The Determinants of Foreign Currency Hedging: Does Foreign Currency Debt Induce a Bias?

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Abstract

The vast majority of foreign currency (FC) hedging studies report results for samples of firms using FC derivatives to hedge FC exposure. Some of these FC derivative users might be using foreign debt either for hedging, funding or speculation. Recent empirical studies have identified a strong link between FC debt use and debt measures such as leverage and interest cover. Given this relationship, this paper argues that the inclusion of firms using FC debt in samples of FC hedgers might bias the empirical results of hedging studies in favour of the financial distress hypothesis. The strong financial distress results observed in some studies could be mechanical since having foreign debt might imply higher leverage and lower interest coverage and not necessarily higher expected costs of financial distress. To the best of our knowledge this paper is the first to attempt to control for the possibility that FC debt might be driving results relating to financial distress. We do this by partitioning the sample of FC hedgers into firms that use and do not use foreign debt. We then examine whether variables frequently used to proxy for the costs of financial distress are an important factor in determining the decision to hedge for firms that only hedge FC exposure **and only** use FC derivatives for hedging. Our results show that leverage and interest cover are significantly related to the FC hedging decision for firms that use FC debt either in isolation or in combination with FC derivatives but not for firms that only use FC derivatives. This suggests that FC debt users are influencing these results. However, other financial distress cost variables with no obvious link to FC debt use are important in the decision to only hedge FC exposure using only FC derivatives.

Keywords: Corporate hedging, Foreign currency hedging, Derivatives, Financial distress, Foreign currency debt.

JEL Classification: F30; G32; G33.

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1. Introduction

Studies investigating the role of foreign currency (FC) debt in firm's corporate financing policy have recently come to the fore (Keloharju and Niskanen, 2001; Allayannis and Ofek, 2001; Kedia and Mozumdar, 2003; Allayannis *et al*., 2003). As well as demonstrating that FC debt plays a key role in the hedging and financing decisions of multinational corporations around the world, these studies also describe the financial and operating characteristics of FC debt users. In particular, some studies (Allayannis and Ofek, 2001; Allayannis *et al*., 2003) identify a strong relationship between the use of FC debt and capital structure. These findings have important implications for studies investigating the determinants of corporate hedging and in particular FC hedging. Several hedging papers report a positive relationship between hedging and debt variables (Berkman and Bradbury, 1996; Nguyen and Faff, 2002; Bartram *et al*., 2004). However, this could be simply because the hedging sample includes foreign debt users who have more liabilities to hedge and not because of financial distress. The underlying premise of this paper is that the inclusion of FC debt using firms in studies of the determinants of FC hedging engenders bias.

Several FC hedging studies define hedgers as firms that use FC derivative users and ignore firms adopting other FC hedging strategies.[1] This approach fails to distinguish between FC derivative use and FC risk management. For example, two firms may manage their FC exposure arising from foreign assets, one firm using a currency swap to create a liability in the required currency, and the other using foreign denominated debt to act as a natural hedge of foreign revenues.[2] Therefore, by

[1] For example, Graham and Rogers (2000) use an electronic keyword search and focus their investigation on the use of derivatives on the grounds that derivative holdings are disclosed in financial statements, while other strategies are more difficult to observe. See, also, Wysocki (1995), Géczy *et al*. (1997),

[2] Allayannis and Ofek (2001), Keloharju and Niskanen (2001) and Kedia and Mozumdar (2003) find strong evidence for the use of foreign debt as a hedge for foreign currency exposure.

equating "FC hedger" with "FC derivative user," the former would be characterised as a "hedger" and the latter a "non-hedger".[3] This approach would make it far more difficult to identify differences between FC hedgers and FC non-hedgers and therefore bias the results against the a priori expectations. Furthermore, if firms using FC debt for hedging are doing so for reasons similar to those using FC derivatives for hedging then we would expect the bias to affect all hypotheses equally. This might explain the mixed results in several previous FC hedging studies.

Recent empirical evidence draws a link between FC debt use and various measures of firm indebtedness. For example, in Allayannis *et al*. (2003) univariate statistics show that for East Asian firms FC debt users possess more than twice as much debt as non users. They also find that FC debt users possess lower levels of interest coverage than non-users and users have a higher percentage of long-term debt. For all countries, users have an interest coverage ratio of 5.48 versus 11.85 for non-users and 66.1% of debt is long-term for FC debt users, whereas only 42.7% is long-term for non-users. Similarly, for UK firms Judge (2005) shows that the leverage for foreign debt users is nearly two times that for non-users (38% versus 20%). Judge (2005) also finds that foreign debt users have lower interest coverage and more long-term debt than non-users. The coverage ratio is 10.7 for users and 29.1 for non-users, 63.9% of debt is long-term for FC debt users, whereas 52.3% is long-term for non-users. These differences are all significant at better than the 1 percent level. Furthermore, in multivariate tests Allayannis *et al*. (2003) find that firms with FC debt have a debt to value ratio 0.115 greater than firms without FC debt. Elliott *et al*. (2003) and Allayannis and Ofek (2001) also report multivariate evidence which shows that firms with higher levels of foreign debt have greater overall leverage. All

[3] Tufano (1996) makes a similar point when investigating risk management activities in the US gold mining industry.

this evidence points to a strong link between firms' use of FC debt and firms' debt levels, debt servicing and debt maturity.

We believe these findings have potentially important implications for empirical hedging studies. It was noted above that the narrow focus of previous FC hedging studies which define FC derivative users as FC hedgers and ignore other methods of FC hedging might bias the results against the *a priori* expectations. If these other FC hedgers include firms that use FC debt for hedging (but not FC derivatives) then an implication of recent evidence on the use of FC debt is that the inclusion of FC debt users in the non FC derivative using sample is likely to adversely affect the observed link between FC derivative hedging and debt related variables and therefore not necessarily affect all hedging hypotheses equally as suggested above. Since debt measures, such as leverage and interest coverage, are used as proxies for the expected costs of financial distress, the classification of FC debt hedgers as non-hedgers in previous studies might explain the relatively weak evidence in support of the distress cost hypothesis. In this vain Graham and Rogers (2002) suggest that in studies investigating the determinants of FC derivative use there could be negative relation between debt and derivatives use if foreign debt substitutes for currency hedging. However, this is only half the story. A countervailing force to the aforementioned bias is the existence of FC debt users in the sample of FC derivative hedging firms. FC derivative hedgers might be using FC debt as a complementary hedging tool or alternatively the FC debt might create an exposure, which is hedged using a FC derivative. It follows that if foreign debt users in the non-derivative using sample can bias the results against the distress costs hypothesis (as mentioned above) then it is conceivable that foreign debt users in the derivative using sample might drive the debt related results in previous studies (Berkman and Bradbury, 1996;

Nguyen and Faff, 2002; Bartram *et al*., 2004). There could be a positive relationship between FC hedging and debt variables simply because the hedging sample includes foreign debt users who have more liabilities to hedge and not because of financial distress. This then casts doubt over the efficacy of the results of previous hedging studies whose samples of FC hedgers include firms that use foreign debt. The degree of this bias depends to a large extent on the number of firms in the sample that use FC debt and the distribution of FC debt users amongst users and non-users of FC derivatives. If the majority of foreign debt users are in the hedging sample then this could lead to a positive relationship between FC hedging and various debt related variables. To the best of our knowledge, this paper is the first to identify the existence of a FC debt bias, which promotes a positive relationship between hedging and various debt variables and the first to control for it.

This study narrows the sample of FC hedgers to those that only hedge FC exposure. This avoids the possibility that interest rate hedging firms that also hedge FC exposure might drive the financial distress results. The key innovation in this paper is that it partitions the sample of FC only hedging firms into those that use and do not use foreign debt. By segregating FC hedging firms that use FC debt from firms that only use FC derivatives the paper is able to avoid the possibility that foreign debt users might be driving the financial distress (or debt) results.

The paper proceeds as follows. Section 2 presents an examination of the potential severity and direction of the bias due to the inclusion of FC debt users in samples employed to investigate the determinants of FC hedging. Section 3 describes theories of optimal hedging and develops our hypothesis. Section 4 describes our sample. Section 5 presents tests on the determinants of FC hedging and Section 6 concludes.

2. The Severity and Direction of Bias Caused by FC Debt Users

The degree of bias in any given sample depends on the proportion of FC debt users in that sample. The higher the proportion of FC debt users greater the potential for bias. The direction of this bias depends on the distribution of FC debt users between FC derivative users and non-FC derivative users. We begin by looking at how severe this bias might be.

Several studies have investigated the use of FC debt by non-financial firms (Hakkarainen *et al*., 1997; Allayannis and Ofek, 2001; Keloharju and Niskanen, 2001; Allayannis *et al*., 2003; Kedia and Mozumdar, 2003). In some instances FC hedging studies employ data on the use of FC debt as an exogenous variable (Geczy *et al*., 1997; Bartram *et al*., 2004). Other studies report that firms use FC debt for hedging (Edelshain, 1995; Berkman *et al*., 1997; Hakkarainen *et al.*, 1997; Hagelin, 2003). We can use data from these studies to develop a picture of the extent to which firms use FC debt. Table 1 provides details of the frequency of FC debt use reported in studies investigating the determinants of FC hedging and/or the determinants of FC debt use.

[INSERT TABLE 1 HERE]

Table 1 shows that in some instances there is data on FC debt usage for firms in a particular country from more than study, for example, Allyannis and Ofek (2001), Kedia and Mozumdar (2003) and Bartram *et al*. (2004) provide data on FC debt use by US firms. Excluding the Bartram *et al*. (2004) study there appears to be some degree of consistency across studies for the extent of foreign debt usage in the US and UK. Both Allyannis and Ofek (2001) and Kedia and Mozumdar (2003) find that 22 percent of US firms use foreign debt and for the UK foreign debt usage rates range

between 60 and 68 percent.[4] Bartram *et al*. (2004) have data on foreign debt usage for firms across many countries and regions of the world. For example, for the US they find that 66 percent of firms use foreign debt, for the UK the usage rate is 86 percent and for Asia its 90.7. Interestingly, these usage rates are higher than those reported in other studies, for example, Allayannis *et al*. (2003) find that 62 percent of East Asian firms use foreign debt. It might be that since Bartram *et al*. (2004) conduct an automated search of annual reports for information on foreign debt their data potentially overstates the proportion of foreign debt users. Notwithstanding this, an interesting pattern of FC debt usage rates can be observed from the Bartram *et al*. (2004) data and the other studies. This is that the level of FC debt usage is markedly higher outside the US. Bartram *et al*. (2004) report that 66 percent of US firms use foreign debt whereas in other countries such as the UK and the Asia Pacific region they find that over 85 percent of firms use foreign debt. A similar pattern, albeit at a lower level, can be observed from data reported in other studies. These show the proportion of firms using FC debt in the US is around 22 percent whereas in countries like the UK, Finland, New Zealand and the countries of East Asia over 65 percent of firms indicate using FC debt. This difference in the use of foreign debt between US firms and non-US firms is consistent with the fact that international trade is lower in the US than in many other countries suggesting that FC debt usage, which might be used to finance foreign trade activity, may also be relatively less important for US firms. For example, Bodnar *et al*. (2003) note that the Dutch Economy is much more

[4] The data from two studies for Finland is not directly comparable since foreign debt usage in Hakkarainen *et al*. (1997) refers to the number of Finnish firms using foreign debt whereas Keloharju and Niskanen (2001) report the number of domestic currency and foreign currency loans made by 44 Finnish firms during the period 1985 to 1991. During this period a total of 337 loans were made consisting of 152 Finnish markka denominated loans and 185 foreign currency loans (initial loan currency).

open to international influences than the US economy.[5] In view of these differences, Bodnar *et al*. suggest that a greater emphasis on currency exposure and foreign exchange hedging by Dutch firms is expected. Consistent with this, they find a higher proportion of Dutch hedgers hedge currency risk than US hedgers (96% versus 79%). Berkman *et al*. (1997) find that, in comparison with US firms, New Zealand firms hedge more financial risk across all size categories. They attribute this finding to a higher currency risk exposure in New Zealand. Since FC debt can be used for financing foreign operations and as a tool for FC hedging it is not unreasonable to expect that this pattern would also apply to the use of FC debt. In relation to the Finnish economy, Hakkarainen *et al*. (1997) write, '*The Finnish foreign exchange markets have been highly volatile, and the exchange rate regime has been altered several times in recent years. Most of the often heavily indebted firms are highly dependent on foreign trade and most firms carry foreign-exchange denominated debt*' (p. 25).

It follows then that like other financial policy practices, differences in FC debt use seem to be partitioned on the basis of openness of the economy. FC debt seems to be more prevalent in economies that are relatively more open and hence where firms have a greater level of international involvement. Therefore, it would seem then that if the bias due to FC debt usage were to exist its severity would be greatest in samples from countries or regions like the UK, Finland, New Zealand and East Asia rather than samples from the US. The results from previous hedging studies would seem to bear this out. For example, Berkman and Bradbury (1996) find that leverage and interest cover are significantly related to the hedging decision for New Zealand firms.

[5] They report that in 1998, Dutch exports were 50.4 percent of GDP, while imports were 46.7 percent of GDP. In comparison, US exports were only 9.2 percent of GDP while imports were only 12.8 percent of GDP.

Berkman *et al*. (1997) report that 70% of New Zealand firms use FC debt. Hagelin (2003) finds that foreign debt use for hedging purposes was more frequent amongst currency derivative users (67% of currency derivative users used foreign debt) than among non-users (32%). Hagelin examines the difference in the level of leverage between firms that use currency derivatives for hedging translation, committed transaction and anticipated transaction exposures and firms that do not. He finds that the level of leverage for currency derivative users is greater than that for non-users only in the case of translation exposure hedging. Hagelin offers no explanation for this. However, close inspection of the composition of the samples of firms that use currency derivatives for hedging FC exposure reveals that 84% of the firms that hedged translation exposure with currency derivatives also used FC debt. The equivalent numbers for the two samples of committed transaction and anticipated transaction exposure hedgers was 67% and 71%, respectively. Therefore, this would seem to suggest that the leverage results for Hagelin's translation exposure hedging sample are potentially driven by the fact that a large proportion (84%) of these hedgers also use FC debt. Pramborg (2004) finds that the use of FC derivatives for hedging is negatively related to leverage. In this sample non-users of FC derivatives include firms that use FC debt and firms that use interest rate derivatives. However, when Pramborg investigates the use of FC debt for hedging the leverage coefficient is positive. It would seem that both sets of leverage results are being driven by FC debt users.

In contrast, very few US FC hedging studies report a strong relationship between FC hedging and various debt related variables. We believe there are two forces at work here. Firstly, several US studies have other hedging firms in their non-FC hedging samples (Géczy *et al*., 1997; Goldberg *et al*., 1998; Graham and Rogers,

2000; Allayannis and Ofek, 2001). These other hedgers are firms that only hedge interest rate or commodity price exposure or both (but not FC exposure). In some instances these other hedgers, mainly interest rate hedgers, have made up around a quarter of the non-FC hedging firm sample in several US FC hedging studies (Géczy *et al*., 1997; Goldberg *et al*., 1998; Graham and Rogers, 2000). The inclusion of these firms alone would be sufficient to bias the results against various debt variables. The inclusion of firms that use FC debt for hedging but not FC derivatives for hedging in the non FC derivative hedging sample would exacerbate the problem. Conversely, firms that use both FC debt and derivatives will help promote a positive relationship between FC hedging and various debt level indicators. Given the relatively low numbers of US firms using FC debt the negative and positive bias due to FC debt is likely to be small. We might then expect that the overall result is a net negative bias arising from the inclusion of interest rate only hedgers in the non-FC derivative hedging sample. The extant FC hedging evidence using US firms is consistent with this (Géczy *et al*., 1997; Goldberg *et al*., 1998; Graham and Rogers, 2000; Allayannis and Ofek, 2001).

Having established that a large proportion of firms use FC debt in several countries and regions of the world we now need to determine the potential direction the bias caused by FC debt might take. This will depend on whether FC debt users are in the non-FC derivative using sample or in the FC derivative using sample. If the majority of FC debt users are in the non-FC derivative using sample then we would expect a negative bias. However, if the majority are in the FC derivative using sample then a positive bias might prevail. FC debt users might be in the non-FC derivative using sample if FC debt substitutes for derivative hedging or if FC debt is

used for speculative purposes.[6] Conversely, FC debt users might be in the FC derivative using sample if FC debt complements derivative hedging, if firms use derivatives to hedge exposure arising from the use of FC debt or if firms use FC debt as part of an arbitrage strategy. For example, there might exist a window of opportunity to lower funding costs via arbitrage, that is, raise FC debt and then swap into a desired currency realising a lower cost of capital than that possible if the desired debt is raised directly. Table 2 summarises the link between the motivation for using FC debt and the composition of the FC derivative using and non-using samples.

[INSERT TABLE 2 HERE]

Several studies have demonstrated that FC debt is used for hedging purposes. Some of these investigate whether FC debt is a substitute or complement to FC derivatives hedging. Bartram *et al*. (2004) find a positive relationship between FC derivatives use and FC debt use, which is consistent with foreign debt either acting as a complement to derivatives or creating a FC exposure on average. Géczy *et al*. (1997) and Allayannis and Ofek (2001) find evidence, which suggests that FC debt and FC derivatives act as substitutes for hedging foreign operations. Elliott *et al*. (2003) find that the level of foreign debt is negatively related to the level of FC derivatives used, which they argue provides evidence that foreign debt substitutes for the use of FC derivatives. However, foreign debt does not necessarily substitute for all FC derivative activity. Allayannis and Ofek (2001) show that exporters prefer the use of FC derivatives to the use of FC debt. In tests investigating whether FC

[6] Interest rate differentials (i.e., local rates minus foreign rates) might provide an incentive to use FC debt with the expectation of lowering funding costs. In these circumstances any exposure due to FC debt is not hedged using a derivative contract. The FC debt user hopes to gain from an expected disequilibrium in the international financial markets, that is, deviation from the International Fisher Effect. Using derivatives to hedge the exposure to exchange rate risk might eliminate the cost advantage of foreign debt. The incentive to hedge the exposure diminishes as the interest rate differential increases (i.e., local rates minus foreign rates). An arbitrage opportunity might prevail if the hedged cost of the synthetic local debt is less than the cost of natural local debt.

derivatives and debt are substitutes or complements it is necessary to distinguish between derivative instruments that are appropriate for hedging short-term transaction exposures, such as forward, futures and options and those derivatives that are appropriate for hedging long-term multiple period FC exposures, such as FC swaps. In tests that exclude FC swap users Judge (2004) shows that FC derivatives complement the use of FC debt for FC hedging. Employing a sample made up of FC swap users Judge (2004) finds that FC debt is a substitute strategy for firms that use FC swaps to convert domestic debt into foreign debt. This demonstrates that FC debt is both a substitute and complement to FC derivatives hedging and therefore firms' FC hedging strategies will include both FC debt and derivatives.

In addition to being used for hedging, some studies have documented that using FC debt creates a currency exposure. For example, Allayannis *et al*. (2003) report that the vast majority of the foreign debt assumed by EA firms was exposed to currency risk and to a potential depreciation of the local currencies against these currencies. Geczy *et al*. and Bartram *et al*. find that derivatives use is positively related to FC debt usage, which they suggest is consistent with FC debt generating an exposure. Keloharju and Niskanen (2001) find that speculative reasons play an important role in determining the currency of debt for Finnish firms. However, surveys of financial officers find relatively weak evidence that firms use foreign debt because foreign interest rates are lower than domestic interest rates (Graham and Harvey, 2001; Bancel and Mitto, 2002).

The extant empirical evidence indicates that in those situations where FC debt creates a currency exposure firms more often that not hedge the exposure. Hakkarainen *et al*. (1997) note that 88% of Finnish firms with FC debt hedge the resulting exposure. Allayannis *et al*. (2003) also report that East Asian firms hedge

the currency exposure due to FC debt. However, they find evidence that firms engage in selective hedging of their foreign debt exposure. Their results show that firms hedge only a fraction of their FC debt with derivatives (usually FC swaps) and hedge less (i.e., use more foreign debt) if the interest rate differential between the local rate and LIBOR is high. Thus, the extent to which firms hedge the resulting exposure is negatively related to the difference between local and foreign interest rates.

In summary the extant empirical evidence suggests that FC debt can act as both a substitute and complement to FC derivatives for hedging. The prevailing evidence also indicates that some firms use FC debt for speculative purposes, however, FC derivatives are then used to hedge some proportion of the exposure arising from the use of FC debt. Overall, the evidence suggests that firms using foreign debt will also be using FC derivatives. Therefore, in the context of this study FC debt users in hedging studies are more likely to promote a positive relationship between FC hedging (or FC derivatives use) and various measures of firm indebtedness. If this is the case, then this calls into question the debt related results of several previous studies.

3. Empirical Implications of Theories of Corporate Hedging

The foundation of our understanding of corporate financial policy is the Modigliani and Miller (1958) proposition. They demonstrated that given the firm's investment policy, with no taxes and no contracting costs, the firm's choice of financial policy does not affect the current market value of the firm. Smith and Stulz (1985) develop a positive theory of hedging by value maximising firms in which hedging is part of overall corporate financing policy. They suggest that an equivalent statement of the Modigliani and Miller proposition is that if hedging is to

affect firm value, then it must do so through changes in tax liabilities, through changes in stakeholder contracting costs, or through interdependencies between the choice of financial policy and future real investment decisions. This implies that hedging can increase firm value by simultaneously reducing external claims to the cash flow stream flowing from the firm's assets. Such claims include taxes paid to government by the firm; bankruptcy costs (both direct and indirect) paid to accountants, lawyers and the firm's non-investor stakeholders; and/or agency costs to align managerial interests with the interests of capital suppliers. Each has the potential to provide an explanation for the corporate demand for hedging.

3.1 Corporate Tax Structure

Smith and Stulz (1985) and Graham and Smith (1999) show that in the presence of a convex corporate tax function the firm's expected tax liability can be reduced by hedging. The more convex the tax schedule the greater the incentive to hedge. The factors that cause convexity in the effective tax function are progressivity in the statutory tax code and tax preference items such as tax loss carry-forwards, investment tax credits and foreign tax credits.

The range of progressivity in the UK corporate tax structure is relatively small since tax rates are progressive between profit levels of £0 and £1.5m and constant beyond £1.5m. The majority of listed firms have pre-tax profits beyond the progressive region which suggests they face a linear effective tax function.[7] This implies that for UK firms this tax based motive for hedging is potentially rather weak. Therefore, this aspect of a firm's tax function is not measured. Many UK firms do, however, report the existence of tax loss carry forwards in the notes to their accounts.

[7] Mian (1996), Wysocki (1996), Gay and Nam (1998) and Brown (2001) make a similar point for US firms.

Following several previous studies this study employs a dummy variable equal to 1 if the firm has tax loss carry forwards.[8] This data is obtained from a search of notes to the accounts contained in annual reports.

3.2 Costs of Financial Distress

Firms with greater variability of cash flows are more likely to find themselves in financial distress, ceteris paribus. Smith and Stulz (1985) argue that the transaction costs of financial distress can induce firms to hedge financial price risks since the probability of incurring the costs is reduced. The savings in expected costs will vary directly with the probability of financial distress if the firm does not hedge and with the cost of financial distress. Most studies use the leverage ratio as an indicator of the likelihood of financial distress to measure expected costs of distress. This study adopts a similar approach and uses three additional measures as proxies for a firm's probability of financial distress. These are the interest coverage ratio, qui score and a dummy variable indicating whether a firm has net interest payable or receivable. The higher the firm's leverage, the lower its interest cover ratio, the lower its qui score[9] and if it is paying net interest, the greater the probability of financial distress. A higher probability of financial distress implies higher expected costs of financial distress, assuming that exogenous bankruptcy costs are constant across firms. However, this assumption fails to consider the possibility that exogenous bankruptcy costs might affect the firm's capital structure choice (Géczy *et al*. (1997)). This study attempts to control for this by assuming firms within specific industries have a common exposure to financial distress and therefore uses an industry-adjusted

[8] Graham and Rogers (2002) suggest that tax loss variables are inappropriate for capturing "incentives that result from the shape of the tax function" (p. 818). Furthermore, this variable may proxy for firms that have recently suffered from or are currently experiencing financial distress.
[9] A qui-score is a measure of the likelihood of firm failure and is similar to a z-score.

leverage ratio. Firms are classified into industries using Datastream industry classifications. The industry-adjusted leverage ratio is calculated by scaling a firm's leverage ratio by its industry average. Firms with leverage above (below) the average for their industry will have an industry adjusted leverage ratio greater (less) than 1. Finally, it is important, in the UK context, to include short-term loans and overdrafts in the definition of debt, as many short-term debts are rolled over continuously to provide long-term finance.

3.3 Underinvestment Costs

Myers (1977) observes that when firms are likely to go bankrupt in the near future, shareholders may have no incentive to contribute new capital even to invest in positive net present value projects. This is because shareholders bear the entire cost of the investment, but the returns from the investment accrue to the debtholders such that the shareholders will be worse off than if the investment had not been made. A high probability of financial distress can induce shareholders to forgo investments that in a low probability environment would be undertaken. Myers refers to this agency problem as "underinvestment". Bessembinder (1991) argues that since hedging reduces the probability of financial distress it effectively shifts individual future states from default to non-default outcomes. The number of future states in which shareholders are the residual claimants increases and consequently they are more willing to provide funds for investment. Furthermore, the hedging firm can effectively commit to meet obligations in states where it otherwise could not and so negotiate better contract terms in the form of lower borrowing costs. Therefore risk management effectively expands the firm's "debt capacity".

Froot *et al*. (1993) present an analysis in which they suggest that variability in internal cash flow will result in either variability in the amount raised externally, or variability in the amount of investment. Variability in investment will be undesirable, to the extent that there are diminishing marginal returns to investment. In the presence of capital market imperfections, such as informational asymmetries, the marginal cost of funds increases with the amount raised externally. A shortfall in cash may be met with some increase in costly outside financing, but also some decrease in investment. Therefore cash flow variability now disturbs both investment and financing plans in a way that decreases firm value. This is because by decreasing planned investment the firm is foregoing positive net present value projects and also since it has insufficient internal funds the firm is forced to raise costly external finance. According to Froot *et al*. (1993) hedging helps ensure the firm has sufficient internal funds which enables the firm to avoid unnecessary fluctuations in either investment spending or external financing and so increases firm value.

In both the Bessembinder (1991) and Froot *et al*. (1993) analysis the costs of underinvestment will be greater for those firms with more growth options in their investment opportunity set. Firms with more positive net present value investments will lose more value if these projects are forgone. In the Bessembinder (1991) framework the incentive to forego value enhancing projects increases as the probability of financial distress increases, which is determined by the level of debt and the variability of cash flows. Therefore, firms with high levels of debt and where growth opportunities constitute a larger proportion of firm value are more likely to undertake a hedging programme. The Froot *et al*. (1993) argument suggests that capital market imperfections, such as asymmetric information, make external finance

costly. There is likely to be more asymmetric information about the quality of new projects for firms with high growth opportunities and small firms. Therefore, the Froot et al. model predicts that hedging is more likely for firms with higher expected growth and for small firms.[10] This study measures underinvestment costs using four proxies for growth options in the firm's investment opportunity set. These are research and development expenditure deflated by total sales, capital expenditure deflated by total sales, the price earnings ratio and the market-to-book value of equity. Firm size is measured using the natural log of total assets.

3.4 Foreign Currency Exposure

Firms with greater variation in cash flows or accounting earnings resulting from exposure to exchange rate risk have greater potential benefits of FC hedging. For example, the probability of encountering financial distress is directly related to the firm's cash flow volatility (Smith and Stulz, 1985). The degree to which a firm's cash flows are affected by exchange rate changes should depend on the nature of its activities, such as the level of export and import activity, its involvement in foreign operations, its competitors currencies, and the competitiveness of its input and output markets. Unfortunately, data on firms' competitors' currencies and the market structure of their markets is not publicly available, however, data on foreign sales and imports and exports exists. Cash flow models of exposure suggest that the exposure should be related to net FC revenues (total revenues minus costs). However, firms only report FC revenues and not costs and so we are forced to employ this unrefined

[10] The growth options argument for hedging assumes that all firms face similar correlations between unhedged cash flow and investment opportunities. However, this may not be the case and thus tests should ideally control for correlations of cash flow with investment opportunities.

proxy for FC exposure.[11] Therefore, in this study the level of the firm's cash flow exposure to foreign exchange rate changes is proxied using the ratio of overseas sales to total sales and a dummy variable denoting the existence of import and export activity. This data is sourced from a firm's annual report.

3.5 Other Motives

We have shown that hedging can mitigate the agency problem of underinvestment. An alternative way to reduce this conflict between shareholders and bondholders is for the firm to reduce the level of debt in its capital structure (Myers (1977)). However, lowering the firm's debt leads to a fall in the interest tax shield and reduces firm value. Nance *et al*. (1993) argue that convertible debt includes an embedded option on the firm's assets which makes this liability more sensitive to firm value changes and thereby reduces the sensitivity of equity to firm value changes. Therefore, firms can maintain the tax benefits of debt and control the underinvestment problem by issuing convertible debt as opposed to straight debt. Thus, convertible debt reduces the incentive to hedge. However, Géczy *et al*. (1997) predict a positive relation between hedging and convertible debt on the assumption that convertible debt reflects additional leverage, which constrains a firm's access to external financing. In this study the use of convertible debt is measured by the ratio of book value of convertible debt to total assets.

Notwithstanding the tax implications, Nance *et al*. (1993) suggest that firms can lower the probability of financial distress by issuing preference capital instead of

[11] Allayannis and Ofek (2001) suggest that the foreign sales ratio is an accurate proxy of the percentage of net foreign revenues out of total net revenues, if foreign profit margins are similar to domestic margins.

debt.[12] A dividend payment due on preference capital can be postponed without any threat of insolvency, whereas non-payment of interest on debt can trigger insolvency. In this study the use of preference capital is measured by the ratio of book value of preference capital to total assets.

A firm could lower the likelihood of financial distress by possessing more liquid assets ensuring that funds will be available to pay debt claims. Also firms with higher levels of liquidity will have less need to access costly external financing to fund their investment programme. Although most studies employ an indicator for liquidity there is variation in how liquidity is measured. A few studies measure liquidity as current assets over current liabilities usually referred to as the current ratio (Nance *et al*., 1993; Mian, 1996; Fok *et al*., 1997). In other studies the quick ratio is preferred (Berkman and Bradbury, 1996; Tufano, 1996; Géczy *et al*., 1997; Howton and Perfect, 1998; Graham and Rogers, 2000). In an UK context the numerator of the quick ratio includes trade debtors which incorporates accounts receivable after one year. Therefore, this study employs the cash ratio defined as cash and current investments over current liabilities. We believe the cash ratio is more closely aligned with a firm's ability to meet its short-term obligations out of its readily realisable assets.

Another method of reducing the probability of financial distress could include imposing dividend restrictions (Nance *et al*., 1993). Although competing arguments suggest that companies facing liquidity constraints might pay little or no dividends (Haushalter, 2000). Therefore, low dividends might imply liquidity constraints and more hedging indicating a negative association between dividend payout and hedging.

[12] Géczy et al. (1997) argue that preference capital more closely mimics the properties of debt rather than equity and therefore assume that it increases the firm's effective debt and consequently limits the availability of internal funds. Thus, they predict a positive relationship between hedging and the existence of preference capital.

This study uses the ratio of the gross dividend per share over share price to proxy for a firm's dividend behaviour.

All empirical studies examine the relationship between firm size and hedging. There are, however, competing arguments for either a positive or negative relation between firm size and hedging activity. The negative relationship between firm size and direct bankruptcy costs suggests that small firms have a greater incentive to hedge. Small firms are also faced with greater information asymmetries and higher financing transaction costs which are likely to make external financing more expensive for smaller firms and therefore hedging more likely. Conversely, hedging activity exhibits significant information and transaction cost scale economies implying that larger firms are more likely to hedge. In this study we use the natural log of total assets to proxy for firm size.

4. Sample Description and Sources of Data on Foreign Currency Hedging

4.1 Sample Construction

This study investigates the FC hedging practices of non-financial firms in the top 500 of UK firms ranked by market value as of year-end 1995. The initial sample consists of 441 non-financial firms. Information on FC hedging practices is sourced from annual reports. Data on hedging and FC debt use is collected manually from annual reports published in 1995. The annual reports of 412 firms out of the initial sample of 441 firms were obtained.

4.2 Identification of Ex Ante Exchange Rate Exposure

Following Géczy *et al*. (1997) and Graham and Rogers (2002) this study excludes firms that do not face FC exposure. Therefore in our sample a non-hedging firm has

decided not to hedge its exchange rate exposure, which is different to that of a firm not hedging because it has no exposure to exchange rate risk. We use the following as indicators of FC exposure:[13]

1. Reporting foreign sales in the notes to the accounts.
2. Disclosure of foreign taxes in the notes to the accounts.
3. Qualitative discussion of the existence of import or export activity or foreign operations in the annual report.

The final sample comprises 366 firms that have at least one of the above sources of FC exposure. None of the 46 firms eliminated through this process are FC hedgers or FC derivative users.

4.3 Annual Report Disclosures of Foreign Currency Hedging Practices

Based on qualitative disclosures in annual reports our sample firms are placed into two categories; firms hedging FC exposure and firms not hedging FC exposure, which includes firms providing no disclosure on FC hedging. Panel A of Table 3 shows 79.2% of firms disclose that they hedge FC exposure and 20.8% are classified as non-hedgers of FC exposure.

Panel B shows that 55.9% of FC hedging firms were hedging other exposures such as interest rate and commodity price risks. The remainder (44.1%) were firms that only hedged FC exposure, referred to as FC only hedgers. We drop from our sample all firms that hedge interest rate and/or commodity price exposure leaving a sample composed of 128 FC only hedgers and 64 non-hedgers. Panel C of Table 2 partitions the sample of FC only hedgers by choice of hedging technique distinguishing between FC derivatives hedging and FC debt hedging. The sample of

[13] Firms with purely domestic operations (i.e. no foreign sales or imports) may be exposed to exchange rates through domestic or foreign competitors who import or export. Due to non-availability of public data this aspect of a firm's foreign currency exposure profile is not accounted for.

128 FC only hedgers consists of 63 firms (49.2 percent) using both FC derivatives and FC debt for hedging, 33 firms (25.8%) using only FC debt and 32 firms (25%) using only FC derivatives for FC hedging. The latter did not use FC debt for funding or speculative purposes either.

[INSERT TABLE 3 HERE]

4.4 Descriptive Statistics and Univariate Analysis

Descriptive statistics for the independent variables used in the univariate and multivariate analysis are presented in Table 4. Table 5 provides correlations for many of the variables used in the analysis. Consistent with the findings of Allayannis *et al*. (2003) Table 5 shows that FC debt usage is highly correlated with leverage, interest cover and debt maturity.

[INSERT TABLES 4 AND 5 HERE]

Table 6 reports t-tests of differences of means between FC only hedgers partitioned by method of hedging and non-FC hedgers (excluding interest rate or commodity price only hedgers). The sample of FC only hedgers are partitioned into firms that only use FC derivatives, firms that use both FC derivatives and FC debt and firms that use only FC debt.

Of the 192 of firms examined in this study, 51.6 percent use FC denominated debt. Of those firms defined as FC only hedgers (128 firms) 75 percent use FC debt for hedging. Two thirds of these FC debt users also use FC derivatives for hedging and the remainder use only FC debt. Table 6 shows that firms using FC debt for hedging either in isolation (col. 4) or combined with FC derivatives (col. 3) have higher levels of leverage, higher absolute amounts of total loan capital, lower interest coverage, lower credit rating, lower profitability and are less likely to be receiving net

interest than FC derivative users and non-hedgers. All these differences are statistically significant at better than the 1 percent level. Furthermore, firms using only FC debt for FC hedging have higher levels of leverage, lower interest coverage, lower profitability and are less likely to be receiving net interest than firms using both FC debt and derivatives, although the differences are not statistically significant. In contrast, the differences between firms that only use FC derivatives and non-hedgers are insignificant, other than firms' credit rating which is significantly lower for FC derivative only users. This univariate evidence is consistent with the notion that the debt related differences between FC hedgers and non-hedgers mighty be driven by the inclusion of FC hedging firms that use FC debt for hedging. This calls into question results in previous studies that show a link between FC hedging and various debt related variables.

Firms that hedge with FC debt (cols. 3 and 4) have significantly more debt maturing after 1 year than FC derivative users and non-hedgers. All three groups of FC only hedgers have lower profitability than non-hedgers. However, these differences are only significant for FC hedgers that use both FC derivatives and FC debt and hedgers that use FC debt only.

All three groups of FC only hedgers have lower levels of capital expenditure and lower market-to-book ratios than non-hedgers. However, FC derivative only users and firms that use both FC derivatives and debt have higher price-earnings ratios and R&D expenditure than non-hedgers, respectively.

This study employs three measures of the level of foreign operations, differences in means show that FC hedgers that use FC debt for hedging have significantly higher levels of foreign operations than both non-hedgers and firms that only use FC derivatives. This suggests that FC debt might be the preferred tool for

hedging exposure arising from foreign operations. Firms using FC derivatives have a significantly greater incidence of import/export activity than both non-hedgers and firms that use only FC debt. This suggests that FC derivatives might be the preferred tool for hedging exposure arising from import/export activity.

All three groups of FC hedgers have significantly lower levels of liquidity than non-hedgers, which is consistent with the substitutes for hedging hypothesis. This also implies an absence of a debt related effect with respect to the liquidity variable. Finally, there was no significant difference in firm size between firms.

[INSERT TABLE 6 HERE]

5. Multivariate analysis

To isolate the possible impact of the use of FC debt we decompose the sample of FC only hedgers into three groups: 1) firms that use FC derivatives and FC debt; 2) firms that use FC debt but not FC derivatives; and 3) firms that use FC derivatives only. The FC only hedging decision is investigated using multinomial logit regression methodology to compare the characteristics of three groups of FC hedging firms. If a firm is classified into one of J+1 outcomes, the general form of the multinomial logit model can be written as:

$$\Pr ob(y_i = j) = \frac{e^{\beta_j' x_i}}{1 + \sum_{k=1}^{j} e^{\beta_k' x_i}} \qquad (1)$$

$$\text{for } j = 1,2,\ldots,J$$

The βs are the parameters of the model and x_i is a vector of characteristics for firm *i*. This paper employs five proxies for the expected costs of financial distress, leverage,

interest cover, tax losses, net interest receivable and credit rating. We use three measures for leverage, these being gross leverage, net leverage and industry adjusted leverage. Including the three leverage variables we have seven proxies in total. All specifications are normalised with respect to non-hedgers. Table 7 presents the results of estimating the specification which includes the credit rating proxy. We report the coefficient estimate, the marginal probability of choosing a particular FC hedging strategy implied by the multinomial logit coefficient estimate and the elasticity. 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. The results from the multinomial regressions identify several variables as significantly related to a firm's FC hedging decision. Consistent with the financial distress hypothesis firms with tax losses are more likely to hedge their FC exposure. This hedging utilises either FC derivatives and FC debt or FC derivatives on their own. Firms with lower credit ratings are more likely to hedge with FC derivatives only. The absolute value of the elasticity shows that the credit rating variable is also the most important factor in determining the FC hedging decision for firms that only use FC derivatives. Both the tax loss and credit rating results for firms that only use FC derivatives demonstrate that financial distress cost factors are important in determining the FC hedging decision after controlling for the use of FC debt. A summary of the results for all seven proxies are presented in Table 8. These results show that leverage and interest cover are highly significant in the hypothesised direction for the groups of FC hedgers that include firms using FC debt for hedging. However, leverage and interest cover are not significant for firms using only FC derivatives. These results are consistent with the main assertion of this paper that the inclusion of FC debt using firms in samples of FC hedgers potentially drives the

results relating to various measures of firm indebtedness. Since variables like leverage and interest cover are frequently used to proxy for expected costs of financial distress and that many FC hedging firms use FC debt, the analysis in this paper raises some doubts concerning the validity of financial distress results in previous studies.

[INSERT TABLES 7 AND 8 HERE]

6. Conclusions

The empirical analysis in this paper is the first to recognise that a sample of FC hedgers that includes firms using FC debt engenders bias. A bias arises because tests that investigate links between FC hedging and factors that are potentially more relevant to FC debt users, such as leverage, might be driven by FC hedgers that also use FC debt. By using a disaggregated sample of FC only hedgers this study avoids the possibility that tests of the determinants of FC hedging are driven by firms that use FC debt. This paper partitions a sample of FC only hedging firms into those that only use FC derivatives and those that use FC debt either in isolation or combined with FC derivatives. The results show FC only hedging using only FC derivatives is not significantly related to leverage or interest cover but is significantly related in the hypothesised direction to other proxies for expected financial distress costs, such as tax losses, net interest receivable and credit rating. To the best of our knowledge, this is the first study to control for the possibility that FC debt use by FC hedging firms might drive the link between FC hedging and measures of financial distress costs. The results show that financial distress cost variables are important in the decision to use only FC derivatives for FC hedging. The analysis calls into question the validity of the debt results in previous studies, which potentially include FC derivative users that also use FC debt.

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Appendix: Variable Definitions and Summary of Hypotheses

This appendix presents the independent variables for the analysis of hedging by UK non-financial firms. It provides the variable's definition, the source of data for the variable, and the predicted sign of the coefficient estimate as predicted by each hypothesis. All variables are computed as three-year averages upto one year prior to the 1995 year -end, unless stated otherwise.

		Hypothesis					
Independent Variable	**Variable Description (Source)**	**Tax Schedule Convexity**	**Financial Distress**	**Underinvest-ment/Costs of External Finance**	**Financial Price Exposure**	**Substitutes for Risk Management**	**Transaction Cost Economies of Scale**
Tax loss carry forwards	A dummy variable equal to 1 if the firm has tax loss carry forwards for the year ended 1995. (Annual report)	+	+				
Gross leverage	Book value of total debt and preference capital as a proportion of the book value of total debt plus the market value of equity. (Datastream)		+	+	+		
Industry adjusted gross leverage	The gross leverage for a firm divided by average gross leverage for the industry. Industry classifications sourced from Datastream.		+	+	+		
Net leverage	Book value of net debt and preference capital as a proportion of the book value of net debt plus the market value of equity, where net debt is total debt less cash and short-term investments. (Datastream)		+	+	+		
Interest cover ratio	Profit before interest and tax divided by interest payments. (Datastream)		-		-		
Net interest charge	A dummy variable equal to 1 if a firm is a net receiver of interest in any given year, where net interest is defined as total interest charges less interest income. The dummy value is averaged over 3 years prior to the annual report year end. (Datastream)		-		-		
Qui-score	Qui-score is a measure of the likelihood of firm failure in the twelve months following the date of calculation. The Qui-score is given as a number in the range 0 (high likelihood of failure) to 100 (low likelihood of failure). This variable is collected for the year ended 1994. (FAME)		-				
Debt maturity > 1 year	Proportion of debt due after 1 year divided by total debt. (Datastream)			+			
Return on capital employed	Pre-tax profit (incl interest) divided by total capital employed plus debt repayable in 1 yr. (Datastream)		-	-			
Total loan capital	Long-term debt due after 1 year. (Datastream)		+				
Capital expenditure	Purchases of fixed assets divided by total sales. (Datastream)			+			
Price-earnings ratio	Share price divided by earnings per share in year. (Datastream)			+			
Market-to-book value ratio	The market value of equity divided by book value of equity, where the book value of equity is measured as equity capital and reserves (excluding preference capital) less goodwill and other intangibles. (Datastream)			+			
Research and development expenditure	Research and development expenditure divided by total sales. (R&D Scoreboard compiled by Company Reporting Ltd.)			+			
Foreign sales by destination	Foreign sales by destination divided by total sales for the year ended 1994. (Annual report)				+		
Foreign sales by origin	Foreign sales by origin divided by total sales for the year ended 1994. (Annual report)				+		
Foreign tax ratio	Total foreign tax charge divided by total tax charge. (Datastream)				+		
Foreign transactions dummy	A dummy variable equal to 1 if a firm indicates that it imports or exports or repatriates dividends and other investment income back to the UK for the year ended 1995. (Annual report)				+		
Cash ratio	Total cash and cash equivalents divided by total current liabilities. (Datastream)					-	
Dividend yield	Gross dividend divided by share price. (Datastream)					+	
Convertible debt	Book value of convertible debt divided by total assets. (Datastream)		+			-	
Preference capital	Book value of preference capital divided by total assets. (Datastream)		+			-	
Firm size	Natural logarithm of the book value of total assets. (Datastream)		-	-			+

Table 1
Proportion of Foreign Currency Debt Users in Samples of Empirical Studies

Author(s) of Study	Publication Year	Country & sample size	% of FC Debt users (year of data collection)
Edelshain	1995	UK – 189	60.0 (1990)
Geczy, Minton & Schrand	1997	US – 372	NA (1990)
Berkman, Bradbury & Magan[a]	1997	NZ – 116	70.0 (1994)
Hakkarainen, Kasanen & Puttonen	1997	Finland – 84	84.1 (1994)
Keloharju & Niskanen[b]	2001	Finland – 44	54.9 (1985-91)
Graham & Harvey[c]	2001	US - 392	31.0 (1999)
Allayannis & Ofek	2001	US – 724 firm years	21.8 (1993)
Allayannis, Brown & Klapper	2003	EA – 327	61.8 (1996)
Kedia & Mozumdar	2003	US – 523	22.0 (1996)
Elliott, Huffman & Makar	2003	US – 88 or 262 firms years	100.0 (1994-97)
Hagelin	2003	Sweden - 101	53.0 (1997)
Bartram, Brown & Fehle	2004	US - 2207	65.5 (2000 & 2001)
		UK - 886	85.6
		Germany - 412	86.7
		France - 163	88.3
		Europe - 2520	88.1
		Asia & Pacific - 1731	90.7
		Africa & M.East - 125	84.0
		Latin Amer/Carib – 88	95.5
Judge	2005	UK - 412	65.8 (1995)
Judge, Clark & Namata	2005	UK – 336 (matched firms for both years)	64.0 (1999) 69.3 (2000)

[a]Berkman et al. report the use foreign debt financing as a financial hedge amongst New Zealand hedgers.
[b]Foreign currency debt is long-term debt.
[c]Graham and Harvey's (2001) figure reports firms that seriously considered issuing debt in foreign markets. This figure therefore overstates the proportion of firms that might actually be using foreign debt.

Table 2

Reasons for Using FC Debt and Distribution of FC Debt Users Between FC Derivative users and non-users

	Hedging		Speculation		Arbitrage
	Substitute	Complement	Exposure not hedged	Exposure hedged	Exposure hedged
Non-FC derivative sample	√		√		
FC derivative sample		√		√	√

Table 3
Foreign Exchange Hedging Activity Disclosures by UK Firms

This table presents data on the number of foreign currency (FC) hedgers amongst the sample of 366 firms that are deemed to have FC exposure as of year-end 1995. Panel A provides data on the number of FC hedging firms and non FC hedging firms, distinguishing between firms that hedge interest rate or commodity price exposure but not FC and firms that do not hedge any financial price exposure. A firm is defined as a foreign exchange hedger if it provides a qualitative disclosure of any FC hedging activity in its annual report. Firms using FC derivatives or FC debt or internal techniques for hedging purposes are classified as FC hedgers. Panel B partitions the sample of FC hedgers into firms that only hedge FC exposure and firms that hedge FC in addition to either interest rate or commodity price exposure or both. Panel C presents data on the methods of hedging used by FC only hedgers distinguishing between the use of FC derivatives and FC debt.

Panel A: Foreign Currency (FC) Hedging Activity	**No.**	**%**
Hedging FC exposure	290	79.2
Hedging interest rate or commodity price exposure but not FC	12	3.3
Not hedging any category of exposure	64	17.5
Total	**366**	**100**

Panel B: FC Hedgers Hedging Other Exposures	**No.**	**%**
FC hedging only	128	44.1
FC & other financial price hedging	162	55.9
Total	**290**	**100**

Panel C: Methods of FC hedging by FC Only Hedgers	**No.**	**%**
FC derivatives and FC debt	63	49.2
FC debt only	33	25.8
FC derivatives only	32	25.0
Total	**128**	**100**

Table 4

Explanatory Variables – Summary Statistics

This table provides summary information for the independent variables used in the analysis.

Independent Variable	N	Mean	Median	Std. Dev.	Min.	Max.
Tax loss carry forwards dummy	192	0.3385	0	0.4745	0	1
Gross leverage	168	0.1393	0.1133	0.1227	0	0.6367
Industry adjusted gross leverage	168	0.8764	0.7181	0.7221	0	3.3795
Net leverage	171	0.0372	0.0300	0.1388	-0.5667	0.6233
Interest cover	187	21.5075	8.5163	29.7215	-20.6320	100
Qui score	184	69.9076	69.0000	17.0248	20	96
Net interest dummy	171	0.3236	0	0.3992	0	1
Debt maturity > 1 year	171	0.5199	0.5800	0.2861	0	0.9900
Return on capital employed	163	18.5266	13.7167	26.1044	-42.2130	228.9370
Total loan capital (Natural log)	168	2.4872	2.7027	1.91429	-3.3697	6.7389
Capital expenditure-to-sales	147	0.0603	0.0400	0.0906	0.0011	0.8742
Market-to-book ratio	170	5.4553	2.6517	15.5437	-5.7500	164.3330
Price-earnings ratio	165	25.1300	18.5000	35.2447	9.1000	376.9500
R&D expenditure-to-sales (%)	192	1.2985	0	5.6872	0	76.4604
Foreign sales by destination (%)	192	38.3288	36.35	31.2395	0	96
Foreign sales by origin (%)	179	29.4415	26	27.4441	0	92.2
Overseas tax ratio	164	0.2724	0.15	0.4806	0	5.13
Import/export dummy	192	0.7292	1	0.4456	0	1
Foreign operations dummy	192	0.7969	1	0.4034	0	1
Cash ratio	187	0.4966	0.31	0.8051	0	6.8767
Convertible debt-to-total assets	187	0.0036	0	0.0150	0	0.1275
Preference capital-to-total assets	187	0.0322	0	0.1585	0	1.9567
Dividend yield	170	3.3475	3.1867	1.6458	0	8.0433
Total assets (Natural log)	187	4.8757	4.7454	1.1366	2.4277	8.3399

Table 5 Pearson Correlation Coefficients

This table reports Pearson correlation coefficients for a selection of variables used in the univariate and multivariate analysis. ***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

	Foreign currency debt user	Tax loss carry forwards dummy	Gross leverage	Industry adjusted gross leverage	Net leverage	Interest cover	Qui score	Net interest dummy	Debt maturity > 1year	Return on capital employed	Total loan capital (Natural log)	Market-to-book ratio	R&D expenditure	Foreign sales by destination	Foreign sales by origin	Foreign transactions dummy	Foreign operations dummy	Cash ratio
Tax loss carry forwards dummy	0.1428**																	
Gross leverage	0.3252***	0.1415*																
Industry adjusted gross leverage	0.2545***	0.1154	0.8625***															
Net leverage	0.2432***	0.0451	0.7399***	0.6579***														
Interest cover	-0.3534***	-0.1983***	-0.5177***	-0.4957***	-0.5006***													
Qui score	-0.0802	-0.1796**	-0.1446*	-0.1714**	-0.0817	0.1524**												
Net interest dummy	-0.1998***	0.0175	-0.4287***	-0.4094***	-0.6266***	0.5596***	0.0825											
Debt maturity >1 year	0.2887***	0.1432*	0.3380***	0.2921***	0.3456***	-0.3155***	0.1252	-0.3425***										
Return on capital employed	-0.1686**	-0.1842**	-0.3356***	-0.3175***	-0.1879**	0.4341***	-0.0037	0.2073***	-0.0995									
Total loan capital (Natural log)	0.2668***	0.0235	0.6075***	0.5506***	0.5700***	-0.5073***	0.0273	-0.4693***	0.5215***	-0.3557***								
Market-to-book ratio	-0.1010	-0.0651	-0.1832**	-0.1506*	-0.0905	0.2836***	-0.1702**	0.2345***	-0.0781	0.5449***	-0.2272***							
R&D expenditure	0.1246*	0.0684	-0.0884	-0.0481	-0.1271*	-0.0992	-0.0500	0.1814**	0.0758	-0.0244	-0.0867	0.0288						
Foreign sales by destination	0.4650***	0.1278*	0.1330*	0.1418*	-0.0707	-0.1464**	-0.0284	0.0325	0.1399*	-0.0623	0.0588	-0.0496	0.1133					
Foreign sales by origin	0.4910***	0.1255*	0.2629***	0.2547***	0.1059	-0.2489***	-0.0370	-0.0943	0.2213***	-0.0539	0.2457***	-0.0384	0.0502	0.8669***				
Foreign transactions dummy	0.2067***	0.0645	-0.0853	-0.0404	-0.1622**	-0.0413	-0.1350*	0.1156	-0.0027	0.0366	-0.1615**	-0.0416	0.1280*	0.4154***	0.2925***			
Foreign operations dummy	0.5209***	0.1423**	0.0661	0.0258	-0.0161	-0.2090***	-0.0139	0.0385	0.1230	-0.0894	0.0752	-0.1033	0.1059	0.5336***	0.5366***	0.2458***		
Cash ratio	-0.1353*	0.0765	-0.1223	-0.1628**	-0.3570***	0.0860	-0.0119	0.4022***	0.1076	-0.0832	-0.1781**	0.1325*	0.4240***	0.0793	-0.0519	0.0523	-0.1600**	
Total assets (Natural log)	0.1280*	-0.0461	0.4633***	0.4185***	0.3172***	-0.2692***	0.0682	-0.2746***	0.2092***	-0.3142***	0.7679***	-0.2637***	-0.0682	0.0426	0.1810**	-0.1327*	-0.0135	-0.0795

Table 6

Differences Between Foreign Currency Only Hedgers Partitioned By Choice of Hedging Technique and Non-Hedgers and Difference Between Foreign Currency Debt Users and Non-Users Using Two Sample T-Test

This table reports means values for the independent variables. The table presents the results of tests of differences of means between FC only hedgers partitioned by method of hedging and non-FC hedgers. Bold (italic) text denotes a value statistically different from non-hedgers (or non-fx debt users) at the 5% (10%) level or better for a two sample t-test. T-tests assume equal variances unless the null hypothesis of equal variances is rejected at a 5% significance level.

	Non-hedgers		FC only hedgers							
	Group 0		Group 1		Group 2		Group 3		Groups 1,2 & 3	
	N	Non-hedgers	N	FC Derivs & FC Debt	N	FC Debt only	N	FC Derivs only	N	All FC only hedgers
Tax loss carry forwards dummy	64	0.2031	**63**	**0.4762**	33	0.2424	**32**	**0.4375**	**128**	**0.4062**
Gross leverage	55	0.0938	**58**	**0.1577**	**28**	**0.2030**	27	0.1262	**113**	**0.1614**
Industry adjusted gross leverage	55	0.6115	**58**	**1.0018**	**28**	**1.0911**	27	0.9239	**113**	**1.0053**
Net leverage	56	-0.0046	**58**	**0.0473**	**30**	**0.1072**	27	0.0246	**115**	**0.0576**
Interest cover	62	35.6993	**62**	**13.3247**	**33**	**8.8200**	*30*	*23.0454*	**125**	**14.4684**
Qui score	60	74.7000	**61**	**69.0656**	***32***	***69.4375***	**31**	**62.7742**	**124**	**67.5887**
Net interest dummy	57	0.4649	**58**	**0.2874**	**29**	**0.1724**	**27**	**0.2654**	**114**	**0.2529**
Debt maturity > 1 year	57	0.4404	**58**	**0.5633**	**29**	**0.6792**	27	0.4236	**114**	**0.5597**
Return on capital employed	56	24.2645	**54**	**14.8203**	27	***14.1894***	26	18.3695	**107**	**15.5235**
Total loan capital (Natural log)	55	1.9406	**62**	**2.7390**	**33**	**3.1925**	28	2.1722	**123**	**2.7316**
Capital expenditure	46	0.0956	**51**	**0.0429**	***26***	***0.0538***	**24**	**0.0368**	**101**	**0.0443**
Market-to-book ratio	58	8.5070	57	4.2299	***28***	***3.4254***	27	3.5921	***112***	3.8750
Price-earnings ratio	55	22.9349	56	24.9819	28	19.5679	26	36.0827	110	26.2276
R&D expenditure	64	0.6181	**63**	**2.7569**	33	0.6328	32	0.4748	***128***	1.6388
Foreign sales by destination	63	23.6106	**63**	**57.3381**	**33**	**43.5018**	32	25.7438	**128**	**45.8724**
Foreign sales by origin	61	16.7012	**57**	**44.7088**	**31**	**38.9019**	30	16.5633	**118**	**36.0276**
Overseas tax	56	0.1147	**58**	**0.2264**	**30**	**0.4127**	27	0.1265	**115**	**0.2515**
Foreign operations dummy	64	0.6094	**63**	**1.0000**	**33**	**1.0000**	32	0.5625	**128**	**0.8906**
Import/export dummy	64	0.5313	**63**	**0.9365**	33	0.5758	**32**	**0.8750**	**128**	**0.8281**
Cash ratio	62	0.7134	***62***	***0.4522***	**33**	**0.2892**	**30**	**0.3686**	**125**	**0.3891**
Convertible debt-to-total assets	62	0.0043	62	0.0017	33	0.0023	30	0.0073	125	0.0032
Preference capital-to-total assets	62	0.0489	62	0.0179	33	0.0333	30	0.0261	125	0.0239
Dividend yield	58	3.1985	57	3.3351	**28**	**4.0972**	*27*	*2.9160*	112	3.4246
Total assets (Natural log)	62	4.7233	62	4.9754	33	4.9801	30	4.8697	***125***	4.9513

Table 7
Multinomial Logit Estimates of the Likelihood of Using Different Foreign Currency Hedging Methods

This table shows the results of a multinomial logit regression of the relation between the likelihood that a firm chooses one of three categories of FC hedging strategy and proxies measuring incentives for FC hedging. The sample excludes firms with no FC exposure and excludes FC hedging firms that hedge interest rate and or commodity price exposure. The hedging sample consists of firms that only hedge FC exposure. The categories of FC hedging strategy choice presented in the table are expressed relative to the choice of not hedging FC exposure (group 0). Group 1 firms are those that use both FC derivatives and FC debt for FC hedging. Group 2 firms use only foreign debt for FC hedging. Group 3 firms use only FC derivatives for FC hedging. The data are presented as coefficients (Coeff.), marginal effects (ME) and elasticities (Elast.). The elasticity measures the percentage change in the probability of FC hedging 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. Summary statistics for the multinomial logit are presented in panel B.

Panel A: Multinomial Logit Model

Independent Variables	Group 1			Group 2			Group 3		
	Coeff.	ME	Elasticity	Coeff.	ME	Elasticity	Coeff.	ME	Elasticity
Tax loss dummy	1.490***	0.270***	0.274***	0.224	-0.087	-0.159	1.102*	0.054	0.141
	(0.002)	(0.002)	(0.005)	(0.684)	(0.218)	(0.291)	(0.089)	(0.371)	(0.404)
Qui score	-0.015	-0.000	-0.020	-0.019	-0.001	-0.325	-0.045***	-0.004**	-2.122**
	(0.278)	(0.971)	(0.971)	(0.171)	(0.656)	(0.677)	(0.006)	(0.023)	(0.015)
Foreign currency trade dummy	2.883***	0.521***	1.134***	0.256	-0.204***	-0.799**	2.444***	0.144*	0.811
	(0.000)	(0.000)	(0.004)	(0.584)	(0.004)	(0.044)	(0.006)	(0.096)	(0.177)
Cash ratio	-0.415*	0.010	0.015	-1.205**	-0.143*	-0.377	-0.605*	-0.021	-0.079
	(0.069)	(0.847)	(0.846)	(0.027)	(0.059)	(0.138)	(0.063)	(0.562)	(0.656)
Natural log of Total Assets	0.483**	0.092**	1.311**	0.221	0.002	0.049	0.043	-0.022	-0.804
	(0.033)	(0.031)	(0.034)	(0.266)	(0.938)	(0.937)	(0.890)	(0.488)	(0.502)
Normalised with respect to:	Group 0			Group 0			Group 0		

Panel B: Summary Statistics

No. of observations	180
No. of non-foreign currency hedging firms	58
No. of firms using both FX derivatives and foreign debt for foreign currency hedging	60
No. of firms using only foreign debt for foreign currency hedging	32
No. of firms using only FX derivatives for foreign currency hedging	30
-Restricted Log Likelihood (Slopes=0)	234.558
-Restricted Log Likelihood at Convergence	197.941
Chi-squared (log-likelihood ratio)	73.234
Degrees of Freedom	15
P-value	0.000
Pseudo R^2	0.1561

Table 8
Summary of Multinomial Logit Results For Financial Distress Variables in Regressions Estimating the Likelihood of Hedging Using Foreign Currency Derivatives and or Foreign Currency Debt

This table presents a summary of multinomial logit results of the relation between the likelihood that a firm chooses one of three categories of FC hedging strategies and variables measuring financial distress cost hedging incentives for the year-end 1995 and for firms with FC exposure. The table shows the level of significance and sign achieved for each financial distress variable when it is included in the multinomial model specification. In addition to the tax loss variable only one other distress variable is included in each specification and therefore the table displays the results from 6 specifications. The FC hedging sample consists of firms that only hedge FC exposure. FC hedging firms that also hedge interest rate or commodity price exposure are excluded. Group 1 consists of FC only hedging firms that use both FC derivatives and FC debt for FC hedging. Group 2 consists of FC only hedging firms that only use FC debt for FC hedging. Group 3 consists of FC only hedging firms that only use FC derivatives for FC hedging. These firms do not use FC debt for any reason. NS stands for not significant.

Financial Distress Variable	Coefficient			Marginal Effect		
	Group 1 FC Derivs & FC Debt	Group 2 FC Debt only	Group 3 FC Derivs only	Group 1 FC Derivs & FC Debt	Group 2 FC Debt only	Group 3 FC Derivs only
Gross leverage	+1%	+1%	-NS	+1%	+1%	-10%
Net leverage	+5%	+1%	+NS	+1%	+1%	-NS
Industry adjusted leverage	+5%	+5%	+NS	+5%	+NS	-NS
Taxloss	+1%	+NS	+1%	+1%	-NS	+10%
Interest cover	-1%	-1%	-NS	-NS	-1%	+NS
Net interest receivable	-1%	-1%	-5%	-NS	-10%	-NS
Qui score	-NS	-NS	-1%	-NS	-NS	-5%