

How Firms Hedge Foreign Currency Exposure: Foreign Currency Derivatives versus Foreign Currency Debt

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ABSTRACT

This paper examines whether foreign currency derivatives and foreign currency debt are complements or substitutes in hedging foreign currency exposure. Using a sample that excludes foreign currency swap users I find significant evidence that firms prefer to use foreign currency debt rather than foreign currency derivatives to hedge foreign currency exposure arising from assets located in foreign locations. Conversely, the evidence shows that firms engaged in exporting prefer the use of foreign currency forwards and or options to the use of foreign currency debt. The paper also finds that issuing foreign debt is not a substitute strategy for firms that swap foreign debt into domestic debt, however, it is for firms that swap into foreign debt. Finally, the results show that foreign debt is not an effective substitute for currency swaps for highly geared or small firms.

KEYWORDS: International Finance, Risk Management, Foreign Currency Hedging, Foreign Currency Derivatives, Foreign Currency Debt, Foreign Currency Swaps.

JEL Classification: G15, G30, G32

1. Introduction

The empirical literature on the use of foreign currency debt by non-financial firms follows two somewhat related paths. The first strand of literature investigates why firms use or issue foreign currency debt (Allayannis and Ofek (2001), Keloharju and Niskanen (2001), Kedia and Mozumdar (2002)). This literature finds strong support for the use of foreign debt as a hedge for foreign currency exposure. There is also some support for the firms' choice of currency of debt being influenced by differences in the cost of debt in different currencies due to capital market imperfections (Keloharju and Niskanen (2001) and Kedia and Mozumdar (2002)). The second strand of this literature examines whether foreign debt and foreign currency derivatives are used as substitutes or complements when hedging foreign currency exposure (Géczy, Minton and Schrand (1997), Allayannis and Ofek (2001), Elliot, Huffman and Makar (2003)). In this literature there is support for the notion that foreign debt acts as a substitute for foreign currency derivatives but there is also evidence which shows that the type or source of exposure might influence the choice of hedging strategy (Allayannis and Ofek (2001)). This paper examines a firm's decision on the choice of foreign currency hedging method, comparing foreign currency derivatives and foreign debt, in order to determine whether they are seen as substitutes or complements. In examining whether foreign currency derivatives substitute for or complement foreign debt this paper identifies firm characteristics that have not been previously considered and is the first paper to investigate this issue using non-US data.

Most previous studies conduct tests employing firms that use foreign currency derivatives such as forwards, futures, options and swaps and firms that use foreign currency debt. Their results suggest that foreign currency derivatives substitute for

the use of foreign debt in hedging foreign currency exposure. However, these studies fail to distinguish between derivative instruments that are potentially better suited for hedging short-term transaction exposures, such as forward, futures and options and those that are appropriate for hedging long-term multiple period foreign currency exposures, such as foreign currency swaps. This paper argues that empirical tests need to be more explicit about which types of foreign currency derivative might substitute for or complement foreign debt. Therefore, unlike previous studies, the tests in this study control for the type of derivative distinguishing between foreign currency forwards, futures, options on the one hand and currency swaps on the other. Furthermore, the tests also, for the first time to my knowledge, control for the type of foreign currency swap distinguishing between firms that swap foreign debt into domestic debt and firms that swap domestic or foreign debt into foreign debt. This distinction is important because using foreign currency swaps or issuing foreign debt are not necessarily substitute hedging strategies. For example, a firm that swaps foreign debt into domestic debt to match domestic assets would treat currency swaps and foreign debt as complements, rather than as substitutes. However, a firm wishing to create a foreign currency liability to hedge a foreign operations exposure could achieve this either by swapping debt into the desired foreign currency or issuing debt directly in the desired foreign currency. Therefore, in this second scenario swapping into foreign debt or issuing the desired foreign debt directly are substitute strategies. Clearly breaking down the use of foreign currency derivatives by derivative type facilitates more effective comparisons between the use of foreign currency derivatives and foreign debt. This makes the empirical tests in this paper far more comprehensive than those conducted in previous empirical studies. In addition to distinguishing between firms that swap into domestic debt and firms that swap into foreign debt, this

study identifies two types of firm swapping into foreign debt. These are firms that create foreign liabilities using combinations of foreign currency swap and direct foreign debt and firms that only use foreign currency swaps for this purpose. For the latter all of their foreign debt is synthetic foreign debt.

The results in this paper show that firms prefer to use foreign currency debt rather than foreign currency forwards or options to hedge foreign currency exposure arising from assets located in foreign locations. Conversely, the evidence shows that firms engaged in exporting prefer the use of foreign currency forwards or options to the use of foreign currency debt. These results suggest that foreign currency derivatives, such as forwards and options, and foreign currency debt are complementary rather than competing strategies for managing foreign currency exposure.

Next, the paper conducts a comparison of currency swap users against foreign currency debt users. This analysis controls for the type of currency swap user, identifying firms that swap into foreign debt and those that swap into domestic debt. The results show that the use of foreign debt only is not a substitute strategy for firms that use currency swaps to translate foreign debt into domestic debt whereas it is for firms that use swaps to convert domestic or foreign debt into foreign debt. Finally, the paper compares firms that use only currency swaps to create foreign liabilities and firms that use both swaps and foreign debt for this purpose. The results suggest that firms with higher gearing are less likely to use both swaps and foreign debt and place greater reliance on just currency swaps. This preference for currency swaps only by highly geared firms might be because these firms are close to the limits of their debt capacity and hence the issuing of more debt in a foreign currency is not a viable option. Firm size is also an important factor in determining whether firms use both

swaps and foreign debt or just swaps. Firm size is negatively related to the use of only foreign currency swaps. This could be due to the relative newness of the foreign operations of small firms which could imply uncertainty associated with the longevity of the foreign investment making synthetic foreign debt a more attractive proposition, since this form of financial hedge can be reversed more quickly and at a lower cost than direct foreign debt.

The article proceeds as follows. Section 2 summarises this article's contribution to the existing literature on foreign currency hedging methods. Section 3 reviews the incentives for foreign currency derivatives and foreign debt use and discusses the effects of underlying foreign currency exposure on a firm's hedging method choice. Section 4 describes the sample and the collection of foreign currency derivatives and foreign debt data. Section 5 presents multivariate analysis on the determinants of foreign currency hedging. Section 6 reports logit tests on the determinants of foreign currency hedging method choice, comparing the use of foreign currency derivatives and foreign currency debt as well as the results of robustness checks on these tests. Section 7 tests the determinants of the choices among types of foreign currency swap. Section 8 concludes.

2. Overview of Related Literature

Many studies have investigated why firms hedge and several of these have examined the determinants of the foreign currency hedging decision. Recently some studies have investigated how firms hedge foreign currency exposure with a particular focus on whether foreign currency debt and foreign currency derivatives are complementary or competing hedging tools.

In their study of the determinants of the use of currency derivatives by US firms Géczy, Minton and Schrand (1997) find on the one hand foreign debt and currency derivatives may act as substitutes for hedging foreign operations and on the other currency derivatives use is positively associated with the use of foreign debt. Bartram, Brown and Fehle (2003) also find a positive relationship in multi-country tests.¹ Both studies conclude that the implication of this is that foreign currency debt is a source of foreign currency exposure, which requires hedging via the use of foreign currency derivatives. This will be the case if foreign debt is issued in a currency in which assets are not held and so creates an exposure in which case a currency swap could be used to translate the debt into the appropriate currency for matching purposes. However, a positive correlation between currency derivative use and foreign debt might be observed if, as shown in this study, both are used for hedging but hedge different sources of exposure to exchange rate risk. For example, forwards, futures and options might be used to hedge short-term transaction exposures whereas long-term foreign currency borrowing might hedge the assets in a foreign operation when the commitment to the investment is of a long-term nature.

Allayannis and Ofek (2001) use data for 94 US firms collected from notes in annual reports to compare the use of foreign currency derivatives and foreign debt.

¹ Bartram et al. (2003) find that foreign currency derivative use is positively related to foreign debt use in their multi-country sample and several single country samples, such as, US, UK, and Australia.

They do not find any significant evidence that firms with revenues from operations abroad prefer to use foreign currency derivatives or foreign debt to hedge currency exposure from foreign operations. This result implies that currency derivatives and foreign debt might be seen as alternatives for hedging currency exposure from foreign operations. Although, they find significant evidence that exporters prefer the use of foreign currency derivatives to the use of foreign currency debt.

The Geczy et al. and Allayannis and Ofek result that firms with foreign operations find foreign currency debt and currency derivatives equally viable for hedging this exposure requires further scrutiny. This is because, as suggested above, not all currency derivatives can effectively substitute for foreign debt when hedging foreign operations. The exposure arising from foreign operations is usually long term in nature and therefore might be more effectively hedged using an instrument with a similar maturity, such as long term foreign debt or a currency swap, since this reduces basis risk. Foreign currency forwards, futures or options might not be appropriate in these circumstances because of their shorter maturities. Both studies provide no indication of the derivative type composition of their sample of currency derivative users.² For example, if the derivative user sample is composed of currency swap users and firms that use other currency derivatives then the result that currency derivatives and foreign debt may act as substitutes might be driven by the inclusion of currency swap users in the derivative user sample. If this is the case, a sample of currency derivative users that excludes currency swap users might not produce the same result.

Elliott et al. (2003) investigate the relationship between foreign currency debt and foreign currency derivative use for a sample of US multinational firms that use

² Geczy et al. (1997) provide a breakdown of the type of currency derivatives used in tests that compare currency swap users and firms that use other currency derivatives.

foreign currency debt. They find that the level of foreign debt is negatively related to the level of foreign currency derivatives used, which they argue provides evidence that foreign debt substitutes for the use of foreign currency derivatives. Their results are unchanged after the exclusion of currency swap users, which seems to suggest that foreign debt substitutes for forwards, options and futures in hedging foreign currency exposure. This result is opposite to the findings in this study. However, the negative relationship between foreign debt use and foreign currency derivative use might be because the multinationals in their sample have higher levels of foreign asset exposure and lower levels of export or other short-term foreign transaction driven exposure. Higher levels of foreign assets can be hedged by matching with higher levels of foreign liabilities, which can be created either by issuing foreign debt directly or swapping into foreign debt. Higher levels of foreign debt usage would imply lower levels of currency swap usage due to the substitution effect. Furthermore, if multinational diversification reduces transaction exposure because foreign markets are served by local and not parent country production, then these firms might use low levels of forwards, futures and options because they have lower levels of exports or other transaction based exposure. Therefore, the negative relationship might be driven by these two substitution effects.

Allayannis, Irhig and Weston (1999) investigate whether the financial and operational exchange rate risk management strategies of US multinational firms are substitutes or complements. The use foreign currency derivatives or foreign debt is defined as financial hedging. A firm's operational hedging is measured using several indicators of the geographic dispersion of its activities. They find that the greater the level of geographic dispersion the more likely firms use financial hedges, which suggests that operational hedging is a complement rather than a substitute for

financial hedging. However, geographic dispersion might also be a proxy for foreign asset exposure, which can be hedged by creating liabilities in a matching currency via foreign currency swaps or foreign debt. It follows that this might explain why financial hedging is positively correlated with geographic dispersion. Laux, Pantzalis and Simkins (2001) find that the ability to construct operational hedges via a geographically spread-out network of operations lowers foreign exchange exposure only for firms that use currency derivatives. According to Laux et al. this result suggests that the most effective way to reduce foreign currency exposure is via a combination of operational and financial hedges. An implication of this result is that operational and financial hedges are more likely to be seen as complements. Laux et al. also find evidence that multinationals with a larger number of financial subsidiaries located in foreign countries facilitates currency matching of assets and liabilities, which can reduce foreign currency exposure without the use of foreign currency derivatives. They argue that these financial strategies complement operational hedges, which might also explain why Allayannis et al. (1999) observe a positive correlation between financial and operational hedges.

3. The Determinants of the use of Foreign Currency Denominated Debt and Foreign Currency Derivatives for Hedging

Disclosures in annual reports indicate that the foreign currency derivative and foreign debt users in our sample are using these instruments for foreign currency hedging. Therefore, this study uses the theoretical framework developed in the corporate hedging literature to investigate whether foreign debt and foreign currency derivatives are substitutes or complements in hedging foreign currency exposure. This is achieved by testing if various sources of underlying exposure to exchange rate risk affect the choice of foreign currency hedging instrument. Foreign currency derivatives, such as forwards, futures and options provide an effective method for managing cash flow exposure arising from regular and uncertain transactions such as imports and exports. However, a key characteristic of the exposure arising from the existence of foreign subsidiaries, such as net worth exposure, is its long-term duration. Foreign exchange forwards, futures and options have a finite time horizon, which makes them inappropriate for hedging long-term exposures because of the mismatch in the duration of hedge and the exposure. This mismatch would result in a higher level of basis risk relative to a hedge whose maturity matched that of the exposure.³ A more appropriate hedge in these circumstances would be a long-term foreign currency swap or long-term foreign debt.⁴ The foreign currency liability created via the foreign debt or currency swap protects shareholders' funds from the effect of currency movements on the net assets of the group. Furthermore, creating liabilities

³ Forward sales contracts, as a hedge of a net investment, can be arranged for a finite date. When the maturing contract is closed out a new forward contract can extend the hedge if required. However, closing out the forward sale at the current spot rate also causes a cash cost if the foreign currency has appreciated. This cash cost is realised, whereas the corresponding benefit on the asset revaluation is unrealised, and with no expectation of subsequent realisation.

⁴ While any individual borrowing will be of finite duration, roll-over of the borrowing will normally provide continuity of the hedge.

in currencies in which revenue is earned reduces exposure through the currency matching of revenue and debt service costs.

This study employs two measures of a firm's underlying exchange rate exposure to help distinguish between foreign currency derivative and foreign debt based hedging strategies. Firstly, a dummy variable indicating that a company exports or receives other foreign currency income such as repatriated profits, dividends, fees and interest. Secondly, a foreign sales by origin ratio measures the proportion of total sales that have originated from operations outside of the UK. This variable does not include export sales from the UK and therefore gives a reasonably accurate indication of the relative size of a firm's foreign assets. In the multivariate tests, a hedging method dummy variable, 1 if the firm only uses foreign currency derivatives for foreign currency hedging and 0 if the firm only uses foreign currency debt for foreign currency hedging, is regressed on the two aforementioned measures of foreign currency exposure along with control variables that proxy for alternative theories of hedging. The control variables are gearing, liquidity and firm size. In the multivariate analysis, a significant positive coefficient for the export transactions variable would indicate that firms with export transactions exposure are more likely to use foreign currency derivatives to hedge this exposure relative to using foreign currency debt and a significant negative coefficient for the foreign sales by origin variable would indicate that firms with foreign assets exposure are more likely to use foreign currency debt to hedge this exposure relative to using foreign currency derivatives. This set of results would suggest that foreign currency derivatives and foreign currency debt are complements in hedging foreign currency exposure. Insignificant coefficients for both exposure variables would suggest that both hedging

methods are substitutes. In this analysis it is expected that the estimated coefficients for the control variables will be insignificant.

4. Sample Description and Sources of Data on Foreign Currency Derivatives and Foreign Currency Debt

4.1 Sample Construction

This study analyses the use of foreign currency derivatives and foreign currency debt by non-financial firms in the top 500 of UK firms ranked by market value as of year-end 1995. The sample consists of 441 non-financial firms. Information on the use of foreign currency derivatives and foreign currency debt is collected from annual reports published in 1995. The annual reports of 412 firms out of the initial sample of 441 firms were obtained.

4.2 The Use of Foreign Currency Derivatives and Foreign Currency Debt by UK Firms

Quantitative data on the corporate use of foreign currency derivatives and foreign currency debt was not disclosed universally in UK annual reports in 1995. However, qualitative disclosure on foreign currency derivative and foreign debt usage was found in various sections of the annual report, such as, the Operating and Financial Review, the Accounting Policies note, and the Creditors Due After More Than One Year note to the accounts.

In 1995 52.2 percent of firms disclose the use foreign currency derivatives for hedging and 63 percent of firms report the use of foreign currency debt, which is similar to Edelshain (1995) who found that 60 percent of 189 large UK-based companies used foreign currency denominated debt. Table 1 presents a summary of foreign currency debt use by the sample firms. For the vast majority of firms (84

percent) qualitative disclosures in annual reports suggest that foreign debt is used for foreign currency hedging purposes. However, in addition to hedging a foreign currency exposure foreign currency debt might also be the source of the exposure. The qualitative disclosures in 2 percent of cases indicate that firms borrowed in various foreign currencies, some of which hedge a foreign currency exposure and others, which increase the firm's foreign currency exposure. In 6 percent of cases qualitative disclosures suggest that firms' use of foreign currency debt increased their foreign currency exposure. Finally, in 9 percent of cases it is not possible to determine the potential impact of foreign currency borrowings on the firm's foreign currency risk profile.

[INSERT TABLE 1 ABOUT HERE]

Table 2 shows the frequency of the use of foreign currency hedging methods, distinguishing between foreign currency derivatives and foreign currency debt. Around 53 percent of foreign currency hedging firms use both foreign currency derivatives and foreign currency debt, approximately 21 percent use derivatives only and nearly 20 percent use foreign currency debt only.

[INSERT TABLE 2 ABOUT HERE]

4.3 The Use of Foreign Currency Swaps by UK Firms

A firm can create foreign currency obligations as a foreign currency hedge by borrowing the needed currencies in the domestic or Eurobond public markets, or via a private placement. Alternatively, a firm can use cross currency swaps to create foreign currency liabilities and cash outflows that match assets and cash inflows in those currencies. Therefore, it follows that direct foreign currency debt and cross currency swaps are potentially competing strategies for reducing currency exposure arising

from foreign assets. In other instances the use of foreign currency debt might increase foreign currency exposure and a cross currency swap can be used to hedge the risk and therefore achieve the desired foreign currency debt mix.

Table 3 shows that qualitative disclosures in 15 cases indicated that the use of foreign debt might have increased firms foreign currency exposure. In all of these cases firms always resorted to foreign currency swaps to mitigate the exposure.⁵ For example, British Aerospace Plc writes, *“The Group has entered into currency swaps to manage the foreign currency exposure associated with borrowings denominated in foreign currency. Borrowings have been swapped on a fully hedged basis into sterling.”* (pg. 39)

Lloyds Chemist writes, *“the Group raised a further \$30 million from the private placement of a fixed rate loan note repayable in 1998, eliminating the foreign exchange exposure by the use of a forward foreign currency swap.”* (pg. 23)⁶

Thirty five firms reported the use of combinations of foreign currency debt and foreign currency swaps to hedge exposure arising from the existence of overseas assets.⁷ For example,

Adwest writes, *“The Group hedges the effect of exchange rate movements on the translation of foreign currency net assets by using foreign currency borrowings and foreign currency swap contracts.”* (pg. 22)

⁵ Hakkarainen et al. (1997) find that 88 percent of Finnish firms with foreign debt hedge the exposure arising from the debt. Phillips (1995) found that 20.7 percent of US firms issued foreign debt and swapped any part of the proceeds into US dollars also 46.9 percent of derivative users believed that derivatives were significant in increasing the flexibility of funding choice.

⁶ Other examples are: Asda writes, *“The group has entered into foreign currency swaps which have the effect of converting US dollar borrowings to sterling denominated interest.”* (pg. 26) HP Bulmer writes, *“The Group issued \$45m fixed coupon senior notes... The Group entered into foreign currency and interest rate swaps which removes all US dollar exposure, resulting in a sterling obligation.”* (pg. 15) Daily Mail writes, *“\$113m of the loan notes have been converted effectively into sterling liabilities using cross currency swaps and forward contracts.”* (pg. 23) Eurotunnel writes, *“Borrowings of US\$254m were converted to sterling for value 1 March 1996 leaving residual borrowings in US dollars of \$316m.”* (pg. 67) McKechnie writes, *“The US\$15m loan note has been swapped into sterling and fixed at £10.1m.”* (pg. 28)

⁷ The use of foreign debt by these firms might also have increased foreign currency exposure.

Carlton Communications writes, *“Dollar denominated net assets were partially hedged by US dollar borrowings and net cross currency swaps.”* (pg. 32)

Compass Group writes, *“The sterling value of overseas assets is protected by borrowing in matching foreign currency and utilising cross currency swaps.”* (pg. 39)

Meyer International writes, *“The Group seeks to protect the value of its overseas investments from swings in the value of sterling by borrowing in foreign currency and through foreign currency swaps.”* (pg. 16)

Tate and Lyle writes, *“Net assets are held in a number of foreign currencies which give rise to balance sheet currency translation exposure. This exposure is managed by selecting the currencies in which the Group borrows and by foreign currency swaps, which change both the interest cost of debt and the translational exposure.”* (pg. 27)

In fourteen cases firms indicated that they used either foreign currency borrowings or foreign currency swaps in order to match foreign assets with foreign liabilities. These firms might have a preference for foreign currency swap over the use of foreign currency debt. Two examples of the types of disclosure are:

Smith and Nephew writes, *“The group protects shareholders funds by matching, where practicable, foreign currency assets, including acquisition goodwill, with currency liabilities. These currency liabilities take the form of either borrowings or currency swaps.”* (pg. 27)

BOC Group writes, *“Usually foreign currency investments are hedged by borrowings in the same currency, either by means of direct borrowings or the use of foreign currency swaps.”* (pg. 37)

Finally in 10 instances firms relied solely on currency swaps to hedge the exposure from a foreign investment. Two examples of the type of disclosure are:

Tesco writes, “*We have hedged our investment in Catteau by swapping the appropriate level of borrowings into French francs and so eliminating exposure to currency movements.*” (pg. 26)

Thames Water writes, “*\$150m 6³/8% notes due 2004 of which \$40m has been swapped into floating rate Deutschmarks to protect against adverse exchange rate fluctuations.*” (pg. 45)

The analysis of qualitative disclosures in annual reports shows that in all instances currency swaps facilitated the currency matching of assets and liabilities. For firms swapping into foreign currency debt their disclosures indicated that they arrived at their desired foreign currency debt mix through the use of currency swaps or a combination of swaps and foreign debt. This suggests that foreign currency debt and currency swaps are substitute strategies for hedging the currency exposure arising from firms’ foreign investments.

[INSERT TABLE 3 ABOUT HERE]

Although the discussion above suggests that currency swaps and foreign debt are substitutes, table 3 identifies 3 groups of firms that swap into foreign debt, group 2 use both swaps and foreign debt, group 3 use swaps or foreign debt and group 4 use only swaps. It would seem that firms in group 4 have a clear preference for currency swaps over foreign debt. Given this the study assumes that firms in group 3 have a higher preference for currency swaps over foreign debt relative to firms in group 2 and that firms in group 4 have a higher preference for currency swaps over foreign debt relative to firms in group 3 (i.e., as we go from group 2 to 4 we assume firms have an increasing preference for currency swaps). (The former group might have a

preference for currency swaps whereas the latter group seem to have a clear preference for currency swaps over foreign debt). This would seem to suggest that there might be circumstances where a currency swap is preferred to foreign debt. If some firms have a preference for currency swaps over foreign debt the pertinent question is why? There are two potential reasons for this observed preference. Firstly, a borrowing hedge may be unnecessary from a cash viewpoint for a cash rich company. The use of foreign debt in this situation would leave unchanged the firm's high cash status.⁸ Secondly, the gearing consequences may be unacceptable. The use of foreign debt for hedging gives rise to the possibility of increased gearing if the foreign currency strengthens against sterling. The risk of higher gearing might be a constraint for a firm whose loan agreements contain a covenant stipulating the maximum gearing permitted. A breach of a covenant in a loan agreement could lead to the loan being called in. It follows that the adverse consequences (disadvantages) of using a borrowing hedge for a highly geared firm are greater than that for a cash rich firm. Furthermore, the paper believes that these reasons for preferring currency swaps over foreign debt are mutually exclusive, since it is unlikely that a firm will use a currency swap instead of foreign debt because it has both high gearing and a large amount of cash. Therefore, the paper argues that firms that potentially have a preference for swaps over foreign debt might do so because they are cash rich and firms that have a definite (strong) preference for swaps do so because they are highly geared.

⁸ The alternative is to finance the foreign operation using the firm's cash and restructure the currency mix of the firm's existing debt using a currency swap.

5. The Determinants of Foreign Currency Hedging

This section presents empirical evidence on firms' use of foreign currency derivatives and foreign currency debt for hedging. If firms use foreign currency derivatives and foreign currency debt for hedging, then the firm level attributes defined in section 3 should be important in the firm's decision to use foreign currency derivatives and foreign currency debt.

In the multivariate analysis, the sample is organised on the basis of firms' hedging method choice. The analysis in this section employs three groups of firm. The first group includes all firms that do not hedge foreign currency exposure.⁹ The second group includes all firms that only use foreign currency derivatives for foreign currency hedging. The third group includes all firms that only use foreign currency debt for foreign currency hedging. The tests in this section combine the second and third groups resulting in one group of foreign currency hedging firms.

Table 4 presents the results of tests on the determinants of foreign currency hedging. The dependent variable is binary indicating whether or not the firm hedges foreign currency exposure. In addition to the parameter estimates and their p-values, the table presents the elasticities for assessing the relative importance of each variable in the models, the log-likelihood ratio statistic for testing the null hypothesis that all coefficients for the explanatory variables are equal to zero and the pseudo-R² measuring the overall fitness of each of the models. The table shows that proxies for financial distress, foreign currency sales by origin, foreign currency transactions, liquidity and the logarithm of total assets are important explanatory variables for foreign currency hedging. It appears from the table that the logarithm of total assets, which proxies for firm size, has on average the highest elasticity and as such it is the

⁹ As in Judge (2003) other hedging firms are excluded from the non-foreign currency hedging sample.

most important explanatory variable in the model. The second most important variable on average is foreign currency transactions, followed by proxies for financial distress, foreign sales ratio, and cash ratio.

The positive firm size effect may indicate that there is a significant fixed cost component to implementing a foreign currency hedging program, and small firms are less likely to achieve sufficient benefits to offset this cost. This finding is inconsistent with the notion that small firms face substantial informational asymmetry costs and therefore are more likely to hedge. As expected indicators of foreign currency exposure are important factors in determining whether a firm hedges.¹⁰ Unlike several previous studies I find a significant relationship between foreign currency hedging and several proxies for financial distress costs.¹¹ These findings are consistent with Mayers and Smith (1982), Smith and Stulz (1985), Mayers and Smith (1987), Bessembinder (1989) and Froot et al. (1993) who argue that hedging facilitates a reduction in financial contracting costs.

Finally, the results show that financing constraints measured by firm liquidity provide incentives for hedging. This result is consistent with the Froot et al. prediction that hedging activity is beneficial because it secures the availability of internal funds. It also supports the Nance et al. prediction that the existence of

¹⁰ This finding is consistent with the results of Wysocki (1995), Géczy et al. (1997), Howton and Perfect (1998), Graham and Rogers (2000) and Allayannis and Ofek (2001).

¹¹ Géczy et al. (1997) use the long-term debt ratio, an industry adjusted debt ratio and S&P credit ratings and find no evidence in support of the financial distress cost hypothesis. Furthermore, they present mixed evidence for proxies measuring underinvestment costs, which can be used to measure expected distress costs (see Graham and Rogers (2002)). Graham and Rogers (2000) find using a probit model no significant relation between foreign currency hedging and measures for financial distress costs, such as debt ratio, debt ratio times market-to-book ratio, firm profitability, tax losses and credit ratings. Allayannis and Ofek (2001) use debt ratio, return on assets, Altman's zscore and liquidity in a probit model and find that the debt ratio is significantly negatively related to foreign currency hedging (opposite to that predicted by theory) and the other measures are not significantly related to foreign currency hedging. Howton and Perfect (1998) find using a tobit model that the interest coverage ratio is positively related, the debt ratio negatively related and cash holdings positively related to foreign currency hedging (all results opposite to theory). Wysocki (1995) does not include financial distress variables in his foreign currency hedging model. Mian's (1996) logit model does not include any debt based measures of financial distress.

negative debt (i.e., cash) reduces a firm's relative need to hedge because the agency costs of debt and the expected costs of financial distress are lower.¹²

[INSERT TABLE 4 ABOUT HERE]

6. Foreign Currency Derivatives and Foreign Currency Debt: Substitutes or Complements?

The dependent variable in the tests above includes firms that hedge with foreign currency derivatives or foreign currency debt. The findings show that both foreign currency exposure factors are relevant to the firm's foreign currency hedging decision. However, as noted previously, the type or source of foreign currency exposure might be important in determining the method of hedging employed to reduce the exposure. For example, long-term foreign debt might be more effective at hedging foreign currency exposure over long horizons, such as that due to operations in foreign locations, whereas foreign currency forwards, futures and options might be more effective at hedging short-term foreign exchange transaction exposure, such as that due to exporting or the receipt of foreign dividends, interest, profit or other income.¹³

Using the foreign currency exposure variables employed in the above analysis this section investigates whether foreign currency derivatives are complements or substitutes in hedging foreign currency risk. The tests employ a logit model that compares the use of foreign currency derivatives and foreign debt. The dependent variable is binary, equal to one if the firm uses only foreign currency derivatives, and

¹² Géczy et al. (1997) also report a negative association between a firm's decision to use foreign currency derivatives and short-term liquidity. However, the significant results (10% level) pertain to their restricted R&D sample only. Allayannis and Ofek (2001) find no evidence of a relationship between liquidity and the decision to use foreign currency derivatives. Mian (1996) and Graham and Rogers (2000) use measures of liquidity, the current ratio and quick ratio respectively, in univariate tests only.

zero if the firm uses only foreign debt for foreign currency hedging. The combinations of foreign currency derivatives used by the firms in the sample are shown in Table 5. This table shows that the foreign currency derivative using sample is made up of 52 firms that use forwards, 25 firms that use currency swaps and 6 firms that use currency options. Given that firms can match foreign currency assets by creating foreign currency liabilities either via a currency swap or by issuing foreign debt directly it follows that the inclusion of currency swap users in the foreign currency derivative sample might bias the results. Therefore, Table 6 reports the results of a test of choice of foreign currency hedging instrument excluding (model 1) and including (model 2) foreign currency swaps. In model 1 the foreign sales by origin variable is significantly negative. This suggests that firms prefer to use foreign currency debt rather than foreign currency forwards or options to hedge foreign currency exposure arising from assets located in foreign locations. This result is consistent with the notion that firms with foreign currency exposure arising from foreign operations might organise their balance sheets such that foreign assets are matched by foreign debt. Therefore, a change in exchange rates resulting in a change in the sterling value of foreign assets is matched by a corresponding change in the value of the outstanding level of debt. The results for model 1 also show that the exporting dummy is significantly positive, which shows that firms engaged in exporting prefer the use of foreign currency forwards and or options over the use of foreign currency debt. This is consistent with the argument that since foreign currency cash flows arising from exports are likely to be uncertain with respect to their timing and size, they might be more effectively hedged using foreign currency derivatives such as forwards or options.

¹³ Short-term debt might compete effectively with forwards, futures and options for hedging short-term cash inflow exposure.

Overall, these results provide strong evidence to suggest that foreign currency derivatives, like forwards and options, and foreign currency debt are complementary rather than competing strategies for managing foreign currency exposure. Consistent with expectations, liquidity and firm size are not important factors in the firms' decision to use foreign currency derivatives over foreign currency debt for foreign currency hedging. However, contrary to expectations gearing, which proxies for the expected costs of financial distress, is statistically significant.¹⁴ The negative coefficient suggests that as gearing increases firms are more likely to hedge with foreign currency debt. However, the causality might run the other way. This is because the use of foreign currency borrowings to hedge net worth exposure gives rise to risks of increased gearing if the foreign currency strengthens against sterling.¹⁵ During the period investigated in this study, sterling's trade weighted exchange rate had depreciated relative to its trading partners' currencies. It follows that, this currency depreciation alone may have caused the base currency value of debt, and therefore the gearing ratio, to increase even when no additional borrowing had taken place.¹⁶ However, a foreign currency borrowing hedge could result in additional borrowing net of any exchange rate effects. Allayannis, Brown and Lapper (2002) report evidence in support of this in their study of foreign debt use by East Asian firms. They find that firms using foreign currency debt have a debt-to-value ratio 10 percent higher than firms not using foreign currency debt. Another plausible explanation for this result is that most (i.e., 80%) of the currency swap users dropped from the sample in model 1 are also interest rate hedgers. Their exclusion creates a

¹⁴ In unreported results industry adjusted gearing and net gearing were also significantly negative, however, other proxies for financial distress, such as interest cover, credit rating and tax losses carry forward dummy were not statistically significant.

¹⁵ There is also the possibility of lower gearing if sterling strengthens.

disparity between the number of interest rate hedgers in the foreign currency derivative and foreign debt using samples (i.e., there are now more interest rate hedgers in the latter), which might increase the significance of factors that are relevant to interest rate hedgers such as gearing.

The result for the foreign sales by origin variable in model 2, which includes currency swap users, shows that the absolute size of the coefficient falls by about a third and the elasticity by around two-thirds, however, both are significant at the 1 percent level. Clearly the inclusion of foreign currency swap users in the derivative sample has some effect on the results, but the bias is insufficient to remove the significant relationship. This result is somewhat surprising given that currency swap users make up over 40 percent of the foreign currency derivative sample and currency swaps might be used to substitute for foreign debt. However, an examination of the type of currency swap used by these firms reveals that 60 percent of these currency swap users swap foreign debt into domestic debt and therefore for the majority of swap users currency swaps complement rather than substitute for foreign debt.¹⁷ Gearing is no longer a significant factor since the inclusion of swap users in the foreign currency derivative sample makes the distribution of interest rate hedgers between derivative users and foreign debt users more even, which neutralises the effect of variables such as gearing.

As a robustness check models 1 and 2 in Table 6 are refitted after firms that hedge interest rate exposure are excluded from the sample leaving a sample of foreign currency only hedgers. Models 3 and 4 show that the qualitative result pertaining to

¹⁶ Allayannis et al. (2001) find in univariate tests that foreign debt issuers have higher levels of overall debt. However, in multivariate tests they find that local debt levels are negatively related to the decision to use foreign debt, which suggests that foreign debt substitutes for local debt.

¹⁷ In unreported analysis we investigate the inclusion of the two types of swap users in the derivative using sample. When firms swapping into foreign debt are included the elasticity for the foreign sales variable is -0.557 and when firms swapping into domestic debt are included the elasticity increases to -

the foreign sales variable is unchanged, although the export transaction variable is no longer significant in model 3. Overall, these results reaffirm the finding that the use of foreign debt for hedging complements the use of foreign currency derivatives for hedging. Gearing is not statistically significant, which suggests that the result in model 1 is driven by the inclusion of interest rate hedgers.¹⁸

[INSERT TABLE 5 ABOUT HERE]

[INSERT TABLE 6 ABOUT HERE]

7. Currency Swap Users and Foreign Currency Debt Hedgers

The analysis in section 4.3 examined qualitative disclosures surrounding the use of currency swaps. Statements made by firms in their annual reports seemed to suggest that for many currency swap users currency swaps substituted for the use of foreign debt. This section explores this further using logit regression techniques.

The tests in this section employ a sample that contains 74 firms that use currency swaps for currency exposure hedging and 57 firms that use only foreign currency debt for currency exposure hedging. A logit model is used to test a model of choice that compares the use of foreign currency swaps and foreign debt. The dependent variable is binary equal to one if the firm uses foreign currency swaps, and zero if the firm only uses foreign debt.

Model 1 in Table 7 shows that the variable proxying for foreign assets, the foreign sales by origin ratio, is not statistically significant. This indicates that firms with exposure from foreign assets have no preference as to how this exposure is hedged. Therefore, using currency swaps in isolation or in addition to foreign

0.778. This shows that the inclusion of firms swapping into foreign debt adversely affects the relative importance of the foreign sales variable.

¹⁸ Around three quarters of interest rate hedgers are in the foreign currency debt sample. Similar changes were observed for industry adjusted gearing and net gearing.

currency debt is considered to be an alternative to using only foreign currency debt. This result is consistent with the argument that firms use either foreign debt or currency swaps or some combination of the two to hedge foreign currency exposure arising from foreign assets. Thus, these results suggest they are substitute or competing foreign currency hedging techniques for hedging foreign currency assets exposure. This is consistent with the finding above based on qualitative disclosures in annual reports.

The results also show that larger firms are more likely to use currency swaps for hedging instead of or in addition to the use of foreign debt for hedging. Larger firms might have foreign operations in many countries and therefore rather than issuing direct foreign debt in each currency they might instead raise the bulk of their financing requirements in one or two major currencies and then swap into the desired currency to achieve the appropriate foreign currency debt mix. Smaller firms with possibly fewer foreign subsidiaries might issue debt directly in the appropriate currency negating the need for a currency swap.

Finally, the foreign currency transaction variable is significantly related to the use of currency swaps. In addition to export activity this variable also picks up foreign currency exposure arising from the receipt of foreign income from other sources, such as payment of royalties, dividends, interest on loans and the repatriation of profits by foreign subsidiaries. This type of exposure might be better hedged with a currency swap given its flexible nature than by issuing foreign debt directly. However, this result might be due to the fact that some of the currency swap users are also users of currency forwards and options. Of the 74 firms that use currency swaps 16 firms use foreign currency forwards and options and 38 firms use forwards, leaving 20 firms that only use currency swaps. In unreported analysis firms that use

other foreign currency derivatives are excluded from the currency swap user sample leaving a sample composed of firms that only use currency swaps. The results show that coefficient to the foreign currency transactions variable is no longer significant and the marginal effect is significant at the 10 percent rather than the 1 percent level and its absolute size is half the corresponding value in model 1. This suggests that the previous result is mainly driven by the inclusion of firms using other foreign currency derivatives.

[INSERT TABLE 7 ABOUT HERE]

7.1 Controlling for the Type of Currency Swap

The preceding analysis suggests that currency swaps substitute for foreign debt in foreign currency hedging activities. However, this analysis does not take into account the type of currency swap entered into. If firms use currency swaps to translate domestic debt into foreign debt or foreign debt of one currency into foreign debt of another currency for asset liability matching then issuing foreign debt in the currency of a firm's assets is a substitute strategy. On the other hand, if firms use currency swaps to convert foreign debt into domestic debt in order to currency match domestic assets with domestic liabilities then issuing foreign debt without the concomitant currency swap would not be a substitute strategy. It follows that foreign currency debt does not necessarily substitute for the use of foreign currency swaps in reducing foreign currency exposure.

In the sample of 74 currency swap users 59 firms swap domestic and/or foreign debt into foreign debt and 15 firms swap foreign debt into domestic debt. Of the 59 firms that swap into foreign debt 49 firms also issue foreign debt for asset

liability matching¹⁹ and 10 firms use only currency swaps for this purpose. In this section the assertion that issuing foreign debt directly is not necessarily a substitute hedging strategy for a currency swap is investigated by comparing each type of currency swap user against firms that only use foreign currency debt. Comparisons between currency swap users are also conducted. Models 2, 3, 4 and 5 in Table 7 compare firms that swap into foreign debt with firms that only use foreign debt. Model 2 includes all firms that swap into foreign debt and model 3 compares firms that use both swaps and foreign debt with firms that use foreign debt only. As noted previously the sample of firms that are classified as using both foreign currency swaps and foreign debt to create foreign liabilities is made up of two groups: firms that use both swaps and foreign debt and firms that potentially use both. Models 4 and 5 conduct comparisons between each of these groups and foreign debt users. In models 2 through to 5 both the log of odds and the marginal effect for the foreign sales by origin variable are insignificant, which suggests that firms with foreign assets have no preference as to how foreign currency liabilities are created. Therefore, swapping into foreign debt or issuing foreign debt directly are seen as equally viable strategies for currency matching assets and liabilities. Model 6 conducts a comparison between firms that use currency swaps or foreign debt and firms that say they use both swaps and foreign debt. The former group is assumed to have a greater preference for swaps over foreign debt relative to the latter group. The results show that both the coefficient and the marginal effect for the cash ratio are positive and significant at the 10 percent level. This result is consistent with the notion that firms with higher levels of liquidity (i.e., cash holdings) have a preference for currency swaps over a foreign currency borrowing hedge because the latter is unnecessary given its cash holdings.

¹⁹ As noted previously, 14 of these firms are classified as currency swap and foreign debt users on the basis of disclosures that say they use foreign currency borrowings or currency swaps for hedging

The models in Table 8 show the results of tests comparing firms that swap into domestic debt, that is, sterling, and firms that use foreign debt and firms that use currency swaps to create foreign currency liabilities. Model 1 compares firms that swap into domestic debt with firms that only use foreign debt. Both the coefficient and the marginal effect for the foreign sales by origin variable are significant and negative which indicates that as the level of foreign assets increases (decreases) firms are less (more) likely to swap foreign debt into domestic debt. This result shows that swapping foreign debt into domestic debt is not a substitute strategy for issuing foreign debt directly. Allayannis et al. (2002) find a similar result in a one-step tobit regression where the dependent variable is the ratio synthetic local currency debt to firm value. They find that foreign earnings are negatively related to synthetic local currency debt use, which suggests firms with lower levels of foreign operations use more synthetic local currency debt.²⁰ However, their results do indicate that synthetic local debt and natural local debt are substitutes.

The discussion above has noted that currency swaps can be used to swap domestic or foreign debt into foreign debt or foreign debt into domestic debt. In models 2, 3, 4 and 5 a logit model is used to compare these two uses of currency swaps. In model 2 the dependent variable is binary equal to one if the firm only uses currency swaps to swap foreign debt into domestic debt, and zero if the firm only uses currency swaps to swap debt into foreign debt. Model 3 excludes from the sample of firms swapping into foreign debt firms that use currency swaps but do not use direct foreign debt and models 4 and 5 compare firms swapping into domestic debt with firms that use both swaps and foreign debt in order to create foreign liabilities and

foreign assets.

²⁰ Allayannis et al. (2002) also examine the determinants of all local currency debt as a percent of total debt (i.e., mix of debt). As with their previous result they find a negative coefficient on foreign earnings.

firms that potentially use both, respectively. In all but two instances the coefficients and the marginal effects for the foreign sales by origin variable are negative and significant at the 5 percent level or better. This shows that firms with higher levels of sales originating from foreign subsidiaries are less likely to use currency swaps to swap foreign debt into domestic debt. These results clearly demonstrate that swapping foreign debt into domestic debt is not a substitute strategy for swapping into foreign debt. Furthermore, the results would seem to indicate that firms are using currency swaps to currency match their assets and liabilities, be it foreign assets with foreign liabilities or domestic assets with domestic liabilities. The implication of this is that currency swaps are being used for hedging and not speculation. The results for models 2, 3 and 4 also show that swapping into domestic debt is significantly negatively related to firm size. This is consistent with the notion that larger firms are more likely to have foreign operations requiring foreign currency denominated financing.

In Table 9 the models compare firms that only use currency swaps to create foreign liabilities and firms that use both currency swaps and foreign debt and firms that only use foreign debt for this purpose. The results for model 1 show that using swaps only or foreign debt only are competing strategies for creating foreign liabilities, although larger firms are more likely to use swaps only than only foreign debt. This result might be because larger firms are more likely to face the size of exposure that makes a swap financing strategy more viable due to economies of scale in the transaction costs of using such instruments.

The results for model 2 show that as gearing increases firms are more likely to use only currency swaps to create foreign liabilities instead of both swaps and foreign debt. It would seem that these firms adjust the currency mix of their existing debt via

a currency swap rather than issuing new foreign debt. This might be because they have reached the limits of their debt capacity and therefore a foreign currency borrowing hedge could engender consequences that are unacceptable, such as a breach of a loan covenant. The significant negative coefficient and marginal effect on the firm size variable might be because of the newness of foreign operations of small firms. Smaller firms might have only recently ventured into foreign operations, and therefore the uncertainty associated with the success of these relatively new ventures might make a currency swap hedging strategy more attractive than issuing direct foreign debt, since the former can be unwound far more quickly and at lower cost than a direct debt issue. Model 3 compares firms that only have synthetic foreign debt with firms that use both swaps and foreign debt to create foreign liabilities. The results are qualitatively similar to those of model 2.

[INSERT TABLE 8 ABOUT HERE]

[INSERT TABLE 9 ABOUT HERE]

8. Conclusions

This paper employs a unique dataset to investigate whether foreign currency debt and foreign currency derivatives are complements or substitutes in the hedging of foreign currency risk. The paper identifies different types of foreign currency exposure in order to be able to distinguish between different foreign currency hedging strategies. This is achieved by examining if different sources of underlying exposure to exchange rate risk affect the choice among types of foreign currency hedging strategies. Unlike previous studies the paper shows that foreign currency debt does not necessarily substitute for foreign currency derivatives in hedging activities.

The evidence presented in this paper demonstrates that it is inappropriate to conduct comparisons of all categories of derivative user with foreign currency debt users. The paper shows that it is important to distinguish between derivative instruments that are appropriate for hedging short-term transaction exposures, such as forward, futures and options and those that are appropriate for hedging long-term multiple period foreign currency exposures, such as foreign currency swaps. In tests that exclude foreign currency swap users the results show that foreign currency derivatives complement the use of foreign currency debt for foreign currency hedging. The inclusion of swap users in the sample decreases the relative importance of the foreign operations variable, although it remains highly significant. This result is maintained despite the inclusion of swap users because the majority use swaps to swap foreign debt into domestic debt. It follows from this result that it is important to distinguish between currency swaps that swap foreign debt into domestic debt and those that swap into foreign debt. The paper conducts comparisons of each type of currency swap user against foreign currency debt users. The results show that the use of foreign debt only is not a substitute strategy for firms that use currency swaps to translate foreign debt into domestic debt whereas it is for firms that use swaps to convert domestic or foreign debt into foreign debt.

The results show that foreign debt is not the preferred hedging tool for highly geared firms, instead these firms use foreign currency swaps to create synthetic foreign currency liabilities. This might be because these firms have no unused debt capacity, which prohibits them from borrowing further funds. Smaller firms also prefer swaps to a combination of swaps and foreign debt. The foreign operations of small firms might be relatively new and therefore their future might be more uncertain. This would make a foreign currency swap hedge more attractive since it is

more flexible and less difficult to reverse than a natural foreign currency borrowing hedge.

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Table 1. Implied Effect of Foreign Currency (FX) Borrowings on Firm's Risk Profile

	No.	(%)
Reduce Currency Exposure (FX debt used for hedging)	219	83.9
Increase Currency Exposure (FX debt swapped into sterling)	15	5.7
Reduce and Increase Currency Exposure	4	1.5
Insufficient Disclosure to Determine Effect	23	8.8
Total	261	100

Table 2. Combination of Foreign Currency Hedging Methods Employed

Methods of Foreign Currency Hedging	No.	(%)
Foreign currency derivatives and debt	153	52.8
Foreign currency debt and other methods	14	4.8
Foreign currency derivatives only	62	21.4
Foreign currency debt only	57	19.7
No disclosure	4	1.4
Total	290	100.0

Table 3. Reasons for Using Foreign Currency Swaps

Reason for Currency Swap Usage	No.	%
1. Only hedge exposure arising from foreign currency debt (swap into sterling debt)	15	20.3
2. Hedge exposure arising from foreign assets with foreign borrowings and currency swaps (swap into foreign currency debt)	35	47.3
3. Hedge exposure arising from foreign assets with foreign borrowings or currency swaps (swap into foreign currency debt)	14	18.9
4. Hedge exposure arising from foreign assets with currency swaps only (swap into foreign currency debt)	10	13.5
Total	74	100

Table 4. Logistic Regression Results of the Likelihood of Foreign Currency Hedging

Table 4 shows logit regression estimates of the relation between the likelihood that a firm hedges foreign currency exposure and proxies for incentives to hedge. The sample of foreign currency hedgers is composed of two types of hedging firm, firstly, foreign currency hedgers that only use foreign currency derivatives and secondly, firms that only use foreign currency debt for foreign currency hedging. The cash ratio is dropped from models 4 and 7 because the level of cash holdings is a key component of net interest and net gearing. The data are presented as log of odds (Coeff.) and elasticities (Elast.). The elasticity measures the percentage change in the probability of hedging for a 1 percent change in the independent variable and effectively measures the importance of the variable in the model. More important variables have larger elasticity values. Unlike the logit coefficients, the elasticity is independent of measurement units for the variables. Elasticities are measured at the mean of the independent variables. P-values are in parentheses and are calculated using heteroskedasticity-robust standard errors. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Independent Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Average elasticity ranking
	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	Coeff.	Elast.	
Interest cover	-0.016**	-0.154**											
	(0.026)	(0.038)											
Credit rating			-0.033***	-0.916***									
			(0.001)	(0.001)									
Net interest receivable dummy					-1.367***	-0.178**							
					(0.007)	(0.013)							
Gross gearing							6.164***	0.397***					
							(0.001)	(0.001)					
Industry adjusted gearing									0.808**	0.281**			
									(0.022)	(0.023)			
Net gearing											3.020**	0.075*	3
											(0.049)	(0.064)	
Foreign currency sales by origin	0.018**	0.157**	0.022**	0.171**	0.023***	0.192***	0.019**	0.155**	0.019**	0.159**	0.023***	0.188***	4
	(0.025)	(0.024)	(0.019)	(0.015)	(0.008)	(0.006)	(0.038)	(0.041)	(0.037)	(0.039)	(0.009)	(0.009)	
Foreign currency transactions dummy	1.230***	0.280***	1.129***	0.236***	1.180***	0.270***	1.328***	0.293***	1.111***	0.250***	1.199***	0.267***	2
	(0.000)	(0.000)	(0.003)	(0.005)	(0.001)	(0.002)	(0.001)	(0.002)	(0.004)	(0.005)	(0.001)	(0.002)	
Cash ratio	-0.530*	-0.119*	-0.455*	-0.095*			-0.774**	-0.162**	-0.528	-0.113			5
	(0.066)	(0.076)	(0.067)	(0.075)			(0.023)	(0.030)	(0.130)	(0.147)			
Natural log of Total Assets	0.460***	1.024***	0.708***	1.457***	0.529***	1.171***	0.349**	0.746**	0.457***	0.995***	0.464***	1.001***	1
	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.027)	(0.034)	(0.004)	(0.006)	(0.003)	(0.003)	
No. of Observations	193		186		176		173		173		176		
No. of foreign currency hedgers	109		107		98		97		97		99		
No. of non-foreign currency hedgers	84		79		78		76		76		77		
-2 Log Likelihood Ratio (Chi-squared)	60.124		63.294		55.492		62.002		55.774		51.424		
Pseudo R²	0.2275		0.2496		0.2296		0.2613		0.2351		0.2132		

Table 5. Choice of Foreign Currency Derivative

	No.
Forwards only	30
Forwards and Swaps	16
Forwards, Swaps and Options	4
Forwards and Options	2
Swaps only	5
No mention	5
TOTAL	62

Table 6. Multivariate Logistic Regression Results of the Likelihood of Using Currency Derivatives

Table 6 shows logit regression estimates of the relation between the likelihood that a foreign currency hedging firm hedges using only foreign currency derivatives relative to foreign currency hedging firms that hedge using only foreign currency debt. Model 1 excludes foreign currency swap users from the sample. The sample in model 2 includes foreign currency swap users. Model 3 removes interest rate hedging firms from the sample in model 1. Model 4 removes interest rate hedging firms from the sample in model 2. The data are presented as coefficients (Coeff.) and marginal effects (ME) and elasticities (Elast.). The elasticity measures the percentage change in the probability of hedging with foreign currency derivatives only for a one percentage point change in the independent variable. The marginal effects and elasticities are calculated at the means of the independent variables. P-values are in parentheses and are calculated using heteroskedasticity-robust standard errors. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Independent variables	Model 1 Exclude fx swap users			Model 2 Include fx swap users			Model 3 Exclude fx swap users & IR hedgers			Model 4 Include fx swaps & exclude IR hedgers		
	Coeff.	ME	Elast.	Coeff.	ME	Elast.	Coeff.	ME	Elast.	Coeff.	ME	Elast.
Gross gearing	-9.787*** (0.007)	-1.746*** (0.003)	-1.366** (0.017)	-3.063 (0.125)	-0.761 (0.125)	-0.291 (0.133)	-10.721 (0.157)	-2.404* (0.098)	-1.076 (0.236)	-7.131 (0.133)	-1.773 (0.125)	-0.609 (0.193)
Foreign currency sales by origin	-5.963*** (0.003)	-1.064*** (0.002)	-1.207*** (0.008)	-3.896*** (0.000)	-0.968*** (0.000)	-0.470*** (0.001)	-6.194*** (0.008)	-1.389*** (0.009)	-1.106** (0.029)	-3.898*** (0.005)	-0.970*** (0.005)	-0.601** (0.015)
Foreign currency transactions dummy	2.246*** (0.009)	0.354*** (0.001)	1.072** (0.022)	2.318*** (0.002)	0.518*** (0.000)	0.703*** (0.001)	2.978 (0.114)	0.477*** (0.000)	1.445 (0.202)	2.938** (0.022)	0.552*** (0.000)	1.195* (0.070)
Cash ratio	0.658 (0.177)	0.117 (0.151)	0.198 (0.199)	0.227 (0.595)	0.056 (0.595)	0.043 (0.595)	1.002 (0.562)	0.225 (0.582)	0.224 (0.543)	0.754 (0.640)	0.187 (0.642)	0.139 (0.631)
Natural log of Total Assets	0.155 (0.642)	0.028 (0.636)	0.635 (0.646)	0.551** (0.027)	0.137** (0.027)	1.449** (0.030)	0.487 (0.413)	0.109 (0.367)	1.585 (0.460)	0.496 (0.223)	0.123 (0.217)	1.325 (0.273)
No. of observations	74			97			49			54		
No. of foreign currency derivative hedgers	28			51			22			27		
No. of foreign currency debt hedgers	46			46			27			27		
- Restricted Log Likelihood (Slopes=0)	49.082			67.106			33.709			37.430		
- Restricted Log Likelihood at Convergence	27.181			48.596			18.927			25.762		
-2 Log Likelihood Ratio (Chi-squared)	43.802			37.02			29.564			23.336		
Pseudo R²	0.4462			0.2758			0.4385			0.3117		

Table 7. Multivariate Logistic Regression Results of the Likelihood of Using Currency Swaps

Table 7 shows logit regression estimates of the relation between the likelihood that a firm hedges using currency swaps and proxies for incentives to hedge. In model 1 the sample of currency swap users comprises all firms that use currency swaps. Model 2 excludes from the currency swap user sample firms that swap into domestic debt. In Model 3 the currency swap user sample includes only those firms that use both currency swaps and direct foreign debt to create foreign currency liabilities. Model 4 excludes from the Model 3 currency swap user sample firms that potentially use both currency swaps and direct foreign debt to create foreign currency liabilities. Model 5 excludes from the Model 3 currency swap user sample firms that use both currency swaps and direct foreign debt to create foreign currency liabilities. Model 6 compares firms that use both currency swaps and direct foreign debt to create foreign currency liabilities and firms that potentially use both. The data are presented as coefficients and marginal effects (ME). The marginal effects are calculated at the means of the independent variables. P-values are in parentheses and are calculated using heteroskedasticity-robust standard errors. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Independent variables	Model 1: All fx swap users versus fx debt only users		Model 2: Swap into fx versus fx debt only users		Model 3: Swap into fx &/or fx debt versus fx debt only users		Model 4: Swap into fx & fx debt versus fx debt only users		Model 5: Swap into fx or fx debt versus fx debt only users		Model 6: Swap into fx or fx debt versus swap into fx&fx debt	
	Coeff.	ME	Coeff.	ME	Coeff.	ME	Coeff.	ME	Coeff.	ME	Coeff.	ME
Gross gearing	-0.806 (0.621)	-0.182 (0.616)	-1.096 (0.527)	-0.269 (0.524)	-3.821 (0.108)	-0.953 (0.112)	-3.430 (0.219)	-0.696 (0.234)	-0.662 (0.858)	-0.068 (0.859)	0.144 (0.964)	0.031 (0.964)
Foreign currency sales by origin	-0.376 (0.757)	-0.085 (0.758)	0.705 (0.642)	0.173 (0.641)	1.118 (0.515)	0.279 (0.516)	1.084 (0.556)	0.220 (0.563)	1.070 (0.595)	0.110 (0.580)	1.180 (0.468)	0.251 (0.466)
Export transactions dummy	2.628*** (0.000)	0.592*** (0.000)	2.190*** (0.004)	0.537*** (0.004)	2.199** (0.017)	0.548** (0.016)	2.411** (0.028)	0.489** (0.017)	2.351** (0.023)	0.243** (0.038)	-0.014 (0.991)	-0.003 (0.991)
Cash ratio	-0.206 (0.730)	-0.046 (0.731)	-0.532 (0.548)	-0.131 (0.550)	-0.457 (0.662)	-0.114 (0.662)	-2.173 (0.302)	-0.441 (0.268)	0.625 (0.398)	0.064 (0.386)	1.681* (0.091)	0.357* (0.098)
Natural log of Total Assets	1.078*** (0.000)	0.243*** (0.000)	1.081*** (0.000)	0.265*** (0.000)	1.169*** (0.000)	0.291*** (0.000)	1.197*** (0.000)	0.243*** (0.001)	0.976*** (0.007)	0.101** (0.039)	0.141 (0.662)	0.030 (0.660)
No. of Observations	114		100		90		76		60		44	
No. of foreign currency swap hedgers¹	68		54		44		30		14		14	
No. of foreign currency debt hedgers²	46		46		46		46		46		30	
- Restricted Log Likelihood (Slopes=0)	76.883		68.994		62.361		50.982		32.596		27.522	
- Restricted Log Likelihood at Convergence	47.917		42.663		35.010		28.636		18.694		25.313	
-2 Log Likelihood Ratio (Chi-squared)	57.932		52.662		54.702		44.692		27.804		4.418	
Pseudo R²	0.3768		0.3816		0.4371		0.4383		0.4265		0.0802	

¹For model 6 read as number of firms potentially using both currency swaps and direct foreign currency debt. ²For model 6 read as number of firms using both currency swaps and direct foreign currency debt.

Table 8. Multivariate Logistic Regression Results of the Likelihood of Using Currency Swaps for Swapping into Domestic Debt

Table 8 shows logit regression estimates of the relation between the likelihood that a firm uses currency swaps to swap into domestic debt and proxies for incentives to hedge. In model 1 currency swap users are compared against firms that only use foreign currency debt. In model 2 firms that swap into domestic debt are compared against firms that swap into foreign debt. In Model 3 the sample excludes firms that only use currency swaps to create foreign currency liabilities. Model 4 excludes from the sample in Model 3 firms that potentially use both currency swaps and direct foreign debt to create foreign currency liabilities. Model 5 excludes from the sample in Model 3 firms that use both currency swaps and direct foreign debt to create foreign currency liabilities. In model 6 firms that swap into domestic debt are compared against firms that create foreign currency liabilities by only using currency swaps (these firms do not use direct foreign debt). The data are presented as coefficients (Coeff.) and marginal effects (ME). The marginal effects are calculated at the means of the independent variables. P-values are in parentheses and are calculated using heteroskedasticity-robust standard errors. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

Independent variables	Model 1: Swap into domestic debt only versus fx debt only users		Model 2: Swap into domestic debt only versus swap into fx debt		Model 3: Swap into domestic debt only versus swap into fx &/or use fx debt		Model 4: Swap into domestic debt only versus swap into fx & use fx debt		Model 5: Swap into domestic debt only versus swap into fx or use fx debt		Model 6 Swap into domestic debt only versus swap into fx only	
	Coeff.	ME	Coeff.	ME	Coeff.	ME	Coeff.	ME	Coeff.	ME	Coeff.	ME
Gross gearing	0.832 (0.739)	0.081 (0.736)	2.536 (0.219)	0.106 (0.306)	1.689 (0.538)	0.086 (0.552)	1.441 (0.642)	0.134 (0.635)	-0.498 (0.885)	-0.116 (0.884)	-7.091* (0.068)	-0.130 (0.376)
Foreign currency sales by origin	-4.739*** (0.010)	-0.460*** (0.004)	-10.458*** (0.000)	-0.437* (0.076)	-10.239*** (0.000)	-0.520* (0.066)	-10.939*** (0.001)	-1.018** (0.019)	-10.596** (0.026)	-2.478** (0.018)	-19.590** (0.021)	-0.360 (0.356)
Export transactions dummy	3.402*** (0.000)	0.330** (0.017)	0.411 (0.672)	0.017 (0.696)	-0.677 (0.513)	-0.034 (0.499)	-1.459 (0.195)	-0.136 (0.109)	0.171 (0.914)	0.039 (0.915)	8.702** (0.014)	0.160 (0.350)
Cash ratio	0.425 (0.287)	0.041 (0.345)	2.158* (0.082)	0.090 (0.204)	2.026* (0.084)	0.103 (0.163)	3.634 (0.109)	0.338 (0.114)	0.574 (0.409)	0.134 (0.386)	14.566** (0.022)	0.268 (0.370)
Natural log of Total Assets	0.825** (0.016)	0.080** (0.018)	-0.630* (0.081)	-0.026 (0.267)	-0.728* (0.056)	-0.037 (0.230)	-0.899** (0.025)	-0.084* (0.091)	-0.849 (0.330)	-0.199 (0.311)	0.831 (0.252)	0.015 (0.387)
No. of Observations	60		67		58		44		28		24	
No. of firms swapping into domestic debt	14		14		14		14		14		14	
No. of firms using foreign currency debt (swapping into foreign debt)¹	46		53		44		30		14		10	
- Restricted Log Likelihood (Slopes=0)	32.596		34.342		32.055		27.522		19.408		15.395	
- Restricted Log Likelihood at Convergence	16.973		17.167		15.400		12.635		7.941		5.071	
-2 Log Likelihood Ratio (Chi-squared)	31.246		34.35		33.31		29.774		22.934		20.648	
Pseudo R²	0.4793		0.5001		0.5196		0.5409		0.5909		0.6706	

¹For models 2, 3, 4, 5, and 6 read as number of firms swapping into foreign debt.

Table 9. Multivariate Logistic Regression Results of the Likelihood of Using Currency Swaps for Swapping into Foreign Debt

Table 9 shows logit regression estimates of the relation between the likelihood that a firm uses currency swaps to swap into foreign debt and proxies for incentives to hedge. In model 1 firms that only use currency swaps to create foreign liabilities (debt) are compared against firms that only use direct foreign currency debt. In model 2 firms that only use currency swaps to create foreign liabilities (debt) are compared against firms that swap into foreign debt. Model 3 excludes from the sample in Model 2 firms that potentially use both currency swaps and direct foreign debt to create foreign currency liabilities. Model 4 excludes from the sample in Model 2 firms that use both currency swaps and direct foreign debt to create foreign currency liabilities. The data are presented as coefficients (Coeff.) and marginal effects (ME) and elasticities (Elast.). The elasticity measures the percentage change in the probability of swapping into foreign currency only for a one percentage point change in the independent variable. The marginal effects and elasticities are calculated at the means of the independent variables. P-values are in parentheses and are calculated using heteroskedasticity-robust standard errors. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Model 1: Swap into fx only versus fx debt only users			Model 2: Swap into fx only versus swap into fx &/or fx debt			Model 3: Swap into fx only versus swap into fx & fx debt			Model 4: Swap into fx only versus swap into fx or fx debt		
Independent variables	Coeff.	ME	Elast.	Coeff.	ME	Elast.	Coeff.	ME	Elast.	Coeff.	ME	Elast.
Gross gearing	4.547* (0.080)	0.433* (0.070)	1.048* (0.091)	11.041*** (0.000)	0.902** (0.013)	2.492*** (0.001)	11.918*** (0.001)	1.478*** (0.008)	2.556*** (0.003)	10.890** (0.028)	2.422* (0.055)	2.113** (0.026)
Foreign currency sales by origin	-0.323 (0.833)	-0.031 (0.833)	-0.109 (0.833)	-0.899 (0.712)	-0.073 (0.700)	-0.446 (0.714)	-1.081 (0.684)	-0.134 (0.656)	-0.485 (0.690)	0.162 (0.956)	-0.036 (0.956)	0.059 (0.956)
Export transactions dummy	1.801** (0.049)	0.171* (0.064)	0.833* (0.057)	-1.876 (0.064)	-0.153 (0.150)	-1.486* (0.066)	-2.305* (0.042)	-0.286 (0.099)	-1.675 (0.143)	-2.206 (0.272)	-0.491 (0.297)	-1.225 (0.263)
Cash ratio	-0.571 (0.598)	-0.054 (0.963)	-0.209 (0.598)	-1.350 (0.221)	-0.110 (0.302)	-0.496 (0.220)	-1.402 (0.403)	-0.174 (0.430)	-0.417 (0.404)	-2.425** (0.032)	-0.539* (0.059)	-0.763** (0.030)
Natural log of Total Assets	0.691* (0.057)	0.066* (0.097)	3.536* (0.061)	-0.918** (0.050)	-0.075* (0.054)	-5.970* (0.061)	-0.861 (0.109)	-0.107 (0.127)	-5.172 (0.125)	-1.047** (0.012)	-0.233** (0.021)	-4.975** (0.021)
No. of Observations	56			54			40			24		
No. of firms swapping into foreign debt	10			10			10			10		
No. of firms using foreign currency debt (swapping into foreign debt)¹	46			44			30			14		
- Restricted Log Likelihood (Slopes=0)	26.276			25.875			22.493			16.301		
- Restricted Log Likelihood at Convergence	20.012			16.963			14.343			9.681		
-2 Log Likelihood Ratio (Chi-squared)	12.528						9.182			13.24		
Pseudo R²	0.2384			0.3444			0.2179			0.4061		

¹For models 2, 3 and 4 read as number of firms swapping into foreign debt.