

Determinants of Hedging: An Empirical Investigation for Mauritius

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This paper attempts to fill an important gap in the empirical literature pertaining to the determinants of hedging by focusing on an upper-income developing country, Mauritius. Indeed, earlier empirical evidences on hedging were mainly based on advanced economies with little emphasis on developing countries. From the data on Mauritian firms for the year 2005-06, it transpires that managers' incentives to hedge and tax convexity motive to hedge, along with financial and operational explanations underlying hedging, are basically not applicable in Mauritius. The size and age of firms are found to be positively related to hedging, endorsing the fact that high fixed costs and knowledge in establishing a derivative framework are important.

Introduction

The empirical literature on the determinants of hedging has overwhelmingly focused on advanced economies. Distinct reasons have been advanced to encourage firms to hedge, such as the financial distress costs, underinvestment hypothesis, convexity of tax structure and others. However, to date, no work has been entertained in this field for a developing country.

An insight into how Mauritian firms really hedge their foreign exchange risk becomes a sine qua non. First, local firms can resort to forwards which are provided by local commercial banks. The benefit attached to forward contracts is that they do not require any initial or maintenance margin account. Another cost-saving advantage is that the fees or commissions applied are low since the bank is providing a whole set of facilities such as overdraft, documentary credit, bank guarantees and loans. Second, practitioners are conversant with the fact that the rupee has consistently been depreciating against the US dollar, euro and pound sterling. Subsequently, for an exporter, the need to hedge its receipts, denominated in any of the above three foreign currencies, is not warranted.

This new research is geared towards assessing the determinants of hedging in Mauritius. The analysis is extensive as it caters to listed and unlisted firms and the top 100 companies in terms of growth and turnover, respectively. Besides, the research is interesting in the sense that it delves into the decision to hedge of an upper-income developing country, empirical evidence of which is scarce or practically nonexistent.

This study provides the rationale as to why firms hedge. It gives an insight into the characteristics of the Mauritian firms, together with explanation relating to the extent to

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which hedging theories are applicable in Mauritius. Subsequently, it discusses the data along with the econometric model and presents the empirical results. Finally, it offers conclusion.

Reasons Motivating the Firms to Hedge

Derivatives markets have grown massively during the last 10-15 years. Under perfect capital markets, it outweighs the purpose for firms to resort to hedging, since investors can themselves replicate corporate hedging activities. Almost all the empirical literature on hedging begins with frictions introduced in the Modigliani and Miller (1958) framework. Unfortunately, till date, no consensus has been reached regarding a well-accepted framework that practitioners can rely on when establishing risk management programs. Nevertheless, the current section provides an updated version as to why firms hedge with derivatives.

Financial Distress Costs Hypothesis

If financial distress is costly, firms are better off with hedging activities because hedging helps to scale down the present value of financial distress costs. Usually, the empirical literature uses leverage, since firms having higher gear in their capital structure are more susceptible to financial distress. Dolde (1995), Berkman and Bradbury (1996), Gay and Nam (1998), Haushalter (2000), and Graham and Rogers (2002), all find a positive relationship between hedging and leverage. On the other hand, Nance *et al.* (1993), Geczy *et al.* (1997), and Allayannis and Ofek (2001) find no support for this hypothesis. Similarly, Joseph and Hewins (1997), in an analysis implemented on the UK multinationals, find that the stress placed on financial distress costs hypothesis is relatively weak.

Dionne and Garand (2003) propose a combination of leverage and liquidity to proxy financial distress costs. The variable is set to one in case a firm is subject to a debt and a quick ratio level that is, respectively, above and below the industry's mean.

Underinvestment Hypothesis

Firms subject to vital investment opportunities and which are financially constrained suffer the most from this problem. Froot *et al.* (1993) show that hedging can scale down cash flow volatility so that firms are able to finance their projects during bad times from internally generated funds. However, Lin and Smith (2003) state that distinct firms are subject to different structure of assets so that a high market-to-book ratio is not synonymous with an indication of more valuable investment opportunities. The second proxy used in the literature is the Research and Development (R&D) expenditure, scaled by total assets. The empirical literature also focuses on the use of the number of financial analysts following the firm in the sense that a firm is expected to suffer less from information asymmetry when it is subject to greater public scrutiny. Allayannis and Ofek (2001) utilize dividend yield on the ground that firms could pile up more liquidity by scaling down their dividend payments. Borokhovich *et al.* (2004) use the quick ratio, while Nguyen and Faff (2003) have recourse to both the current ratio and the ratio of cash

and cash equivalents to the firm's size. Gay and Nam (1998) resort to a dummy variable, which takes the value of one in case a firm is simultaneously subject to low level of cash and high level of growth opportunities. In the same vein, Haushalter (2000) conjectures that firms whose debt is rated are basically subject to more examination and thereby they suffer less from information asymmetry.

Tax Convexity

The tax benefit hypothesis points out that firms subject to larger tax loss carryforwards are more susceptible to hedging. If a firm is subject to an effective tax schedule which is convex, a fall in the volatility of before-tax income would scale down expected taxes, and it would thus be beneficial for the firm to hedge. The tax motive for hedging is to reduce the variability of taxable income and not the variability of cash flow. Consequently, under a convex tax function, as long as hedging costs do not exceed its benefits, hedging scales up the after-tax firm value. The most popular measure of the tax function convexity has been the amount of tax loss carryforwards. A second measure which is commonly proposed for the tax function convexity comprises a dummy variable, showing whether the firm's pretax income is anticipated to be in the progressive region of the tax code. Smith and Stulz (1985) show that hedging smooths pretax income functions so that firms are able to scale up the probability of using tax preference items.

Managers' Motives

Managerial theories state that firms engage in hedging to avoid capital market discipline. Several papers use the number of exercisable options held by managers to proxy for the risk-taking incentives of managers. Besides, other theories such as DeMarzon and Duffie (1995) and Breeden and Viswanathan (1998) attempt to relate corporate hedging to managerial reputation. In that context, hedging can mitigate the extent of informational asymmetry among shareholders, managers and labor market. The rationale is that managers having superior skills may resort to hedging to better communicate their skills to the labor market. Joseph and Hewins (1997) also find that the aim of hedging is to reduce risk at a level at which management feel is comfortable.

Country-Specific Features

De Jong *et al.* (2002) show that the use of derivatives is more widespread in the case of Dutch firms relative to US firms. They attribute such a finding to the fact that the US tends to have a more cushioned legal structure for the shareholders' rights compared to the Netherlands. Besides, LeI (2004) finds that firms operating in a country characterized by a developed financial market and strong corporate governance have a greater propensity to engage in hedging. In a parallel manner, Bartram *et al.* (2004) find that the size of derivatives market and the level of financial risk have an impact on the hedging decision.

Size

The empirical literature points out that lower size induces higher hedging. Indeed, if hedging costs are inversely proportional to firm size, smaller firms should have a higher

hedging ratio, since they are more concerned about financial distress costs. Besides, according to Froot *et al.* (1993), firms subject to costly external finance are more likely to hedge, and since smaller firms are likely to be buffeted by information asymmetry, larger cost of external finance should lure them to hedge. However, assessing the other side of the picture, it is argued that larger size induces higher hedging in the sense that there are economies of scale in transactions. Moreover, larger firms might also hedge more since they tend to have more complicated and geographically-dispersed operations, and subsequently a greater need to hedge.

Corporate Governance

Corporate governance features are expected to have an impact on risk management policy via their role as mitigation tool for agency problems. The two main channels discussed in the literature comprise ownership concentration and board characteristics. Under the former, firms characterized by a high level of ownership concentration are less susceptible to suffer from agency conflicts and they should thereby hedge to maximize their values. The reason is that large shareholders possess the required resources to ensure that strict monitoring is being exercised on managers' activities to mitigate any management's self-interest-based motive towards hedging. The variable mostly applied to control for the firm's ownership structure constitutes the percentage of shares held by blockholders. Under board characteristics, it is assumed that board independence should play a vital role in the firm's risk management horizon. Indeed, Whidbee and Wohar (1999) show that managers' decision to hedge with derivatives is affected by the membership of outside directors in the board in case there are low levels of insiders' shareholdings.

Characteristics of Mauritian Firms

Prior to moving to the methodology, it is important to know the features of Mauritian firms. Indeed, each country has its own features which tend to affect the hedging behavior. For instance, De Jong *et al.* (2002) show that the use of derivatives is more widespread in the case of Dutch firms relative to the US firms because, in comparison to the Netherlands, the US tends to have a more cushioned legal structure for shareholders' rights.

Characteristics of Local Firms

The following aspects are considered to best describe the Mauritian companies from the hedging perspective.

Concentrated Ownership Structure

Local firms tend to exhibit concentrated ownership level to the effect that agency costs are practically nonexistent. Such a feature, being so blatant, even prevails among the listed firms. This implies that the managers' motives to hedge will systematically not apply in Mauritius.

Derivative Products (Forwards) Collected from Firms

Mauritius is basically a bank-based financial system. The main source of finance for local firms consists of loans. Indeed, bank financing is so overwhelming in Mauritius that even

the listed firms prefer bank financing relative to equity financing. Consequently, local companies mainly use forward contracts provided by local banks to hedge their foreign exchange risk exposure rather than resorting to foreign instruments. The reason is that these banks offer this service as a whole package of banking facilities. For example, a company can avail the benefit of lower fees charged for a forward contract facility in case the latter is used along with distinct facilities such as loans, overdraft or bank guarantees, synonymous with economies of scale in transactions. Thus, the use of forward contracts does not impose heavy costs on the local companies relative to a scenario where foreign instruments would have been used or only a forward contract facility is used. Besides, local forward contracts are denominated in rupees against a foreign currency, while foreign instruments will be one foreign currency against another foreign currency, synonymous with additional risk.¹ In addition, the bid-ask spreads (the margin between the rate at which banks buy and the rate at which they sell) are not materially different from those for spot transactions.

Therefore, the above clearly shows that the extent of financial market development as a determinant of the choice of derivative instruments and its hedging costs does matter. Otherwise, had local banks not provided these facilities, many local companies would not have been able to hedge their foreign exchange risk exposure, or they would forgo hedging if it is too costly. However, one word of caution is that banks in Mauritius are selective in providing forwards since only healthy corporates are eligible for such a type of facility.

Chronic Depreciation Due to Ongoing Deficit²

The structural problem of the depreciating rupee dissuades firms from converting the export revenues into the Mauritian rupee. Subsequently, many exporters prefer to maintain a foreign currency bank account to hold their foreign revenues rather than directly convert them into rupees. Ironically, not only exporters but also importers tend to have a taste for such foreign currency bank account to alleviate the consistently rising costs of imports. Indeed, the rupee has been subject to a systematic depreciation against the euro, the pound sterling and the US dollar since 1999 up to 2006. Such depreciation is fundamentally linked to the balance of payments deficit. Theoretically speaking, a country subject to a deficit should have a depreciating currency to render its exports more competitive and thereby restore equilibrium.

Price Takers

Traditionally, Mauritian exporters and importers have been international price takers rather than price setters and have had little choice but to accept exchange rate risk as something which is inherent in international trade.

Complacent Hedging Behavior Risk Borne by Consumers

In the case of the local car industry, many car dealers maintain bank accounts in foreign currency. Should there be a rise in the costs, they merely transfer that to the consumers.

¹ This could also lead to lower risk; it all depends on the movements in the two currencies vis-à-vis the rupee.

² Such depreciating rupee has been highly welcomed by exporters as it scales up their revenue receipts denominated in rupees.

It can be argued that a car dealer, if successful in hedging its risk, can lower its sale price and thereby avail a larger pool of customer base. Such a need is underscored bearing in mind the intense level of competition prevailing in the car dealer industry.

Underlying Risk Exposure

Local firms do not usually report the level of foreign sales. Consequently, due to data limitations, it is not possible to know the underlying risk exposure of local firms. Nevertheless, such a concern is mitigated in the sense that the financial data does help in having the sample of forward hedgers which should be subject to ample foreign exchange risk for them to use forwards. Besides, the use of foreign sales variable in the empirical literature has been mainly for multinationals. However, in Mauritius, many of the local firms do not have subsidiaries abroad; i.e., multinationals (locally established company having subsidiaries abroad) are virtually absent in Mauritius. Otherwise, even the largest firms in Mauritius are relatively smaller compared to those from abroad or those covered in previous empirical literature on hedging.

Relevance of Hedging Theories in Mauritius

As the saying goes, "Cut your coat according to your cloth", in the same vein, at first sight, it seems inappropriate to consider that all the motives for hedging will apply in the Mauritian context. Country-specific factors need to be given due consideration. Under the following subheads, the paper discusses each of the motives to hedge and its relevance in Mauritius.

Tax Hypothesis

At the outset, it is vital to note that in Mauritius, the tax hypothesis is unlikely to hold because the local corporate tax system has been set at a flat rate of 15%. Consequently, the tax convexity motive which induces hedging does not apply in Mauritius.

Financial Distress Costs Hypothesis

It can be argued that for Mauritian firms which are subject to a high level of foreign exchange risk exposure, the above explanation for hedging can be valid. For instance, with hedging, savings obtained from undesired movements in exchange rates could be used to pay interest payments, thereby scaling down any possibility of the firm getting bankrupt. Hence, hedging, to curb financial distress costs, tends to be relevant for many of the local firms, mainly those which are buffeted by cash shortfalls during rising interest rates.

Underinvestment

A priori, underinvestment is bound to hold in Mauritius due to external finance being costly than internal source of funds. Subsequently, with hedging providing additional funds, it can scale down the underinvestment level of local firms. Indeed, many of the Mauritian firms, though do not engage in R&D, yet, are constantly involved in the acquisition and disposals of new equipment and machinery to the effect that hedging can assist in reducing the burden of the acquisition costs, mainly when these machineries are purchased from abroad.

Managers' Motives

Like the tax hypothesis, the managers' motives to hedge is also weak in Mauritius, irrespective of whether the firm is quoted on the Stock Exchange of Mauritius or unlisted. The underlying rationale is that the presence of concentrated level of ownership outweighs the purpose for managers to hedge to signal about the quality of management.

In a nutshell, among the distinct motives for hedging found in the empirical literature, it is believed that the underinvestment effect, along with the expected financial distress costs hypothesis, is most likely to hold in Mauritius. Tax convexity and managers' incentives to hedge are not really applicable.

Substitutes for Hedging in Mauritius

Like the distinct motives to hedge, here the paper analyzes the degree to which the different substitutes for hedging are likely to hold in Mauritius. First, corporate governance, foreign currency debt and dividend are considered as per the empirical literature. Second, focus is laid on the practical side of the picture as to how local firms use non-derivatives means to hedge their foreign exchange risk exposure.

Corporate Governance

Corporate governance, as underscored by Lel (2006), is important in case there are agency costs. However, in Mauritius, even the listed firms (both on the official market and on the development enterprise market) have concentrated ownership structure, with most firms being managed by their main owners. As far as unlisted firms are concerned, the owners are mostly the managers. Hence, corporate governance inducing a higher level of hedging is unlikely to hold in Mauritius. Being closely-held ones, local firms do not need corporate governance to strive for higher market values.

Foreign Currency Debt

Foreign currency debt can also be used as a hedging device. This could occur either by borrowing from a local bank in foreign currency or directly borrowing in foreign currency from abroad. As clearly pointed out by Clark and Judge (2007), it is vital to distinguish between hedging instruments suited for short-term transaction exposures such as forwards, futures and options and those which are more appropriate for long-term multiple period foreign currency exposure such as currency swaps and foreign currency debt. However, a priori, it is expected that local firms, being more shortsighted and not very much concerned about long-term position, would tend to use more short-term hedging tools such as forwards rather than foreign currency debt.

Dividends

As aforesaid, since the local shareholdings structure is concentrated and managers tend to be the owners of the firms, the use of dividends as a signalling device does not affect hedging. Indeed, with most of the local firms being closely-held ones, independent of whether they are listed or not, there is no need to use either dividends or hedging to send a positive signal to the market (mainly for the listed firms).

Operational Hedging

How exchange rate fluctuations affect the cash flow of multinational corporations has been the subject of much empirical research in economics and finance. Exchange rate movements directly affect these firms' cash flows and asset and liability values. Subsequently, most of the estimates of foreign exchange risk have focused on the exposure of multinational companies. This had led to the testing of whether operational hedging could act as a substitute or complement to financial hedging. However, such testing does not benefit the local context, since locally-established ones do not have subsidiaries abroad. There might be only a marginal number of multinationals. Consequently, the element of operational hedging is not of much importance in Mauritius. Besides, as pointed out by Kim *et al.* (2006), "For most exporting firms, the need for financial hedging should be greater since they are not operationally-hedged or less-hedged." Therefore, unlike prior studies which have focused exclusively on multinational corporations, this paper focuses on foreign exchange exposure of local firms.

Practical Side of the Picture

An interesting finding that was noted while going through the financial statements is that the following ways were mentioned by local firms as to how they hedge their foreign exchange risk exposure:

- Cash buffers/profits since exchange rate is managed on an ongoing basis;
- Maintenance of bank accounts in foreign currency;³
- Use of forward contracts; and
- Use of debt denominated in a foreign currency⁴

The classification bodes well the fact that hedging is basically meant for short-term risk rather than long-term risk. The above list has been classified in decreasing order of usefulness, i.e., the first one is used overwhelmingly by firms which are affected by foreign exchange risk. The last one is found to be used only by a few firms. Based on the above list, the most widely used hedging device consists of the degree to which the company has plenty of cash or profits (eventually to be converted into cash) so that it can withstand any foreign exchange risk. Indeed, Nance *et al.* (1993) argue that companies might use their profits as substitutes to the use of currency derivatives. Therefore, more profitable companies would be less likely to use currency derivatives. Hence, while analyzing the significance of forward contracts among local firms, it becomes sensible to consider its main substitutes which are in the form of cash/profits level and bank accounts denominated in foreign currencies.

³ The solution is to see whether they report their assets and liabilities in foreign currencies to make them eligible for the analysis.

⁴ But this holds merely for a marginal number of companies.

Data and Econometric Model

A priori, as has been underscored several times in the empirical literature, the playing field should be leveled at the beginning of any analysis of hedging foreign exchange risk by incorporating in the sample only firms which are *ex ante* exposed to such type of risk. Alternatively stating, only those companies whose activities make them a likely candidate for exchange rate risk are considered. In that respect, the study considers about 400 firms. This paper sheds light on this question by studying the behavior of a sample of non-financial Mauritian companies for the year 2005-06. The analysis undertaken is extensive, as it focuses on importers, exporters,⁵ and listed and unlisted firms.

All the data were hand-collected from the Registrar of Companies. A priori, the sample under consideration should exclude financial firms (banks, and investment and insurance companies). The rationale is that hedging tends to characterize the non-financial sector, while speculation is more prevalent among the financial counterpart.⁶ Utilities have been overlooked in the analysis. They comprise Central Water Authority, Central Electricity Board, the State Trading Corporation and the Mauritius Sugar Syndicate (since government is involved there). Apart from being a utility company, the Mauritius Sugar Syndicate was ignored since it is the most active and dynamic hedger in Mauritius.

Theoretically, a larger sample of importers and exporters was considered and their financial statements were properly examined to see whether they hedge or not. It was considered improper to dichotomize the sample into importers and exporters respectively due to the fact that many exporters were also importers in one way or another, the most common pertaining to the imports of raw materials.

While collecting data, it is imperative to ensure that nowhere has it been mentioned that derivatives are used for speculative purposes, compatible with the fact that hedging constitutes the main motive for hedging among non-financial firms. Indeed, under the financial instruments section, the firm should display information pertaining to all risks that it is subject to. The most common risk identified was credit risk related to trade payables.

Contribution to Empirical Literature

This research investigates the foreign exchange risk exposure and hedging features of Mauritian companies. As a matter of fact, none of the previous studies analyzed the determinants of hedging for firms in developing countries; more emphasis was given to developed countries due to data availability. Some cross-country analyses have been done, but they have been criticized on the basis of too much heterogeneity in the degree to which firms behave. Hence, it is considered better to focus on a specific country with a view to deriving more reliable results pertaining to the determinants of hedging.

⁵ Technically speaking, the sample should be biased towards importers based on the depreciating rupee; however, since many exporters are also importers, they were included in the analysis.

⁶ Both hedgers and speculators make up the derivatives market.

Hedging Model

As per Gezcy *et al.* (1997), the hedging decision model is specified as follows with some ramifications, with the objective of having cleaner proxies and also to be consistent with the Mauritian context:

$$D_i = f(R\&D, Liquidity, Profit, Size, Tang, Age, Growth, Distress) \quad \dots(1)$$

where,

- Size* : Natural logarithm of total assets
- R&D* : Capital expenditures over total assets
- Liquidity* : Quick ratio and cash over total assets
- Profit* : Net profit over total assets
- Age* : Log of number of years of existence as from the year incorporated
- Tang* : Tangibility of assets denoted by fixed assets over total assets
- Growth* : Percentage change in total assets
- Distress* : Leverage over total assets, interest coverage ratio, and a dummy variable that is equal to one in case debt and quick ratio level is, respectively, above and below the sample's mean.

Both probit and logit models are used in the estimation process. The dependent variable, D_i in Equation (1) is a binary one, i.e., it takes the value of one in case the firm hedges and zero otherwise. The hedging decision is considered to be a linear function of the independent variables. The benefit of using the binary variable is that it obviates the use of notional amounts of derivatives buffeted by noisy disclosures due to aggregation and netting.

The above model overlooks the accuracy variable since, in Mauritius, we do not have variable for analyst forecast accuracy to proxy for asymmetric information. Nevertheless, a priori, no major distinction is anticipated, bearing in mind the high level of insider ownership prevailing in Mauritius. In a parallel manner, the tax variable has been ignored since the tax function convexity is inapplicable in Mauritius, where the firms are subject to a flat tax system rather than a progressive tax system.

Financial Distress Cost Hypothesis

In order to capture this variable, leverage over total assets is used with a positive relationship expected between these two variables. Leverage is defined as all loans and leases.

Expertise in Hedging

Effort is made to capture the expertise level by the age of the company based on the fact that expertise is considered to be important in the practice of hedging. Age is measured

as the natural logarithm of the number of years lapsed since the date of incorporation. A positive relationship is posited between age and hedging.

Profitability

It is expected that not only liquidity but also profitability may have an impact on the hedging decision or the extent of hedging. Hence, it becomes vital to incorporate profitability to gauge the degree to which it acts as an effective substitute to hedging with forwards. In that respect, profitability should unleash a negative impact on hedging.

Tangibility of Assets

The more tangible are the firm's assets, the greater is its ability to issue secured debt. Since foreign debtors are more likely to demand collateral, companies with higher tangible assets will be more likely to borrow from abroad. These companies would be more likely to keep unhedged positions; therefore a negative relationship is expected between tangibility and the use of currency derivatives.

Size

Size is used to reflect the fact that bigger firms are more susceptible to engaging in risk management by virtue of economies of scale. In fact, the economies of scale involved in establishing a hedging program constitute a common explanation for the relationship between size and hedging. Above all, there are fixed costs in setting up a derivatives program. Previous empirical studies find a strong positive relationship between the size of the firm and the likelihood of hedging activity (Mian, 1996; Geczy *et al.*, 1997; Haushalter, 2000; Allayannis and Ofek, 2001; and Graham and Rogers, 2002). We include size—the logarithm of total assets—to control for the size effect. A positive relationship between size and hedging is expected to exist. Furthermore, it is most likely that larger firms have a larger risk exposure relative to smaller firms.

Liquidity

We also include the quick ratio (*QUICK*)—current assets less inventories divided by current liabilities—to measure the availability of internal funds (Geczy *et al.*, 1997). Quick ratio is used as a proxy for the state of the liquidity of the firm. A negative relationship is expected between *QUICK* and hedging activities. Cash over total assets is also used as a proxy for another potential substitute for hedging in Mauritius. Indeed, in case foreign exchange risk does not significantly affect the assets or liabilities of the company, sufficient maintenance of cash constitutes the best way to withstand the foreign exchange rate risk.

Growth Opportunities

Froot *et al.* (1993) argue that given capital market imperfections, the firms would hedge in order to mitigate their underinvestment problem. Therefore, firms with higher growth opportunities are more likely to use currency derivatives. Companies' growth opportunities are defined as the ratio of capital expenditure to total assets. The empirical literature has

used R&D costs over total assets to proxy directly for R&D. However, in Mauritius, R&D is practically nonexistent among the local firms. Local firms are not much involved in R&D; indeed, even the larger firms, when compared to international firms, are relatively much smaller in size. The best feasible way present to capture such a variable is the level of capital expenditure, captured by the purchase of fixed assets. So, investment is mainly focused towards acquisition of vehicles with a view to ensure higher production or to replace old machinery. A positive relationship is anticipated between hedging and capital expenditure in line with the underinvestment hypothesis.

It is assumed that hedging, financing and investment decisions are exogenously determined so that there is no need to have recourse to a simultaneous equations framework, as stated by Lin and Smith (2003).

Results

No multicollinearity problem surfaces, since among the independent variables, the highest correlation noted revolves around 0.41 (between cash and quick ratio). Therefore, the estimation model is ascertained of no multicollinearity issue that can perturb the regression results.

Interestingly, a perusal of the hedge dummy variable reveals that among the distinct independent variables considered, it has statistically significant correlation with both size and age. The positive correlation between size and the decision to hedge is undeniably attributed to significant economies of scale and hedging transaction costs. Hence, indirectly, prior to utilizing any regression model, it can be conjectured that size and age will entail important effects on the decision to hedge in Mauritius.

Under alternative forms of hedging, the use of foreign debt (Aabo, 2006; and Geczy *et al.*, 1997) was not testable, since merely four firms clearly reported the use of such type of debt in their financial statements. In the same vein, convertible debt of the issue of preferred stock is also not applicable in Mauritius. Alternatively stating, financial and operational hedges were deliberately omitted. In a parallel manner, it does not make sense to resort to dividend payout by unlisted firms as a signalling mechanism. The alternative forms of hedging that were tested are related to cash and liquidity.

Actual Sample Size and Heteroscedasticity

Among the 384 firms that were considered to have been affected by exchange rate risk as per their activity level, a further analysis of their financial statements reveals that under the financial instrument section, they did not mention exposure to foreign exchange risk, while credit risk was the one that was overwhelmingly faced. Hence to have a proper sample, it was deemed necessary to eliminate all those firms that either did not mention or report such exposure on the assumption that foreign exchange exposure was somewhat immaterial to them, not significantly impacting their cash flows. After this screening process, there were 286 firms, out of which 60 firms were on the hedging side, representing around 20.9% of the whole sample. The existence of outliers in some of the specific

variables handicapped the use of all the identified hedgers. Therefore, an elimination process was initiated so that 61 firms (comprising both hedgers and non-hedgers) had to be discarded, leaving a total of 225 firms, of which 47 were hedgers, again constituting around 20.9% of the remnant sample. To eliminate the heteroscedasticity problem, robust options were employed for all estimation techniques.

Univariate Analysis

The Pearson correlation coefficients between the dependent and the independent variables were analyzed. The results are presented in Table 1.

Multivariate Analysis

Decision to Hedge

As per the results are presented in Table 2, out of the five statistically significant variables, size emerged with a positive effect on the decision to hedge. Such a result is compatible with the prior empirical evidence where size was found to be the main underpinning for firms to hedge. The ongoing justification is linked to the economies of scale and transaction costs in hedging. Such a positive relationship was also found by Mian (1996). In the same vein, Tufano (1996) argues that managers will have a tendency to overinvest to maximize their utility, so the hedgers will tend to be the larger firms. The notion is that with hedging sending good signals for managers, the latter are able to take on projects without facing scrutiny from the capital markets. However, it is important to note that in the Mauritian context, many of these firms are unlisted. In that dimension, a possible explanation accounting for the size effect on the decision to hedge relates to the fixed costs involved in setting up a hedging program. But such a reason may appear questionable by virtue of the fact that, in Mauritius, forwards are being offered as a set of banking facilities by banks to their customers. In that respect, the fees and commissions may not be exorbitant as banks avail economies of scale in transactions. Factoring in these caveats, the most plausible reason pertaining to the size effect is that due to their larger activity base, larger firms have greater exchange rate risk and thereby find it lucrative to hedge with forwards, with the objective of saving funds from unexpected losses.

Regarding age, a positive and statistically significant impact is identified. The positive impact blends well with the fact that expertise constitutes an important factor so that with the increasing years following the date of incorporation, the firm is able to cope with any new derivative program. This shows that there is a tendency for well-established firms to be a part of the sample that comprises the hedgers. Above all, among the statistically significant variables, age emerged as the one embodying the highest statistical significance. This could imply that a new firm, though buffeted by foreign exchange rate risk, may find it somewhat risky to have recourse to forward contracts. Alternatively stating, this could also imply that, over time, as a firm builds on sufficient experience, it can identify areas where losses could be avoided by using derivatives such as forwards.

Table 1: Pearson Correlation Coefficients

	Hedge Dum	Net Profit	Cap. Exp.	Quick	Tang	Size	Leverage	Age	Growth	Cash
Hedge Dum	1.0000	0.1007	-0.0593	0.0194	-0.0233	0.1588	0.0888	0.1889	-0.0753	0.076
Net Profit	-	0.1320	0.3763	0.7722	0.7286	0.0172	0.1843	0.0045	0.2607	0.2653
Capital Expenditure	-	1.0000	0.0061	0.3097	-0.0835	0.0478	-0.2191	0.0036	0.0729	0.3108
Quick	-	-	0.9277	0.0000	0.2120	0.4752	0.0009	0.9570	0.2761	-
Tang	-	-	1.0000	-0.0799	0.3173	-0.0804	0.2112	-0.1159	0.2235	-0.0249
Size	-	-	-	0.2325	0.0000	0.2299	0.0014	0.0828	0.0007	0.7107
Leverage	-	-	-	1.0000	-0.1714	0.1180	-0.2073	0.0371	0.0927	0.4089
Age	-	-	-	-	0.0100	0.0773	0.0018	0.5800	0.1658	0.0000
Growth	-	-	-	-	1.0000	0.2385	0.3690	0.1799	-0.0675	-0.1538
Cash	-	-	-	-	-	0.0003	0.0000	0.0068	0.3134	0.0210
						1.0000	-0.0148	0.2927	0.0437	0.0082
						-	0.8248	0.0000	0.5147	0.9023
						-	1.0000	-0.0266	0.0405	-0.1941
						-	-	0.6917	0.5456	0.0035
						-	-	1.0000	-0.1840	-0.1836
						-	-	-	0.0056	0.0057
						-	-	-	1.0000	0.0486
						-	-	-	-	0.4682
						-	-	-	-	1.0000

Table 2: Determinants of the Decision to Hedge Under Probit and Logit		
	Dependent Binary Variable; 1 if hedges, 0 otherwise	
	Probit	Logit
Net Profit	1.5539 1.99*	2.6904 2.02*
Capital Expenditure	-0.3373 -0.2100	-0.4375 -0.1500
Quick Ratio	-0.1699 -0.9200	-0.2844 -0.8700
Tangibility	-1.0652 -2.02*	-1.7997 -1.96*
Size	0.1359 2.09*	0.2349 2.01*
Leverage	2.4647 2.72**	4.2905 2.57**
Age	0.4677 3.04**	0.8041 2.93**
Cash	1.4160 1.7100	2.2900 1.4900
Growth	-0.4838 -1.1200	-0.8873 -1.1100
Constant	-4.7207 -4.08**	-8.1199 -3.84**
Wald $\chi^2(9)$	27.2000	24.68
Prob. > χ^2	0.0013	0.0033
Pseudo R ²	0.1126	0.1106
Log Likelihood	-102.327	-102.5583
Number of Obs.	225	225
Note: * and ** denote statistical significance at 5% and 1% level, respectively.		

Prior research has underscored the significance of underinvestment in the sense that firms subject to investment opportunities and constrained by funds are more susceptible to hedge (Fazzari *et al.*, 1988; Froot *et al.*, 1993; and Kaplan and Zingales, 1997). However, as mentioned earlier, in Mauritius, there is practically no scope for R&D like in foreign firms. The best way that R&D expenditure can be captured relates to the purchase of fixed assets. In that vein, information on capital expenditure was gleaned from the cash flow

section of their financial statements. The results show that such a variable has no effect on the decision to hedge, irrespective of the logit or probit model used. Linking such finding with the net profit result, it could be conjectured that hedgers in Mauritius are usually big firms that have established a firm and sound business operational status so that they tend to be awash with funds, thereby unleashing little scope for the underinvestment problem to occur and eventually lesser motive to hedge. Another explanation is based on the investment opportunity in Mauritius, whereby due to high upfront investments in certain industries, many firms have already ensured their market share, so that there is no room for aggressive investment, to consistently keep an edge over their competitors.

Among the statistically significant variables, net profit came out as the one having the second highest economic significance just after leverage. This signifies that profitable firms are more likely to hedge relative to less lucrative ones. Such a finding, though not uncovered in prior empirical evidence, nevertheless is found to be robust for a developing country like Mauritius. Hence, this shows as to why firms, though buffeted by foreign exchange risk under a somewhat high exposure, may not have recourse to hedging because they are making losses. As a matter of fact, this research constitutes the first piece of research pertaining to determinants of hedging for a developing country. Besides, it can also be considered that companies which have larger size are the well-established ones with high net profits.

Among the independent variables which are statistically significant, only tangibility has the negative sign, which is consistent with the previous empirical finding that firms with higher tangible assets are more likely to borrow from abroad, so they prefer to have an alternative hedging strategy without using forwards. But while scanning through the financial statements of these firms, only a marginal number of firms (five to six) admitted that they borrow from abroad. Hence, the negative impact of tangibility is not clearly explainable in this context. The most plausible explanation could be that firms having higher levels of fixed asset can easily absorb losses emanating from exchange rate risk, so they prefer not to hedge with forwards. Or, a still better explanation could be that these larger firms have monopoly power in their field of operation, so any exchange rate loss is merely transferred to the customers, ruling out the purpose for them to hedge. Indeed, in the car dealer study mentioned earlier, it was found that the car dealers prefer to pass on the loss of exchange rate onto their customers via higher selling prices.

The quick ratio entails a negative impact on the decision to hedge, which is theoretically consistent with the fact that liquidity acts as a non-derivative form of hedging (Adam, 2002). The negative sign bodes well the fact that firms having greater liquidity can be viewed as bold exchange rate risk shock absorbers, and there is lesser incentive for them to hedge. An interesting feature of this result is that even firms subject to foreign exchange rate risk do not take recourse to hedging with forwards because their exposure is not high enough and can easily be managed on an ongoing basis via maintenance of ample liquidity. However, the quick ratio is not a statistically-significant symptomatic to liquidity, not really working as an effective alternative to hedging in Mauritius.

The growth variable unleashed a negative and statistically insignificant impact on the dependent variable. Hence, generalizing such a result for developing countries, it can be posited that the underinvestment problem does not matter so much as to stimulate firms to hedge. A plausible explanation is based on the characteristic of these firms. Being unlisted, these firms attempt to optimize their resource allocation, so hedging does not serve its purpose as a signalling tool to outsiders. Higher growth does not imply hedging in case the firm has little exchange rate risk. Another explanation is linked to knowledge and expertise related to the use of derivative instruments. Indeed, it could be that these firms merely operate on conventional basis without factoring in any new financial tools that they could use to enhance their profits. A third explanation, many times cited, relates to the complete transfer of exchange rate loss incurred to the customers.

As stated by Tufano (1996), cash variable was also tested to see whether cash buffers reduce the need for hedging with forwards. However, like the quick ratio, such a variable was found to be statistically insignificant. Hence, there is robust evidence that non-alternative forms of hedging do not work in Mauritius. Another potential explanation could be linked to the size of the foreign exchange risk exposure. It could be that the hedgers are mainly those firms which are heavily affected by exchange rate risk, and forwards give them an avenue to scale down losses from the depreciating rupee.

Finally, focusing on the leverage variable, it transpires that such a variable is imbued with not only very high statistical but also a very high economic significance relative to all other statistically and economically significant independent variables. Higher leverage firms tend to hedge with derivatives to mitigate the probability of financial distress costs. Hence, Mauritius also enjoys the financial distress cost hypothesis rationale for hedging. Indeed, Nance *et al.* (1993) clearly point out that hedging is motivated by two main factors—the probability that the firm is subject to financial distress costs if it does not hedge, and the eventual costs of bankruptcy.

Conclusion

This study analyzed the determinants of hedging in Mauritius. When analyzing hedging, it is vital to consider the characteristics of the local firms like concentrated ownership structure and flat tax system. In this respect, the estimation model did not take into consideration the convexity of the tax structure and managers' incentives to hedge since these two motives are not relevant in the case of Mauritius. In the same vein, financial and operational hedges were deliberately omitted on the ground of their irrelevance in the local context.

Subsequently, the other hypotheses, such as underinvestment, financial distress costs, and alternative forms of hedging, were tested. Results showed that under the binary metric, net profit, tangibility, size, leverage and age were found as the important variables explaining the decision to hedge. In contrast to the argument advanced by Nance *et al.* (1993), evidence was found that profits of companies do not act as substitutes to the use of currency derivatives due to a positive relationship between net profits and the decision

to hedge. Besides, the analysis also showed in consistence with prior empirical evidence, that size does matter in the decision of whether to hedge or not. Moreover, the fact that older firms were found to have a higher incentive to hedge may be attributable to a rise in their activity level or an increase in knowledge in the use of derivatives.

The research made the following contributions. First, it provided evidence pertaining to the decision to hedge in the case of a developing country, where country-specific factors need to be given due consideration. Second, the age proxy has not been employed in previous studies. The most plausible explanation is that foreign firms are very dynamic, so the age is not a problem. However, in the case of a developing country, years of establishment are vital and this also matters during the learning curve process, whereby the companies start to have a sense of maturity in their operations. Besides, business cycles usually occur after electoral cycle to the effect that successful establishments pose lesser risk to these problems. Third, this study proposes the use of capital expenditure as the best proxy to reflect R&D, since the latter is practically nonexistent in developing countries.

Limitations: However, analyzing the other side of the coin, certain limitations have been identified. It is not feasible to directly measure the foreign exchange rate risk exposure level⁷, which becomes vital in the case when even smaller firms hedge, so the size may not be an important determinant in the case of a developing country subject to a depreciating local currency. The rationale is that even smaller firms hedge when there is an ongoing loss of reserves due to the depreciating rupee. Such a finding benefits the local context where commercial banks provide forwards under a whole range of banking facilities. Besides, a major hitch of this study relates to the hedging metric applied. Due to data limitations, it is not feasible to have the continuous measure that would enable a full-fledged analysis or a general picture of whether hedgers are more tilted towards the long or the short position. Three distinct versions of the notional amount could be used: first, each position can be examined separately (long and short position, respectively); then, net long position (i.e., long position minus short position); and finally, the total position (long plus short position). By implementing these analyses, it is anticipated that more insights pertaining to the determinants of hedging foreign exchange risk using forward contracts can be gained.

Implications: Indirectly, this study showed that the extent of financial market development does matter when it comes to the use of derivatives. For instance, absence of operational hedging and convertible debt signifies that other forms of hedging may be used. In this context, local hedgers widely use forward contracts due to a myriad of reasons. First, these forwards are linked to the rupee and this may further signify that they may be reluctant to use foreign currency futures which are linked to another currency. Second, as mentioned earlier, these forward contracts are provided under a range of banking facilities (letter of credit, overdrafts, loans and others) so that the bank can reduce its commissions.

⁷ In fact, companies do not display their level of foreign sales in their financial statements.

Third, companies often have some negotiating power when contracting forward contracts with banks, chiefly in case of involvement of considerable amount of foreign currencies.

Currently, Mauritius is going through a new phase of development following the approval of FSC to Financial Technologies Ltd. to set up commodity derivatives in Mauritius. Time will tell the degree to which hedging activities will be of real blessing to Mauritius. Nevertheless, it would be sufficient to say that hedging can be devastating, as has been in the case of Air Mauritius Ltd. and State Trading Corporation, in case wrong decisions are taken. ❖

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