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THE ECONOMIC EXPOSURE OF U.S. MULTINATIONAL FIRMS

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Abstract

In this paper we find that the exchange rate exposure of individual firms increases with the return horizon. Also, the cross-sectional differences in the magnitude of exposure of individual firms are significantly related to firm size but not to the relative portion of foreign sales to total sales. The empirical evidence is consistent with the hypothesis that hedging activities exhibit economies of scale, and, consequently, the magnitude of economic exposure is less for larger firms than for smaller firms.

I. Introduction

Changes in the relative price of domestic and foreign goods are widely believed to influence the current and future expected cash flows of multinational firms. The value of multinational firms should react to (nontransitory) movements in exchange rates. The empirical evidence, however, provides little corroboration that changes in exchange rates affect stock returns.

Jorion (1990), using monthly returns on a sample of 287 U.S. multinational firms, finds that exchange rate exposure is heterogeneous across firms. The degree of exposure is positively related to the ratio of foreign sales to total sales, but only a few firms in the sample exhibited statistically significant exposure. Using monthly returns on twenty industry portfolios formed from the universe of New York Stock Exchange (NYSE) stocks, Jorion (1991) reports that most industry portfolios do not exhibit statistically significant exchange exposure. He

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concludes that foreign exchange risk is not priced and that hedging is unnecessary. Similarly, Amihud (1993) finds no significant contemporaneous exchange rate exposure for the thirty-two largest U.S. exporting firms from 1982 to 1988. Classifying all firms on the University of Chicago's Center for Research in Security Prices (CRSP) file into two-digit industry portfolios, Bodnar and Gentry (1993) observe that only eleven of thirty-nine industries exhibit significant exchange rate exposure from 1979 to 1988.

In this paper we document the existence of exchange rate exposure using stock returns on four U.S. diversified equity portfolios and a sample of 213 U.S. multinational firms. Because exchange rate changes can have short- and long-term effects, we employ return horizons that vary from one to sixty months. We find that exchange rate exposure becomes more significant as the horizon lengthens and that the magnitude of this exposure is unrelated to foreign sales but significantly, inversely related to firm size. We also find that small firms tend to be negatively exposed while large firms tend to be positively exposed.

The effects of exchange rate changes on a firm's cash flows are conventionally classified as either transaction or economic exposure. Transaction exposure—the effect of exchange rate changes on cash flows between the time a transaction is "booked" and when it is "settled"—is short term. Economic exposure—the effect of exchange rate changes on a firm's long-term cash flows—is long term. Furthermore, transaction exposure, especially from commitments such as receivables and payables, is typically considered straightforward to evaluate and hedge. To the extent hedging is effective, the short-term effect of exchange rate changes on a firm's stock price is mitigated. Economic exposure, in contrast, is difficult to ascertain and not easily hedged. The effect of long-term exchange rate changes will be impounded in a firm's stock price only as information about future cash flows are revealed over time. By examining both short- and long-term exchange rate changes, we can analyze the effect of economic exposure in a manner not previously attempted.

Our approach parallels Bartov and Bodnar (1994), who contend that stock prices may not respond instantly to changes in exchange rates. Mispricing may arise from systematic errors by investors as a result of the complex set of issues involved in modeling and estimating the relation between fluctuations in the dollar and firm value.[1] The complexities include identifying the possible asymmetrical effect of currency appreciation and depreciation on firm value, determining the extent to which a currency movement is temporary or permanent, and assessing how real internal and strategic activities by the firm may be altered in response to new competitive conditions arising from exchange rate changes.

[1]Fama (1990) makes a similar argument. The effect of changes in aggregate production is impounded in stock prices only as information about real economic growth is revealed in future periods.

Unlike Bartov and Bodnar (1994), we do not regress short-horizon returns on lagged exchange rate changes in the dollar, nor do we confine our analysis to firms with foreign currency adjustments that are negatively correlated with changes in a trade-weighted U.S. dollar exchange rate. We regress long-horizon stock returns on corresponding long-horizon exchange rate changes and consider firms that are both positively and negatively exposed. Long-horizon stock returns are better suited for detecting long-term exchange rate effects on firm value than are short-horizon stock returns.

Because short-term transaction exposure management is widespread, we expect to find no significant differences in the short-horizon exposures of large and small firms. The extent to which a firm faces economic exposure is affected by its long-term exposure hedging activities. Because of the significant costs and important economies of scale in hedging, firms of different sizes hedge to different degrees. We contend that the magnitude of economic exposure is less for large firms than for small firms.

Nance, Smith, and Smithson (1993) argue that the likelihood of hedging is directly related to firm size.[2] In addition, economies of scale exist in the acquisition of information necessary to implement hedging programs (Block and Gallagher (1986)). Moreover, financial instruments used for hedging exhibit significant transaction cost economies of scale. Large firms have a greater economic incentive to hedge than smaller firms because the information and transaction costs of hedging may be sufficiently lower for large firms.

II. Managing Foreign Exchange Exposure

Transaction Exposure Management

The objective of transaction exposure management is to preserve the home currency value of foreign currency transactions. Dufey and Srinivasulu (1983) maintain that in an imperfect market where transactions are costly, a firm should manage its foreign exchange risk, especially if its default risk is affected. Shapiro and Titman (1985) propose that total, not just systematic, risk matters. Firms with higher total risk, other things equal, are more likely to experience financial distress that can disrupt the real operations of the business by adversely

[2]Whether large firms hedge more than small firms is, ultimately, an empirical question. Nance, Smith, and Smithson (1993) point out two reasons small firms are more likely to hedge than large firms. First, Warner (1977) finds that the direct costs of financial distress are less than proportional to firm size, so small firms have more incentive to hedge such costs. Second, small firms are more likely to be in the progressive region of the tax schedule and, consequently, might reap higher potential tax shelter benefits from hedging. Our findings, together with those of Nance, Smith, and Smithson (1993), support the thesis that large firms hedge more than small firms in practice.

affecting risk-averse customers, employees, suppliers, and other corporate stakeholders. Hedging foreign exchange risk creates value, Smith and Stulz (1985) argue, by diminishing the variance of firm value and reducing the expected costs of financial distress.

Managing transaction exposure is a widespread practice. Rawls and Smithson (1989) report that in a 1989 Business International Corporation survey of 173 subscribers, 79 percent of the firms manage firm-commitment transaction exposure, and that nearly all of the firms use forward contracts and numerous other firms use swaps and options. Dolde (1993) finds that 85 percent of his sample of 244 Fortune 500 firms employ forwards, futures, swaps, or options to manage foreign exchange and interest rate risk. In an informationally efficient market, stock prices should immediately reflect the short-term effects of exchange rate changes. The widespread practice of hedging short-term foreign currency inflows and outflows can, however, sever the link between the short-term effects of exchange rate changes and short-horizon stock returns. Because firms of all sizes hedge transaction exposure, we do not expect to find significant short-horizon exchange rate effects.

Economic Exposure Management

Because only current, and not future, transactions are hedged in transaction exposure management, Pringle and Connolly (1993) show that firms that continually hedge current transactions through sequential hedges cannot eliminate the risk of unexpected exchange rate changes that occur between the dates when the hedges are implemented. Economic exposure can only be managed through operational hedges, where foreign currency inflows and outflows are matched so the amount of exposed cash flows are reduced.

However, since foreign currency inflows and outflows generally are not perfectly matched, an operational hedge may only provide partial protection against unexpected exchange rate changes. For example, Japanese automakers initially operated with extensive dollar-based revenues and extensive yen-based costs. In the first half of the 1980s, a strong dollar was beneficial. But the dollar's weakness after 1985 had an adverse effect on their yen-based profits. After significant investment in U.S. production facilities in the latter 1980s, the economic exposure of Honda, Nissan, and Toyota was reduced because their investments matched dollar-based revenues with dollar-based costs.

An operational hedge can be costly to implement since it influences the firm's international mix of marketing and production activities. Firm size may be a factor in the decision to implement an operational hedge since smaller firms may not have the resources to construct and manage international facilities. Agarwal and Ramaswami (1992), using the framework developed by Dunning (1988), find that when confronted with a choice of entering a foreign market via exporting, licensing, joint venture, or sole venture, large firms tend to choose a

sole venture while small firms tend to choose a joint venture or to not enter the foreign market.

Agarwal and Ramaswami (1992) also point out that a firm's level of international business experience sways foreign investment decisions: firms that have less international experience prefer noninvestment modes of business and firms that have more international experience prefer investment modes. To the extent that a complex, ongoing international organizational structure is required, only large firms may have the financial capability, managerial resources, and international experience to undertake an operational hedge.

If managing economic exposure entails high costs, small firms would be less likely than large firms to undertake economic exposure management, especially if small firms face more severe resource constraints. In addition, if operating, financial, or informational economies of scale exist, small firms face less favorable benefit-cost trade-offs than large firms. Thus, large firms are more likely to manage economic exposure. As a result, the foreign currency inflows and outflows of large firms should be matched to a greater degree than those of small firms so that the effect of exchange rate movements on the home currency cash flow streams of large firms is diminished relative to that of small firms. We anticipate that the magnitude of economic exposure is less for large firms than for small firms.

III. Estimating Exchange Rate Exposure

Economic exposure can be measured as the slope coefficient in a regression of a firm's stock returns against exchange rate changes (Adler and Dumas (1984)). As in Jorion (1990, 1991), we use actual exchange rate changes to proxy for unexpected changes in exchange rates. To assess the short-term and long-term effects of changes in exchange rates, we employ horizons ranging from one month to sixty months in our return regressions. All of the variables are measured in real terms, so the results are not sensitive to inflation or inflation changes. Because realized stock returns are the dependent variables, we include business condition variables that have been found to "explain" expected stock returns to ensure that our results are not confounded by macroeconomic events.

Fama and French (1989) argue that expected (excess) returns are low when economic conditions are strong and high when economic conditions are weak. They report that the dividend yield, default premium, and term premium manifest the same business-cycle patterns found in stock and bond returns. The dividend yield and default premium imbed the persistent long-term effect of business conditions, and the term premium imbeds the short-term effect. Collectively, these three factors capture the market's ex-ante expectations of the asset's returns.

Unexpected changes in stock and bond values associated with market revisions in interest rates and cash flows result in realized returns that deviate from ex-ante expectations. The extent to which these unexpected changes in value are correlated with unexpected changes in real exchange rates defines exchange rate exposure. We use the following multifactor model to estimate the exchange exposure in common stock returns:

$$R_{i,t+T} = \gamma_{i0} + \gamma_{i1}\text{XRTE}_{t,t+T} + \gamma_{i2}\text{DYLD}_{t-12,t} + \gamma_{i3}\text{DPRM}_t + \gamma_{i4}\text{TPRM}_t + \varepsilon_{i,t+T} \quad (1)$$

where $R_{i,t+T}$ is the excess return on the stock of firm i for period t to $t+T$ (T = 1, . . ., 60) and is computed as the continuously compounded total return (dividends included) less the risk-free rate of interest; $\text{XRTE}_{t,t+T}$ is the continuously compounded rate of change in a real exchange rate index for period t to $t+T$; and $\text{DYLD}_{t-12,t}$, DPRM_t, and TPRM_t, respectively, denote the prevailing dividend yield, default premium, and term premium at period t.[3]

Following Jorion (1990, 1991), Bodnar and Gentry (1993), and Bartov and Bodnar (1994), we use an exchange rate index as a parsimonious representation of exchange rates. This approach avoids the problem of multicollinearity that using separate but positively correlated bilateral exchange rates would introduce. In our analysis, $\text{XRTE}_{t,t+T}$ is the continuous rate of change in a trade-weighted real exchange rate index (January 1980 = 100) over a T-month period. The index is computed as a weighted average of six bilateral real exchange rates, defined as U.S. dollars per unit of foreign currency for the British pound, Canadian dollar, French franc, German deutsche mark, Italian lire, and Japanese yen. The weights, updated annually, are each country's proportion of the six countries' total trade with the U.S. as reported in the International Monetary Fund's (IMF) *Directory of Trade Yearbook*. End-of-month exchange rates are obtained from the IMF's *International Financial Statistics*. Real exchange rates are derived using nonseasonally adjusted Consumer Price Indices obtained from Citibase, an economic database compiled by Citicorp.[4]

The dividend yields in equation (1) are obtained by summing the dividends on the value-weighted CRSP portfolio for the year preceding month t and dividing by the portfolio's value at month t except for equally weighted returns, in which the equally weighted CRSP portfolio dividend yield was used

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[3]As Fama and French (1989) note, the dividend yield and default premium essentially capture the same effect in excess returns. We adopt their approach and use only one of the two variables in our regressions. The results are qualitatively similar regardless of the variable chosen. For brevity, the exposure coefficients reported throughout the paper are only for the dividend yield specification.

[4]Note that by subtracting the risk-free rate, which includes an inflation premium, the equity return dependent variables are essentially expressed in real terms as well. A similar comment applies to the construction of the default and term premia variables discussed next. Furthermore, as the ratio of two nominal series, the dividend yield is equivalent to that which could be obtained from two deflated series.

instead. $TPRM_t$, the monthly term premium, is the difference between the yield on a constant maturity (thirty-year) U.S. Treasury bond portfolio and the three-month Treasury bill yield. $DPRM_t$, the default premium, is the difference between AAA corporate bond and constant maturity (thirty-year) Treasury bond yields.[5] All yield data are taken from the Federal Reserve Bulletin from March 1977 to December 1991. This sample period, constrained by when the Federal Reserve began reporting this Treasury bond data, nonetheless covers most of the current flexible exchange rate regime.

We examine the exchange rate exposure of a sample of diversified stock portfolios and multinational firms from March 1977 to December 1991. The portfolios are the small firm (SFIRM) and Standard & Poor's 500 (SP500) portfolios from Ibbotson Associates' (1992) *Stocks, Bonds, Bills, and Inflation Yearbook*, and the equally weighted (EW) and value-weighted (VW) portfolios from CRSP.

Jorion (1990) uses the ratio of foreign sales to total sales as a proxy for the cross-sectional differences in U.S. multinational firms' exchange exposure. He argues that exposure should increase as the proportion of foreign sales increases.[6] To make our results comparable to his initial study, we use the availability of foreign sales data as a sample-selection criterion. For a firm to be included in our sample, the ratio of foreign sales to total sales had to be reported in the Value Line database each year from 1977 to 1991. The CRSP monthly files and the Compustat annual files were used to extract the corresponding stock returns, stock prices, shares outstanding, and total assets. Excluding firms with missing data, we obtained a sample of 213 firms.

To fully exploit the information contained in the data, we use all available monthly observations in estimating exchange exposure. Fama and French (1989) note that this procedure results in overlapping observations for return horizons longer than one month ($T > 1$) and causes the error term $\varepsilon_{t,t+T}$ to be autocorrelated with order $T-1$. Since the variance-covariance matrix of estimated coefficients will be inconsistent, Hansen's (1982) method is used to adjust the matrix both for general conditional heteroskedasticity and autocorrelation in the error terms. The Newey and West (1987) adjustment ensures that the variance-covariance matrix is positive semidefinite.

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[5]The empirical results are qualitatively invariant to alternative specifications of default premia, that is, when AAA bond yields are replaced by BAA bond yields or when BAA yields are subtracted from AAA yields to obtain the default premia.

[6]Firms with minimal foreign sales but facing significant import competition (e.g., steel companies) may be more exposed than firms with significant foreign sales. This may be why Jorion (1990) does not find exchange rate exposure to be significantly related to foreign sales ratio. We thank the referee for pointing this out. Bodnar and Gentry (1993) provide a detailed analysis of the relation between exchange exposure and industry characteristics such as trade ratios and the use of internationally priced inputs.

TABLE 1. Regression Results for the Diversified Stock Portfolios.

		Horizon (in months)							
Ind. Var.	Portfolio	1	3	6	12	24	36	48	60
XRTE	SFIRM	-.04	.00	.07	.45	.140	-.22	-.473	-.65
		(-0.25)	(0.01)	(0.20)	(2.32)**	(1.42)	(1.01)	(-3.78)***	(-13.54)***
	SP500	.09	.15	.22	.52	.56	.44	.56	.52
		(.68)	(.80)	(1.03)	(3.08)***	(4.23)***	(6.41)***	(8.75)***	(10.13)***
	EW	.01	.07	.12	.39	.33	.20	.10	-.08
		(.07)	(.28)	(.38)	(1.93)	(3.09)**	(1.61)	(2.21)***	(-2.13)***
	VW	.084	.155	.225	.505	.511	.378	.478	.427
		(.66)	(.84)	(1.04)	(3.06)***	(3.95)***	(6.33)***	(8.42)***	(9.55)***
DYLD	SFIRM	1.98	6.55	12.14	2.04	25.77	26.56	33.37	36.64
		(2.85)***	(2.81)***	(3.45)***	(8.92)***	(11.93)***	(4.50)***	(7.00)***	(17.69)***
	SP500	.99	3.24	5.81	11.33	11.48	12.76	12.24	19.51
		(1.61)	(1.80)	(2.05)**	(3.74)***	(6.61)***	(7.80)***	(7.87)***	(8.66)***
	EW	1.94	6.66	11.45	2.47	21.35	24.66	28.52	32.30
		(2.31)**	(2.42)***	(2.73)***	(5.46)***	(6.94)***	(9.36)***	(7.62)***	(17.98)***
	VW	1.09	3.56	6.36	12.31	12.45	13.99	14.08	2.90
		(1.78)	(1.97)**	(2.27)**	(4.45)***	(7.56)***	(10.75)***	(9.90)***	(11.14)***
TPRM	SFIRM	055	1.47	2.13	3.11	.16	1.05	3.80	3.48
		(1.97)**	(1.66)	(1.58)	(1.64)	(.08)	(.36)	(1.70)	(5.12)***
	SP500	.43	1.09	1.51	2.21	1.66	2.52	-.57	.18
		(2.01)**	(2.04)**	(1.72)	(1.51)	(1.24)	(5.78)***	(-.99)	(.33)
	EW	.61	1.71	2.59	4.36	1.91	1.308	1.01	1.80
		(2.29)**	(2.25)**	(2.17)**	(2.22)**	(.99)	(.65)	(4.25)***	(2.46)***
	VW	.44	1.10	1.53	2.34	1.69	2.77	-.01	.47
		(2.03)**	(2.01)**	(1.73)	(1.56)	(1.28)	(6.26)***	(-.02)	(1.04)
R^2	SFIRM	.03	.12	.23	.50	.53	.56	.68	.89
	SP500	.01	.07	.13	.34	.58	.62	.78	.79
	EW	.03	.12	.21	.46	.45	.53	.64	.76
	VW	.02	.08	.14	.36	.56	.61	.75	.78
No. of obs.		177	175	172	166	154	142	130	118

Notes: Excess returns on four U.S. stock portfolios are regressed on real exchange rate changes (XRTE), dividend yields (DYLD), and term premia (TPRM). The numbers in parentheses are the Hansen (1982) heteroskedasticity-consistent *t*-statistics.

**Significant at the 5 percent level.
***Significant at the 1 percent level.

IV. Evidence on Exchange Rate Exposure

Table 1 presents the results of regressing the returns on the four portfolios against changes in real exchange rates, dividend yields, and term premia for horizons of increasing lengths. This table shows that the statistical significance of exposure increases with horizon and becomes significant at horizons of twelve months or longer for all portfolios. This evidence affirms our view that the short-

term effect of exchange rate changes are mitigated by transaction exposure management and that the long-term economic exposure effect is captured by the long-horizon economic exposure betas. In addition, Table 1 suggests that small firms, whose returns are reflected by the SFIRM and EW portfolios, tend to be negatively exposed, and large firms, whose returns are reflected by the SP500 and VW portfolios, tend to be positively exposed.

Checking for Regression Bias

Regressing excess returns on changes in real exchange rates could produce a bias in the estimated conditional exposure beta coefficients if current changes in dividend yield (which can be considered as a lagged endogenous variable) are correlated with future changes in real exchange rates. We use bootstrap simulations, based on the procedure described in Goetzmann and Jorion (1993), to examine the potential bias in ordinary least squares (OLS) regression slope coefficients and *t*-statistics that could stem from covariation between conditional expected changes in the exchange rate and the dividend yield.

From the observed data on monthly stock returns, exchange rates, and term premia, we formed an empirical distribution, assigning an equal probability to each observed set of contemporaneous monthly returns, exchange rates, and term premia. On each simulation, 165 observations of monthly stock returns, exchange rates, and term premia were drawn with replacement from the empirical distribution to compute the series of 154 excess stock returns, exchange rate changes, dividend yields, and term premia. We then regressed excess stock returns on exchange rate changes, dividend yields, and term premia for each horizon using overlapping intervals. The OLS *t*-statistics were adjusted for autocorrelation using Hansen's (1982) procedure modified by the Newey-West (1987) correction to ensure a positive semidefinite covariance matrix. We repeated the simulation 3,000 times and computed summary statistics for the OLS slope coefficients and Hansen-Newey-West *t*-statistics.

The randomization process embeds the null hypothesis that the beta coefficients are not significantly different from zero for all horizons. The means and standard deviations of the OLS exchange rate exposure slope coefficients and Hansen-Newey-West *t*-statistics obtained from the simulations are reported in Table 2. No significant bias is evident.

Sample of Multinational Firms

We obtained the exposure betas for the multinational firms by regressing the returns of each of the 213 firms on the same factors used in the portfolio regressions. We also examine the cross-sectional pattern of exposure over two subperiods of equal lengths—March 1977–January 1985 and February 1985–December 1991—since a firm's exposure could change over time

TABLE 2. Simulation Results for XBETA.

Portfolio		Horizon (in months) 1	3	6	12	24	36	48	60
SFIRM	Mean	.012	.011	.012	.013	.012	.011	.013	.015
	Std dev	.017	.028	.041	.058	.085	.103	.122	.134
t-statistic	Mean	.83	.48	.37	.30	.22	.22	.27	.32
	Std dev	1.14	1.06	1.11	1.14	1.33	1.54	1.83	2.17
Critical values	.01	-1.40	-1.81	-2.17	-2.36	-2.89	-3.22	-3.78	-4.82
	.05	-.91	-1.18	-1.44	-1.54	-1.95	-2.14	-2.61	-3.20
	.95	2.82	2.23	2.24	2.20	2.35	2.79	3.22	3.79
	.99	3.73	3.10	2.96	2.85	3.29	4.10	4.77	5.85
SP500	Mean	-.007	-.007	-.006	-.006	-.007	-.005	-.004	-.003
	Std Dev	.011	.021	.030	.043	.062	.080	.092	.103
t-statistic	Mean	-.62	-.31	-.22	-.15	-.14	-.11	-.09	-.04
	Std dev	1.02	1.04	1.06	1.14	1.29	1.52	1.82	2.19
Critical values	.01	-2.98	-2.69	-2.69	-2.87	-3.10	-3.85	-4.27	-5.16
	.05	-2.32	-2.05	-1.96	-1.97	-2.20	-2.58	-3.17	-3.54
	.95	1.08	1.36	1.52	1.76	1.98	2.28	2.83	3.55
	.99	1.90	2.13	2.39	2.64	2.95	3.46	4.15	5.42
EW	Mean	.003	.003	.003	.004	.006	.006	.007	.008
	Std dev	.014	.024	.035	.049	.072	.091	.107	.118
t-statistic	Mean	.26	.17	.12	.12	.12	.14	.16	.19
	Std dev	1.06	1.07	1.10	1.15	1.31	1.53	1.85	2.18
Critical values	.01	-2.12	-2.25	-2.35	-2.56	-2.93	-3.45	-4.26	-5.15
	.05	-1.39	-1.57	-1.64	-1.75	-1.97	-2.29	-2.83	-3.30
	.95	2.08	1.96	1.96	1.97	2.31	2.55	3.22	3.65
	.99	2.85	2.62	2.83	2.85	3.27	3.77	4.80	5.49
VW	Mean	-.006	-.005	-.005	-.005	-.003	-.003	-.003	-.004
	Std dev	.014	.021	.030	.044	.064	.081	.091	.101
t-statistic	Mean	-.48	-.25	-.16	-.11	-.05	-.04	-.03	-.05
	Std dev	1.02	1.05	1.06	1.14	1.29	1.53	1.79	2.11
Critical values	.01	-2.74	-2.70	-2.65	-2.76	-3.07	-3.73	-4.70	-5.48
	.05	-2.11	-1.95	-1.89	-1.97	-2.12	-2.48	-3.03	-3.30
	.95	1.23	1.47	1.62	1.73	2.11	2.45	2.79	3.31
	.99	1.96	2.18	2.35	2.66	2.92	3.66	4.44	5.13

Note: Bootstrap simulations using Goetzmann and Jorion's (1993) procedure are repeated 3,000 times to examine the potential bias in OLS regression slope coefficients and *t*-statistics that could stem from covariation between conditional expected changes in the exchange rate and the dividend yield.

because of economic expansion or contraction, diversification of the original line of business, or the adoption of hedging programs, for example. Coincidentally, February 1985 was the month of peak strength for the dollar over the sample period. Because of the shorter time frame, however, exposure analysis was limited to horizons of thirty-six months or less in each subperiod. Table 3 presents a summary of these regression results.

The last four columns show that over the entire sample period few firms have statistically significant exposure for horizons of twelve months or less. This is consistent with the findings of Jorion (1990), Bodnar and Gentry (1993), and Bartov and Bodnar (1994). However, the number of significant exposure betas increases with horizons. In particular, at the sixty-month horizon, 190 firms of 213 are exposed at the 6 percent significance level.

Also, over the entire sample period the number of negatively exposed firms is greater than the number of positively exposed firms for horizons shorter than twelve months, but the number of negatively exposed firms decreases as the horizon length increases. This finding and the preceding finding are consistent with the portfolio results presented in Table 1.

In addition, we find some evidence in support of Jorion's (1990) comment that the pattern of exposure may have shifted over time. In the second subperiod, February 1985–December 1991, the majority of firms are exposed negatively in the short run but positively in the long run, and this pattern is consistent with that for the overall sample period. But in the first subperiod, March 1977–January 1985, the exposure pattern is the opposite. Furthermore, the number of firms that are statistically significantly exposed in the second period is much larger than in the first period, especially for longer horizons.

Finally, the increase in the magnitude and significance of exchange exposure with horizon, presented in Panels A and C, suggests that investors' ability to assess the long-term effect of noisy changes in exchange rates on a firm dramatically improves with horizon length. Table 4 indicates that a strong, positive correlation exists between the estimated exchange exposures across horizons. While the correlation diminishes as the difference between any two horizons increases, the correlation between any two horizons of twelve months or more is greater than that between horizons of less than twelve months.

The findings in Tables 1 and 3 substantiate our thesis that transaction exposure management makes short-term exposure betas indistinguishable from zero. More important, our results, unlike those of Jorion (1990, 1991) and Bodnar and Gentry (1993),[7] show that over horizons of twelve months or longer, the exposure betas that reflect economic exposure are statistically significant. Stock prices adjust to movements in the U.S. dollar over time rather than instantly

[7]In these papers, the authors examine only monthly horizons. The lack of significance they find is consistent with the lack of significance we find for the short horizons in Tables 1 and 3.

TABLE 3. Exchange Exposure of U.S. Multinational Firms.

									Significantly Negative		Significantly Positive	
Horizon	Median	Mean	Std. Dev.	Minimum	Maximum	Avg. *t*-stat	No. Neg.	No. Pos.	1%	5%	1%	5%
Panel A. March 1977–December 1991												
1	-.11	-.11	.19	-.75	.35	-.42	158	55	0	5	0	0
3	-.10	-.13	.28	-1.11	.54	-.36	137	76	1	10	0	2
6	-.06	-.11	.39	-1.88	1.08	-.22	128	85	7	15	4	12
12	-.10	-.16	.62	-2.30	1.42	-.25	124	89	19	37	10	21
24	.30	.12	.93	-3.52	1.87	.52	79	134	31	43	57	73
36	.64	.36	1.14	-4.04	2.95	2.85	64	149	23	35	114	124
48	.60	.22	1.33	-5.58	3.39	3.15	75	138	43	52	118	122
60	.49	.25	1.29	-5.96	3.20	3.41	72	141	52	57	128	133
Panel B. March 1977–January 1985												
1	.06	.08	.30	-.73	1.06	.20	93	120	0	1	1	7
3	.31	.32	.41	-1.03	1.67	.69	47	166	0	3	9	26
6	.18	.21	.49	-1.36	1.74	.50	71	142	1	3	12	34
12	-.39	-.45	.76	-2.88	2.43	-.80	155	58	21	43	2	6
24	-.38	-.53	1.51	-5.45	2.94	-.99	128	85	66	92	33	51
36	.05	-.15	1.80	-5.97	4.46	-.93	100	113	68	78	40	63
Panel C. February 1985–December 1991												
1	-.20	-.23	.25	-1.12	.39	-.69	188	25	0	10	0	0
3	-.29	-.33	.42	-2.43	.50	-.72	174	39	3	25	0	0
6	-.10	-.19	.59	-3.24	1.39	-.37	131	82	17	36	6	16
12	.51	.47	.84	-3.50	2.99	2.93	49	164	14	22	102	119
24	.86	.71	1.13	-4.81	3.60	9.10	38	175	29	31	153	164
36	1.04	.92	1.28	-4.82	3.91	8.99	35	178	27	30	166	170

Note: Summary statistics are presented for the XBETAs for a sample of 213 U.S. multinational firms for which foreign sales data are available, obtained by regressing each firm's excess returns on real exchange rate changes (XRTE), dividend yields (DYLD), and term premia (TPRM).

TABLE 4. Correlation Coefficients Between Exposure Betas of Different Horizons.

	Correlated with Horizon						
Horizon	1	3	6	12	24	36	48
Panel A. March 1977–December 1991							
3	.61						
6	.42	.88					
12	.32	.63	.83				
24	.31	.51	.68	.93			
36	.23	.38	.54	.82	.96		
48	.20	.29	.47	.75	.90	.97	
60	.19	.29	.46	.72	.87	.93	.99
Panel B. March 1977–January 1985							
3	.67						
6	.39	.76					
12	.09	.26	.67				
24	.00	-.09	.18	.69			
36	-.08	-.19	.09	.65	.96		
Panel C. February 1985–December 1991							
3	.57						
6	.32	.88					
12	.24	.68	.83				
24	.32	.55	.56	.84			
36	.28	.42	.36	.59	.89		

because investors learn the full effect of changes in the dollar on firm value only as information about the performance of the firm becomes available. Using long-horizon returns captures the lagged effect of exchange rate changes on firm value.[8]

V. Determinants of Economic Exposure

We now consider two potential determinants of economic exposure documented in Tables 1 and 3. The first is Jorion's (1990) notion that the breadth of globalization of a firm's business is positively related to its foreign exchange

[8]An alternative explanation is that short-horizon returns have so much noise that it takes a longer horizon return to pick up the effect of changes in exchange rates. The simulated statistics in Table 2 suggest that the increase in statistical significance with horizon length is not an artifact of regression bias, but, rather, reflects the long-term effects of changes in exchange rates.

exposure. As Jorion notes, *ceteris paribus*, an appreciating foreign currency should increase profits, and for a U.S. multinational firm, this exposure should increase as the proportion of foreign sales increases. The second potential determinant is that of Nance, Smith, and Smithson (1993) who find that large firms are more likely to hedge, which is a reflection of economies of scale in hedging. To the extent that the effectiveness of hedging varies directly with hedging effort, the degree to which a firm is exposed should be negatively related to its size. We examine whether foreign sales or size is the more critical determinant of a firm's economic exposure.

For each horizon, we regress the exposure betas against firm size, SIZE, and/or the foreign sales ratio, FSALE. For each firm, SIZE is computed as the natural log of the sample period average of the year-end market values of its common shares outstanding. For each firm, FSALE is computed as the sample period average of the ratio of foreign sales to the total sales as reported annually in *Value Line*. Two firms whose foreign sales ratios were greater than one are excluded from this part of the analysis. The cross-sectional regression results for the remaining 211 firms are reported in Table 5.

In Table 5, equation (1) in Panel A indicates that although exchange rate exposure is positively related to the foreign sales ratio as Jorion (1990) finds, the foreign sales ratio is not statistically significant and does not explain the cross-sectional variation in exchange exposure at all. As shown in equation (2), this result obtains even when the fifteen oil firms in the sample are removed.[9] These findings do not suggest that exchange exposure is significantly determined by the globalization of a firm's business.

In contrast, equations (3) and (4) reveal that SIZE is a material factor in explaining exchange exposure. The statistical significance of the relation between exposure and size increases with horizon and does not seem to be sensitive to the measurement of firm size. Equations (5) and (6) substitute the natural log of average year-end total assets, ASSET, as a proxy for firm size and produce results similar to, but not as strong as, those for SIZE.

Tables 1 and 3 indicate that exchange rate exposure can be either negative or positive, which means that positively exposed firms benefit and negatively exposed firms suffer when the dollar depreciates. However, if large firms hedge more than small firms and if hedging activities are effective, then, *ceteris paribus*, the degree of the exposure should decrease with size regardless of whether the firm is negatively or positively exposed. We examine this implication by implementing two classification procedures: 1) firms are categorized into dichotomous groups of negatively and positively exposed firms; and 2) firms are sorted by the magnitude of the exposure betas and then formed into eight

[9]Jorion notes that since oil is priced in dollars worldwide, U.S. oil companies should be relatively insensitive to fluctuations in the dollar even though these firms have high proportions of foreign sales.

TABLE 5. Determinants of Exchange Exposure for 213 Multinational Firms.

		Horizon (in months)							
	Ind. Var.	1	3	6	12	24	36	48	60
Panel A. March 1977–December 1991									
Eq. (1)	FSALE	.048	−.07	−.10	.07	.38	.29	.53	.65
	All firms	(.46)	(−.51)	(−.55)	(.24)	(.96)	(.60)	(.97)	(1.27)
Eq. (2)	FSALE	.04	−.05	−.06	.06	.36	.26	.49	.59
	Excl. oil firms	(.40)	(−.34)	(−.29)	(.19)	(.83)	(.49)	(.84)	(1.09)
Eq. (3)	SIZE	.02	.05	.08	.14	.20	.21	.29	.31
		(2.43)***	(3.05)***	(3.63)***	(4.18)***	(4.46)***	(3.85)***	(4.80)***	(5.07)***
Eq. (4)	SIZE	.04	.05	.08	.14	.20	.21	.29	.30
		(2.41)***	(3.13)***	(3.62)***	(4.13)***	(4.35)***	(3.82)***	(4.74)***	(4.99)***
	FSALE	.00	−.15	−.24	−.18	.03	−.08	.01	.11
		(−.02)	(−1.14)	(−1.22)	(−.59)	(.06)	(−.16)	(.02)	(.22)
Eq. (5)	ASSET	.01	.02	.04	.09	.15	.18	.27	.28
		(.56)	(1.05)	(1.92)	(2.72)***	(3.18)***	(3.09)***	(4.08)***	(4.39)***
Eq. (6)	ASSET	.01	.02	.04	.09	.15	.18	.27	.28
		(.55)	(1.07)	(1.93)	(2.72)***	(3.16)***	(3.08)***	(4.06)***	(4.37)***
	FSALE	.04	−.07	−.11	.04	.34	.24	.44	.56
		(.44)	(−.54)	(−.61)	(.14)	(.84)	(.50)	(.84)	(1.13)
Panel B. March 1977–January 1985									
Eq. (7)	SIZE	−.02	−.03	−.02	−.05	−.12	−.11		
		(−1.08)	(−1.30)	(−.81)	(1.24)	(−1.60)	(−1.19)		
	FSALE	−.07	−.22	−.35	−.30	.39	.15		
		(−.59)	(−1.20)	(−1.59)	(−.92)	(.60)	(.21)		
Panel C. February 1985–December 1991									
Eq. (8)	SIZE	.05	.10	.12	.14	.17	.14		
		(3.87)***	(3.89)***	(3.22)***	(2.93)***	(2.92)***	(2.15)**		
	FSALE	.02	−.19	−.41	−.43	−.08	−.20		
		(.21)	(−1.36)	(−2.06)**	(−1.45)	(−.19)	(−.39)		

Notes: XRTE is regressed against SIZE, the natural log of the average year-end market value of equity; FSALE, the natural log of the average annual foreign sales divided by total sales; and ASSET, the average year-end total assets. The numbers in parentheses are Hansen's (1982) heteroskedasticity-consistent *t*-statistics.

**Significant at the 5 percent level.
***Significant at the 1 percent level.

groups of equal size, where group 1 contains the most negatively exposed firms and group 8 contains the most positively exposed firms. For each group and horizon, we then compute the mean values of the exposure betas, firm size, total assets, and the foreign sales ratio.

TABLE 6. Analysis of Negatively and Positively Exposed Firms.

		Horizon (in months)							
Category	Variable	1	3	6	12	24	36	48	60
Negative exposure	XBETA	-.19	-.28	-.33	-.54	-.81	-.99	-1.15	-1.10
	SIZE	3.16	2.94	2.75	2.08	1.95	2.03	2.05	1.81
	ASSET	4.72	4.35	4.65	3.73	3.45	3.77	3.19	3.17
	FSALE	.28	.28	.28	.27	.289	.27	.26	.26
Positive exposure	XBETA	.12	.15	.23	.37	.67	.95	.98	.94
	SIZE	2.71	3.23	3.50	4.41	3.70	3.48	3.59	3.68
	ASSET	3.08	4.22	3.72	5.11	4.81	4.54	4.91	4.88
	FSALE	.25	.27	.26	.28	.27	.28	.29	.29
Differences between groups	XBETA	.07***	.13***	.11***	.17***	.14***	.04	.18**	.15
	SIZE	.45	-.29	-.75	-2.33***	-1.75**	-1.45**	-1.54**	-1.89***
	ASSET	1.64	.14	.88	-1.37	-1.36*	-.78	-1.71*	-1.71*
	FSALE	.03	.02	.02	-.01	.01	-.02	-.03	-.03

Notes: Mean values are presented separately for positively and negatively exposed firms. Differences between groups are obtained by subtracting the absolute value for the positively exposed group from that for the negatively exposed group. The differences in means are evaluated using one-sided tests.

*Significant at the 10 percent level.
**Significant at the 5 percent level.
***Significant at the 1 percent level.

Table 6 presents the mean values for the negatively and positively exposed groups. The differences in the absolute values of the means shows that the magnitude of exposure is greater for the group of negatively exposed firms across all horizons and is significant except for the thirty-six- and sixty-month horizons. From the three-month horizon on, the average size of the negatively exposed firms is consistently smaller than that of the positively exposed firms, and the difference in size increases with horizon length. Smaller firms tend to be negatively exposed; larger firms, positively exposed. In contrast, the variation in the foreign sales ratio across each group is very small, and the differences in the foreign sales ratio between the groups are insignificant across all horizons.

These findings extend to Table 7. Across all horizons, the smallest firms are negatively exposed, and the largest firms are positively exposed. The magnitude of exposure also tends to be larger for small firms and smaller for larger firms across all horizons. Furthermore, Table 7 shows that the average foreign sales ratios are similar across the groups for each horizon.

Finally, we estimate the following pooled cross-sectional regression:

$$\text{FXBETA}_{i,T} = \xi_0^+ D_i^+ + \xi_0^- D_i^- + \xi_1^+ D_i^+ \text{SIZE}_i^+ + \xi_1^- D_i^- \text{SIZE}_i^- + \xi_2^+ D_i^+ \text{FSALE}_i^+ + \xi_2^- D_i^- \text{FSALE}_i^- + \varepsilon_{i,T} \quad (2)$$

TABLE 7. Mean Values for Firms Sorted by Exposure Betas.

		Horizon (in months)							
Group	Variable	1	3	6	12	24	36	48	60
1	XBETA	-.43	-.65	-.85	-1.38	-1.76	-1.93	-2.51	-2.40
	SIZE	.71	.88	.50	.80	.84	.73	.61	.64
	FSALE	.21	.26	.28	.29	.27	.25	.25	.25
2	XBETA	-.27	-.38	-.45	-.68	-.60	-.53	-.77	-.63
	SIZE	2.24	2.64	2.06	1.26	1.74	2.20	2.04	1.79
	FSALE	.30	.28	.31	.28	.27	.30	.28	.28
3	XBETA	-.21	-.26	-.25	-.37	-.190	-.03	-.17	-.10
	SIZE	3.60	2.19	3.36	2.77	2.79	3.52	3.44	3.16
	FSALE	.30	.31	.27	.27	.29	.23	.23	.24
4	XBETA	-.15	-.16	-.13	-.18	.10	.40	.26	.27
	SIZE	3.40	2.21	4.26	2.71	2.98	2.66	2.34	2.61
	FSALE	.31	.27	.26	.28	.21	.25	.29	.30
5	XBETA	-.10	-.08	-.04	-.06	.35	.69	.63	.59
	SIZE	2.74	5.90	3.55	2.78	2.18	3.97	3.05	6.58
	FSALE	.27	.28	.32	.25	.24	.34	.29	.28
6	XBETA	-.06	.00	.04	.10	.55	.89	.85	.86
	SIZE	2.79	4.72	3.95	6.88	6.33	5.62	7.20	4.15
	FSALE	.27	.29	.26	.26	.29	.23	.29	.27
7	XBETA	.020	.07	.14	.26	.78	1.15	1.10	1.12
	SIZE	6.61	3.64	3.44	4.19	4.60	3.78	2.97	2.84
	FSALE	.24	.28	.26	.28	.31	.28	.29	.29
8	XBETA	.16	.26	.39	.65	1.21	1.67	1.70	1.64
	SIZE	2.45	2.39	3.12	2.93	2.87	2.15	2.72	2.64
	FSALE	.29	.25	.27	.29	.29	.28	.27	.28

Note: The firms are first sorted in ascending order by XBETA and then formed into eight equally sized groups.

where $FXBETA_{i,T}$ is the exposure beta of firm i over horizon T, and D_i^- and D_i^- are dummy variables that equal one when is $FXBETA_{i,T}$ positive and zero when $FXBETA_{i,T}$ is negative. The results in Table 8 show that over the entire sample period and the second subperiod, a statistically significant inverse relation exists between the magnitude of exposure and size for all horizons for negatively exposed firms and for the shorter horizons for positively exposed firms. The foreign sales ratio demonstrates a significant effect only for positively exposed firms and only at the one-month and the twenty-four-month horizons for the entire period and at the twelve-month horizon in the second subperiod. Tests of differences in the estimated coefficients indicate the inverse relation between the magnitude of exposure and size is significantly different across the negatively and positively exposed groups of firms. The results using a seemingly unrelated regressions (SUR) estimation procedure are qualitatively the same.

The results in this section show that larger firms are less exposed to long-term exchange rate effects than smaller firms, regardless of whether exposure is negative or positive. This evidence is consistent with the hypothesis that larger

TABLE 8. Regression of Exchange Betas on Size and Foreign Sales Ratio by Negative and Positive Exposure.

	Horizon (in months)							
Variable	1	3	6	12	24	36	48	60
Panel A. March 1977–December 1991								
NSIZE	.03	.07	.08	.13	.22	.30	.28	.27
	(4.28)***	(4.80)*	(3.76)***	(3.79)***	(3.75)***	(3.95)***	(3.18)***	(2.89)***
PSIZE	-.03	-.02	-.04	-.06	.00	.01	.04	.03
	(-2.70)***	(-1.79)*	(-1.49)	(-2.17)**	(.08)	(.18)	(1.11)	(.84)
NFSALE	.08	-.03	-.15	-.391	.16	.28	-.22	.034
	(1.11)	(-.25)	(.80)	(-1.32)	(.33)	(.45)	(-.34)	(.05)
PFSALE	.18	-.06	.22	.34	.48	-.21	-.46	-.20
	(2.70)***	(-.44)	(1.07)	(1.58)	(1.90)*	(-.61)	(-1.33)	(-.58)
Panel B. March 1977–January 1985								
NSIZE	.03	.01	.00	.02	-.07.	.17		
	(3.01)***	(.37)	(-.23)	(.61)	(-.96)	(1.80)*		
PSIZE	-.052	-.01	-.03	.00	-.04	-.01		
	(-3.79)***	(-.64)	(-1.45)	(.12)	(-.78)	(-.10)		
NFSALE	-.00	.09	.05	-.09	.42	.73		
	(-.01)	(.80)	(.30)	(-.33)	(.80)	(1.19)		
PFSALE	.02	-.22	-.02	-.12	.19	-.28		
	(.13)	(-1.14)	(-.10)	(-.35)	(.38)	(-.50)		
Panel C. February 1985–December 1991								
NSIZE	.05	.11	.15	.18	.32	.37		
	(4.94)***	(4.79)***	(3.76)***	(3.13)***	(2.78)***	(2.90)***		
PSIZE	-.03	-.04	-.05	-.01	.04	-.01		
	(-2.44)***	(-3.56)***	(-2.35)***	(-.13)	(1.09)	(-.29)		
NFSALE	.07	-.12	-.16	-.02	.68	.50		
	(.92)	(-.91)	(-.87)	(-.06)	(.87)	(.35)		
PFSALE	-.04	-.11	.26	-.39	-.14	-.48		
	(-.25)	(-.95)	(1.11)	(-1.69)*	(-.46)	(-1.29)		

Notes: Results for pooled cross-sectional regressions of XBETA for negatively (positively) exposed firms on NSIZE (PSIZE) and NFSALE (PFSALE) are presented. The numbers in parentheses are Hansen's (1982) heteroskedasticity-consistent *t*-statistics.

*Significant at the 10 percent level.
**Significant at the 5 percent level.
***Significant at the 1 percent level.

firms hedge more than smaller firms. Table 8 provides weak support for the hypothesis that the magnitude of exposure is positively related to the globalization of a firm's revenues; however, the negative coefficient reported in the second subperiod is inconsistent with this hypothesis.

VI. Concluding Remarks

In this paper we explore the variation in firm value associated with changes in exchange rates. Analyzing stock returns over horizons as long as sixty months enables us to document the existence of economic exposure in our sample of 213 U.S. multinational firms. If investors are prone to making systematic errors in estimating the relation between firm value and changes in the dollar in the near term, the effect of exchange rate changes on value can be discerned only from long-horizon stock returns. We find that the statistical significance of exchange rate exposure increases with the length of the return horizon and that large (small) firms are on average positively (negatively) exposed to exchange rate changes across all horizons. The cross-sectional differences in the magnitude of exposure are significantly related to firm size, but they are, at best, weakly related to the ratio of foreign sales to total sales.

To the extent that hedging effectiveness is positively related to hedging effort, we interpret these findings as indicating that most firms successfully hedge the effects of short-term exchange rate changes through easily accessible, low-cost financial market vehicles such as interbank forward contracts. Managing economic exposure, in contrast, requires matching foreign currency inflows and outflows through operational hedges that are costly and exhibit significant economies of scale in terms of both capital and human resources. Consequently, large firms are more likely to attempt economic exposure management than small firms.

References

Adler, M. and B. Dumas, 1984, Exposure to currency risk: Definition and measurement, *Financial Management* 13, 41–50.

Agarwal, S. and S. N. Ramaswami, 1992, Choice of market entry mode: Impact of ownership, location, and internalization factors, *Journal of International Business Studies* 23, 1–27.

Amihud, Y., 1993, Evidence on exchange rates and valuation of equity shares, in Y. Amihud and R. Levich, eds.: *Recent Advances in Corporate Performance* (Business One Irwin, Homewood, IL).

Bartov, E. and G. M. Bodnar, 1994, Firm valuation, earnings expectations, and the exchange-rate exposure effect, *Journal of Finance* 49, 1755–86.

Block, S. B. and T. J. Gallagher, 1986, The use of interest rate futures and options by corporate financial managers, *Financial Management* 15, 73–78.

Bodnar, G. M. and W. M. Gentry, 1993, Exchange-rate exposure and industry characteristics: Evidence from Canada, Japan and the U.S., *Journal of International Money and Finance* 12, 29–45.

Dolde, W., 1993, Use and effectiveness of foreign exchange and interest rate risk management in large firms, Working paper 93-042, School of Business Administration, The University of Connecticut.

Dufey, G. and S. L. Srinivasulu, 1983, The case for corporate management of foreign exchange risk, *Financial Management* 12, 54–62.

Dunning, J. H., 1988, The eclectic paradigm of international production: A restatement and some possible extensions, *Journal of International Business Studies* 19, 1–31.

Fama, E. F., 1990, Stock returns, expected returns, and real activity, *Journal of Finance* 45, 1089–1108.

Fama, E. F. and K. R. French, 1989, Business conditions and expected returns on stocks and bonds, *Journal of Financial Economics* 25, 23–49.

Goetzmann, W. N. and P. Jorion, 1993, Testing the predicative power of dividend yields, *Journal of Finance* 48, 663–79.

Hansen, L. P., 1982, Large sample properties of generalized method of moments estimators, *Econometrica* 50, 1029–54.

Jorion, P., 1990, The exchange rate exposure of U.S. multinationals, *Journal of Business* 63, 331–45.

———, 1991, The pricing of exchange rate risk in the stock market, *Journal of Financial and Quantitative Analysis* 26, 363–76.

Nance, D. R., C. W. Smith Jr., and C. W. Smithson, 1993, On the determinants of corporate hedging, *Journal of Finance* 48, 391–405.

Newey, W. K. and K. D. West, 1987, A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703–8.

Pringle, J. J. and R. A. Connolly, 1993, The nature and causes of foreign currency exposure, *Journal of Applied Corporate Finance* 6, 61–72.

Rawls, S. W. III and C. W. Smithson, 1989, Strategic risk management, *Journal of Applied Corporate Finance* 2, 6–18.

Shapiro, A. C. and S. Titman, 1985, An integrated approach to corporate risk management, *Midland Corporate Finance Journal* 3, 41–56.

Smith, S. W. and R. M. Stulz, 1985, The determinants of firms' hedging policies, *Journal of Financial and Quantitative Analysis* 20, 391–405.

Warner, J., 1977, Bankruptcy costs: Some evidence, *Journal of Finance* 32, 337–48.