foreign currency debt \( F \), if and only if, \( C < \mathfrak{I} R I E(\mathcal{S}) \), where

\[
\mathfrak{I} = \frac{\rho \frac{\epsilon}{p} [1 - (2s - 1)^2 \theta]}{[(1 - s)(p - \epsilon)] [1 + (2s - 1)^2 (1 - \theta) \rho + (2s - 1)^2 \rho \frac{\epsilon}{p}]} \quad \text{(A1a)}
\]

Proof: Using risk neutral valuation, the firm maximizes its net domestic currency denominated cash inflow. The expected cashflow of a type \( e \) firm for financing alternatives \( F \) and \( H \) are given in Eq. (9) Eq. (11). The first two terms of Eq. (9) are identical to the terms in Eq. (11), if \( U R I P_{\text{dev}} = 0 \). The exposure effect in foreign debt \( F \) is the third term on the right hand side (RHS) of Eq. (9) and the loss of non-assignable rent is the third term on the RHS of Eq. (11). Then \( U(e, H) \) is larger than \( U(e, F) \) if and only if

\[
IR I E(\mathcal{S}) \frac{\theta \rho \frac{\epsilon}{p} [1 - (2s - 1)^2 \theta]}{[1 + (2s - 1)^2 (1 - \theta) \rho + (2s - 1)^2 \rho \frac{\epsilon}{p}]} > (1 - s)(p - \epsilon)C,
\]

or

\[
C < \mathfrak{I} R I E(\mathcal{S}),
\]

where
Proposition 2: When firms are faced with negative economic exposure ($\varepsilon < 0$), and $C > 0$, foreign currency debt (F) will be preferred to home currency debt (H).

Proof: First the stockholders’ payoff $U(q, a)$ is computed for each financing alternative computed from the face value of debt $K(q, a)$ for each financing alternative available to the type $m$ firm.

\[
K(m, F) = \frac{IR^f}{s(1 - s)(p - \varepsilon) + (1 - \theta)p + (1 - s)\theta(p + \varepsilon)}
\]

\[
K(m, H) = \frac{IR^h - (1 - s)\theta(1 - \rho)(p + \varepsilon)X}{s(1 - s)(p - \varepsilon) + (1 - \theta)p}
\]

and

\[
U(m, F) = FVCF(m) - IR^fE(\bar{S})
\]

\[
+ \left[ \frac{\theta p - (2s - 1)^2\theta^2 p}{p} \right]
\]

\[
U(m, H) = FVCF(m) - IR^h - (1 - s)\theta(p + \varepsilon)C
\]

Condition 2 is a necessary condition for this result to hold. For $C > 0$, and $\varepsilon > 0$, it will always be the case that $U(m, F) > U(m, H)$. Therefore the proposition follows.

Proposition 3: When firms are faced with positive economic exposure ($\varepsilon > 0$), and $C > 0$, eurocurrency debt (E) dominates other financing alternatives: foreign currency debt (F), as well as home currency debt (H).

Proof: Compare the Eqs. (9) and (13) for $U(e, F)$ and $U(e, E)$ respectively. $U(e, F)$ reduces the expected value of the foreign debt for the shareholders because of the exposure effect. $U(e, E)$ is fairly priced for the domestic shareholder and therefore greater than $U(e, F)$. Thus, the eurocurrency debt will be preferred by the shareholder to foreign debt.

Now compare Eqs. (11) and (13) for $U(e, H)$ and $U(e, E)$ respectively. The first two terms on the right hand side of Eq. (11) equal the first two terms on the right hand side of Eq. (13) when Condition 2 holds. The loss of non-assignable rent or bankruptcy cost reduces the expected cost of the home currency debt alternative for the shareholder. Therefore, $U(e, E) > U(e, H)$ and the proposition follows. Thus, the eurocurrency debt will be preferred by the shareholder to home currency debt.
**Proposition 4:** When firms are faced with negative economic exposure ($\xi < 0$), foreign currency debt ($F$) dominates eurocurrency debt ($E$). For $C > 0$, eurocurrency debt ($E$) dominates home currency debt ($H$).

Proof: First we compute the stockholders' payoff $U(m, E)$ for eurocurrency debt from the face value of debt $K(m, E)$ for this financing alternative available to the type $m$ firm.

$$K(m, E) = \frac{IR^E(E)}{[s\theta(1 + \rho)(p - \xi) + (1 - \theta)p + (1 - s)\theta(p + \xi)]} \quad (A4a)$$

and

$$U(m, E) = FVCF(m) - IR^E(E) \quad (A4b)$$

Compare the Eqs. (A2c) and (A2d) in the proof of Proposition 2 with Eq. (A4b) above. From these equations it is easy to see that $U(m, F)$ is always higher than $U(m, H)$ and $U(m, E)$. Also, bankruptcy cost (even if it is low) makes $U(m, H)$ lower than $U(m, E)$. The ordering of shareholder wealth is as follows,

$$U(m, F) > U(m, E) > U(m, H).$$

Therefore, the proposition follows.

**Proposition 5:** Firms with no economic exposure ($\xi = 0$) are indifferent between foreign currency debt and eurocurrency debt. Home currency debt is dominated by other financing alternatives when non-pecuniary control rents or bankruptcy costs, $C > 0$. In case $C = 0$, the firm will be indifferent between the three debt financing alternatives.

Proof: Following the same argument in the proofs of Propositions 1 and 2, face values of debt and stockholders' payoff are computed for each financing alternative for the type $n$ firm.

$$K(n, H) = \frac{IR^b - (1 - s)\theta(1 - \rho)pX}{[s\theta p + (1 - \theta)p]} \quad (A5a)$$

and

$$K(n, H) = \frac{IR^f}{p} \quad (A5b)$$

and

$$K(n, E) = \frac{IR^E(E)}{[1 + (2s - 1)\theta\rho]p} \quad (A5c)$$

The shareholders' payoff is also computed,

$$U(n, H) = FVCF(n) - IR^b - (1 - s)\theta p C \quad (A5d)$$

$$U(n, F) = FVCF(n) - IR^f E \quad (A5e)$$

$$U(n, E) = FVCF(n) - IR^E(E) \quad (A5f)$$

If Condition 2 holds and $C$ is positive, $U(n, E) > U(n, H)$. However, $U(n, F)$ is always equal to $U(n, E)$. If $C = 0$, then $U(n, E) = U(n, H) = U(n, F)$. Therefore, the proposition follows.
References


