Exchange-Rate Hedging: Financial vs. Operational Strategies

By George Allayannis, Jane Ihrig and James P. Weston*

Exchange-rate exposure is an important source of risk for multinational corporations. To mitigate the impact of exchange-rate fluctuations, it has been claimed that multinational corporations can employ risk management strategies not only through financial derivatives, but also through operational hedges. For example, Schering-Plough in its 1995 annual report (page 25) argues in support of exclusive use of operational hedges: "To date, management has not deemed it cost-effective to engage in a formula-based program of hedging the profitability of these operations using derivative financial instruments. Some of the reasons for this conclusion are: The Company operates in a large number of foreign countries; the currencies of these countries generally do not move in the same direction at the same time". Conversely, many corporations with large worldwide networks, such as IBM or Coca Cola, make extensive use of derivative financial instruments.

This paper investigates both financial and operational exchange-rate risk management strategies of multinational firms. While several studies have examined either firms' financial hedging or firms' operational hedging activities, no study thus far has examined financial and operational hedging simultaneously for a large cross-section of firms. To the extent that the decision to use financial hedging strategies is related to (and affected by) the operational strategies that a firm employs, it is important to examine how each strategy contributes to the overall goal of mitigating risk and improving shareholder value.

Using a sample of U.S. multinational nonfinancial firms between 1996-1998, we find that operational hedging is not an effective substitute for financial risk management.[1] However, we find that the more geographically disperse a firm is, the more likely it is to use financial hedges. The end result on firm value is that operational hedging strategies benefit shareholders only when used in combination with financial hedging strategies.

I. The Use of Financial and Operational Hedging Strategies

In this study we use four proxies for a firm's operational hedging: (1) the number of countries that it operates in, (2) the number of broad regions it is located in,[2] (3) the geographic dispersion of its subsidiaries across countries, and (4) the geographic dispersion of its subsidiaries across regions. Most of these measures of operational hedging strategies are significantly, positively correlated. For example, the correlation between the country dispersion index and the number of countries (regions) is 0.86 (0.86).

Geographic dispersion is constructed with the Hishman-Herfindahl concentration index over all the countries or regions that a firm operates in. For example, our third measure of geographic dispersion for firm i is calculated as:

$$Dispersion_i = 1 - \sum_{j=1}^{K} \left[\frac{\#Subs_j}{Total\#Subs_i} \right]^2 \tag{1}$$

where K is the total number of countries that firm i operates in. This measure has a value close to one if the firm has subsidiaries in many countries and a value of zero if the firm has subsidiaries in only one country.

We begin by examining whether the use of operational hedges affects the exchange-rate risk of corporations. We create a measure of exchange-rate exposure for each firm using a two-factor model as in Philippe Jorion (1990). In this model, the dependent variable is the rate of return on each firm's stock and the two factors are the rate of return on the market portfolio and an exchange-rate index. We estimate a firm's exposure, for each firm-year, by estimating the coefficient on a monthly firm-specific exchange-rate index using monthly return data during the three years surrounding the particular year.[3]

Exchange-rate exposure is then regressed on the use of financial and operating hedges as well as the percent of overall revenues from abroad. The financial hedge variable is an indicator variable set

equal to one if the firm has foreign currency derivatives or uses foreign debt.[4] If firms use currency derivatives or foreign debt as a hedge, then we should expect a negative relationship between the use of financial hedges and exchange-rate risk. Similarly, if firms use geographic dispersion as a means to hedge exchange-rate risk, then we should expect a negative relationship. *Ceteris paribus*, the higher the percent of revenues that are generated abroad, the higher the exposure.[5]

Table 1 presents the results of OLS regressions using all firm-years (1996-98), but similar results are obtained in tests by year. Consistent with Wayne Guay (1999) and Allayannis and Ofek (2000), we find a negative and significant relationship between exchange-rate exposure and financial hedges, indicating that firms use currency derivatives and foreign debt as hedges. We include foreign sales as a fraction of total sales as is used in most studies of financial hedging to proxy for a firm's exchange-rate exposure. Here, however, we emphasize that the foreign sales ratio is not highly correlated with our measures of operational hedging. For example, the correlation between foreign sales to total sales and the number of regions (countries) is only 0.19 (0.22), suggesting that earlier studies did not appropriately control for operational hedging. In our tests, we find no significant relationship between the foreign sales ratio and exchange-rate exposure.

The coefficient on each of the four measures of dispersion is positive and in some cases significant. This indicates that firms that are geographically disperse have relatively high exposures. A firm that increases its countries (regions) of operation by one, on average, increases exposure by 0.003 (0.016). That is, a one percent appreciation in the dollar will reduce the average firm's return by an additional 0.3 (1.6) percentage points with the additional country (region). If a firm (such as Schering-Plough) employs only operational hedges, then such a strategy does not reduce its exposure, on average. Overall, our results suggest that operational hedging is not an effective substitute for financial risk management. We therefore consider whether firms employ operational strategies in isolation or in conjunction with financial strategies.

To determine whether financial and operational hedges are complements or substitutes we use a model similar to Christopher C. Geczy, Bernadette A. Minton and Catherine Schrand (1997). Specifically, we regress our financial hedge dummy variable on our various measures of operational dispersion along with standard control variables that proxy for alternative theories of hedging. Table 2 presents the results of logistic regressions on whether or not a firm uses financial hedges.[6] The coefficient on the foreign sales ratio is significant and positive, indicating that the more foreign sales a firm has, the higher is the probability that it uses financial hedges.

All four regressions show a positive and significant relationship between the geographic dispersion measure and the use of financial hedges. For example, a firm that increases its countries (regions) of operation by one, on average, increases the probability it uses financial hedges by 6 (25) percent. These results suggest that firms that are geographically disperse do not rely exclusively on their dispersion as a means to hedge foreign exchange rate risk. Rather, they tend to complement dispersion with the use of currency derivatives. In this sense, Schering-Plough is the exception, rather than the rule.

II. Firm Value, Financial and Operational Hedging

In section I we find firms that use operational hedges do not lower their exchange-rate risk; however, on average, firms that are employing operational hedging strategies, are more likely to use financial hedging strategies which do reduce exchange rate risk. In this section, we investigate whether the use of financial and operational risk management strategies together create shareholder value. We expect that the operational strategies should add value to the firm only if they are used in conjunction with financial risk management.

In this test, we follow closely George Allayannis and James P. Weston (2000). Firm value, as proxied by market to book, is regressed on standard controls as well as our measures of operational

hedges and an interaction term between the operational and financial hedging variables. We expect the coefficient on the interaction term to be positive, indicating that firms that are disperse and use financial derivatives improve value. Conversely, we do not expect that operational hedges alone are value-increasing.

Table 3 reports results of OLS regressions.[7] As found in other studies, the coefficient on the foreign sales ratio is negative and significant. Consistent with our hypothesis, we find that operational hedges alone are not significantly related to value. However, when used in conjunction with financial hedges, operational hedges are significantly positively related to value. In all cases, the positive effect of financial hedges on firm value offsets the negative effect of dispersion. For example, the elasticity of firm value with respect to the number of countries is -0.03 when the firm does not financially hedge but +0.04 when it does. Similar results are obtained for all measures of operational hedging.

III. Conclusions

This paper investigates the importance of financial and operational hedges as tools for managing foreign currency exposure. By developing several alternative measures of geographic dispersion that proxy for the use of operational hedging strategies, we find that geographic dispersion through the location of subsidiaries across multiple countries or regions does not reduce exchange rate exposure. In contrast, firms' financial hedging strategies are related to lower exposures. In addition, we find that geographically disperse firms are more likely to use financial hedges to protect themselves from exchange rate risk. Consistent with these findings, we find that while firms' operational hedges are not associated with higher value, the use of operational hedges in conjunction with foreign currency derivatives improves firm value. Hence, firms that rely exclusively on operational hedges for their exchange-rate risk management may not maximize shareholder value.

* Allayannis: Darden Graduate School of Business Administration, University of Virginia, PO Box 6550, Charlottesville, VA 22906; Ihrig: Division of International Finance, Federal Reserve Board, 20th and C Streets NW, Washington D.C. 20551; Weston: Jesse H. Jones Graduate School of Management, Rice University, Houston, TX 77005. We would like to thank Cynthia Petruska and Sadayuki Ono for invaluable research assistance. The views in this paper are solely the responsibilities of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of other members of its staff.

[1] Our dataset consists of all COMPUSTAT companies for which there exists level-1 subsidiary data from the National Registry. The final sample consists of 265 firms over three years for a total of 795 firm-year observations. Balance sheet and income statement information is from COMPUSTAT. Return data is collected from CRSP. The foreign currency derivatives data is collected from the footnotes of the annual reports for each firm-year. Data is available from the authors upon request.

[2] We divide the world into ten major regions: NAFTA, Europe, Remaining Western Europe, Advanced Asia, Other Asian, Eastern Europe, Central and South America, Africa, Middle East and South East Asia.

[3] For example, for the exposure of firm i, in 1997, we use monthly returns between 1996:1 and 1998:12. The exchange rate index is computed for each firm using an equal-weighted portfolio of exchange rates over all countries that a firm has foreign subsidiaries in.

[4] For example, International Paper states in its 1995 annual report (page 61): "The Company has a policy of financing a portion of its investments in overseas operations with borrowings denominated in the same currency as the investment...The purpose of this activity is to provide a hedge against fluctuations in exchange rates".

[5] For this test, we only use positive exchange-rate exposures. See Jia He and Lilian Ng (1998) and George Allayannis and Eli Ofek (2000) for a detailed explanation of the issue.

[6] Coefficients on the control variables are consistent with earlier literature: the interaction between R&D expenditures and debt-to-equity is negative and significant; size and the percent of shares owned by institutions are positive and significant.

[7] Coefficients on the control variables are in line with what earlier literature finds: size, industrial diversification, and leverage are negatively related to value; growth opportunities and profitability are positively related value.

References

Allayannis, George and Ofek, Eli. "Exchange Rate Exposure, Hedging, and the Use of Foreign Currency Derivatives," forthcoming, Journal of International Money and Finance, 2000.

Allayannis, George and Weston, James P. "The Use of Foreign Currency Derivatives and Firm Market Value," forthcoming, Review of Financial Studies, 2000.

Geczy, Christopher C; Minton, Bernadette A. and Schrand, Catherine. "Why Firms Use Currency Derivatives?," Journal of Finance, September 1997, 52(4), pp. 1324-1354.

Guay, Wayne. "The Impact of Derivatives on Firm Risk: An Empirical Examination of New Derivative Users," Journal of Accounting and Economics, January 1999, 26(1-3), pp. 319-351.

He, Jia and Ng, Lilian K. "The Foreign Exchange Exposure of Japanese Multinational Corporations", Journal of Finance, April 1998, 53(2), pp. 733-753.

Jorion, Philippe. "The Exchange-Rate Exposure of U.S. Multinationals," Journal of Business, July 1990, 63(3), pp. 331-45.

Lang, Larry H. P. and Stulz, Rene M. "Tobin's q, Corporate Diversification, and Firm Performance," Journal of Political Economy, December 1994, 102(6), pp. 1248-80.

Stulz, Rene M. "Optimal Hedging Policies," Journal of Financial and Quantitative Analysis, June 1984, 19(2), pp. 127-40.

TABLE 1 – GEOGRAPHICAL DISPERSION
AND EXCHANGE RATE EXPOSURE

Dependent Variable: Exchange Rate Exposure > 0				
Financial Hedge Dummy	-0.295**	-0.332**	-0.277**	-0.283**
	(0.133)	(0.131)	(0.132)	(0.131)
Foreign/Total Sales	-0.045	-0.077	-0.053	-0.055
	(0.174)	(0.177)	(0.180)	(0.179)
Dispersion Index (All Countries)	0.142	–	–	–
	(0.159)	–	–	–
Dispersion Index (All Regions)	–	0.309*	–	–
	–	(0.181)	–	–
ln(# of countries)	–	–	0.035	–
	–	–	(0.058)	–
ln(# of regions)	–	–	–	0.070
	–	–	–	(0.097)
R^2	0.017	0.023	0.017	0.017
obs	508	508	508	508

Note: Standard errors are reported below coefficient estimates. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

Table 2 – GEOGRAPHICAL DISPERSION
AND FOREIGN CURRENCY DERIVATIVES

Dependent Variable: Financial Hedge Dummy				
Foreign/Total Sales	1.492***	1.486***	1.369***	1.386***
	(0.463)	(0.455)	(0.470)	(0.464)
Dispersion Index	1.799***	–	–	–
(All Countries)	(0.335)	–	–	–
Dispersion Index	–	1.451***	–	–
(All Regions)	–	(0.408)	–	–
ln(# of countries)	–	–	0.725***	–
	–	–	(0.140)	–
ln(# of regions)	–	–	–	1.062***
	–	–	–	(0.232)
R^2	0.293	0.274	0.290	0.283
obs	756	756	756	756

Note: Standard errors are reported below coefficient estimates. ***, **,* denote significance at the 1%, 5% and 10% levels, respectively.

TABLE 3 – GEOGRAPHICAL DISPERSION,
HEDGING, AND FIRM VALUE

Dependent Variable: ln(Market-to-book)				
Foreign/Total Sales	-0.247***	-0.251***	-0.257***	-0.251***
	(0.083)	(0.083)	(0.083)	(0.083)
Dispersion Index	-0.051	–	–	–
(All Countries)	(0.091)	–	–	–
Dispersion Index $*I_{FCD>0}$	0.167**	–	–	–
	(0.082)	–	–	–
Dispersion Index	–	-0.098	–	–
(All Regions)	–	(0.107)	–	–
Dispersion Index $*I_{FCD>0}$	–	0.218**	–	–
	–	(0.105)	–	–
ln(# of countries)	–	–	-0.027	–
	–	–	(0.037)	–
ln(# of countries)$*I_{FCD>0}$	–	–	0.066**	–
	–	–	(0.031)	–
ln(# of regions)	–	–	–	-0.032
	–	–	–	(0.053)
ln(# of regions)$*I_{FCD>0}$	–	–	–	0.085**
	–	–	–	(0.039)
R^2	0.617	0.616	0.618	0.617
obs	665	665	665	665

Note: Standard errors are reported below coefficient estimates. ***, **,* denote significance at the 1%, 5% and 10% levels, respectively.