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Exchange Rate Exposure of Exporting and Importing Firms

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With so many companies trading internationally in some way, few are immune to the effects of currency fluctuations.

—*Financial Times*, April 12, 2005 (p. 23).

Start by dividing all companies into four categories: multinationals with operations in foreign countries (MNCs), exporters, importers, and wholly domestic firms with no foreign trade or operations. Then subdivide the fourth category, domestic companies, into two groups: those that face foreign competition and those that do not. In a recent study, we attempted to answer the following question: Of these five categories of companies, which have the greatest exposure to currency risk?

The findings of our recent study may surprise you. Neither exporters nor multinational firms were the most affected by changes in exchange rates. The firms that suffered most from currency fluctuations were wholly domestic U.S. companies facing foreign competition. When the dollar strengthens, foreign products become more competitive, cutting into sales. But lacking any foreign trade, such firms generally don't think of hedging their currency exposures.

Next in line in terms of exposure to currency risk are importers—companies that import foreign goods for sale in domestic markets. And we devote most of the pages that follow to explaining why such companies are likely to suffer more from exchange rate variability than multinationals and exporters.

What do we mean by exposure to currency changes? Many managers tend to think in terms of translation and transaction exposures—exposures that are relatively easy to understand and hedge with foreign exchange derivatives. But even though such exposures can have large effects on reported earnings, they are not nearly as important as a third form of currency risk known as "competitive exposure"—the risk that currency fluctuations will affect the firm's long-run competitive position, cash flow, and total value.

More generally, a company's *economic exposure* (which is effectively the combination of its competitive and transaction exposures) is "the extent to which the value of the firm—as measured by the present value of its expected cash flows—will change when the exchange rate changes."[1] The estimate of a firm's *economic* exchange rate exposure is of obvious interest to corporate managers responsible for managing such exposure or risk and to investors seeking to hedge their portfolios. But the search for statistically significant and economically meaningful exposure estimates in the vast literature of the last few decades has largely been unsuccessful. Although economic theory and conventional wisdom suggest that U.S. multinationals and export-oriented firms are adversely affected by a strengthening dollar and benefit from a depreciating dollar, the research to date provides little evidence of any relationship between FX changes and the stock prices of such firms.

The Dual-Effect Hypothesis

In our study, we proposed a "dual-effect" hypothesis that attempts to explain this puzzle. We suggested that currency changes are likely to have two effects on companies: (1) the direct competitive effect that results from the change in the effective price to consumers of the firm's products; and (2) an indirect effect stemming from the tendency of strong currencies to be correlated with strong domestic economies, and weak currencies to be associated with weak economies. (The Appendix provides an empirical analysis of the latter point.) Thus, while a strong dollar hurts exports, it also tends to be associated with a strong domestic market. And the smaller the firm's ratio of exports to total sales, the greater is the extent to which the negative impact of a strong

* Authors' names are in alphabetical order. This article draws extensively on our published study, "Foreign Exchange Exposure of Exporting and Importing Firms," *Journal of Banking and Finance*, Vol. 28, No. 7 (2004), pp. 1697-1710.

1. A. Shapiro, *Foundations of Multinational Financial Management*, 5th ed. (New York: John Wiley & Sons Inc., 2005).

currency on exports is likely to be offset by higher domestic sales. For this reason, the net effect on exporters of a stronger dollar could be close to zero.

Besides testing this dual-effect hypothesis for exporters, we also applied the hypothesis to importers, a sample not previously studied in the literature. In this case, we found that the impact of a stronger dollar through the domestic economy adds to, or compounds, the direct effect. So, for example, the value of U.S. importers tends to increase during periods of dollar strength both because imports become less expensive for U.S. consumers and because the local economy tends be strong. On the other hand, a weak dollar tends to have a "doubly" negative effect on importers, stemming from both the resulting higher domestic price of imports and the associated weakness of the local economy. And so importers, in contrast to exporters, are likely to have significant exposures to currency fluctuations.

Prior to our study, the existing research on corporate currency exposure had completely overlooked the case of importers, focusing exclusively on multinationals and exporting firms. And this inattention to the currency risk of importers by researchers appears to reflect corporate practice. Take the case of Sears before its recent acquisition by Kmart. More than 85% of its sales were derived from the domestic market, with the rest coming from Canada. But a significant fraction of the goods it sold were imported from other countries, creating a large mismatch in sales and purchases. Such a mismatch creates significant exchange rate exposure, as confirmed by financial analysis. To determine whether and how Sears managed this currency risk, we examined Sears' annual reports and SEC filings. Corporate annual reports typically include discussions of financial risks, especially interest rate risk and currency risk. But based on the information provided in its annual report, Sears didn't appear to recognize currency risk as a significant risk. Moreover, its financial statements did not report any outstanding currency forwards or currency swaps, which suggests that Sears did not actively manage its transaction exposure.

On the other hand, exporting companies appear to take a more active approach to managing exchange rate exposure. Johnson & Johnson's revenue from non-U.S. sales makes up more than 40% of its total revenue ($19.6 billion out of $47.4 billion for 2004). The mix of U.S. and non-U.S. sales provides at least a partial natural hedge for currency fluctuations. In addition, the company has overseas manufacturing facilities to supply foreign markets that have the effect of mitigating currency risk. The insignificance of Johnson & Johnson's remaining currency risk is also borne out by financial analysis. Yet, based on information contained in its annual reports, Johnson & Johnson has an active currency risk management program, one that appears designed mainly to limit transaction exposure using currency forward contracts and swaps.

Besides contrasting the currency risk and currency risk management of exporters and importers, we were also able to demonstrate that the exposure estimates for exporters become significant when the hedging effect of domestic factors is correctly controlled for. In particular, some previous studies have used the value-weighted market index to control for domestic and other factors. But because the value-weighted index favors large multinationals and exporters, it imparts a downward bias to exposure estimates. Using a portfolio of domestic firms with no foreign competition eliminates this bias and reveals the negative impact of a strong dollar on exporting firms, and the positive impact of a strong dollar on importing firms. These results *are* consistent with economic theory and conventional wisdom.

Empirical Tests and Results: Total Foreign Exchange Exposure

In our study, we examined the total foreign exchange exposure of 67 export-oriented and 28 import-oriented U.S. companies with the aim of evaluating the impact of the dual-effect hypothesis on total exposure. Starting with the S&P 500 firms as of December 1997, we classified as export-oriented firms (E) those companies that, according to reports by Compustat, had at least 50% of their total sales in foreign countries or 50% of their assets located overseas.[2]

Since companies do not report quantitative information about imports, we identified importing firms (I) based on qualitative information about their import activity provided by Value Line Investment Survey, corporate annual reports, footnotes accompanying financial statements, and websites. The industries are primarily in the retailing business, and representative companies include Wal-Mart, Circuit City, Toys"R"Us, Liz Claiborne, and Home Depot. (For a description of the categories of exporting and importing firms along with examples of firms in each category, see Panels A and B of Table 1.)

2. Foreign sales included exports as well as goods produced and sold overseas. Though Compustat reports exports and sales of foreign produced goods separately, the separation is not always reliable and is missing for many firms. For consistency and accuracy we use the combined figure. Previous studies focusing on this category have also hypothesized a negative exposure coefficient: see P. Jorion, "The Exchange-Rate Exposure of U.S. Multinationals," *Journal of Business*, Vol. 63 (1990), pp. 331-346; P. Jorion, "The Pricing of Exchange Rate Risk in the Stock Market," *Journal of Financial and Quantitative Analysis*, Vol. 26 (1991), pp. 363-376; Y. Amihud, "Evidence on Exchange Rates and Valuation of Equity Shares," in Y. Amihud and R. Levich, Eds., *Exchange Rates and Corporate Performance* (Homewood, IL: Business One Irwin, 1993); E. Bartov and G. M. Bodnar, "Firm Valuation, Earnings Expectations, and the Exchange-Rate Exposure Effect," *Journal of Finance*, Vol. 49 (1994), pp. 1755-1785; J. J. Choi and M. M. Prasad, "Exchange Risk Sensitivity and its Determinants: A Firm and Industry Analysis of U.S. Multinationals," *Financial Management*, Vol. 24 (1995), pp. 77-88; and C. Pantzalis, B. Simkins, and P. Laux, "Operational Hedges and the Foreign Exchange Exposure of U.S. Multinational Corporations," *Journal of International Business Studies*, Vol. 32 (2001), pp. 793-812.

Table 1 **Categories of Sample Firms**
The S&P 500 firms as of December 1997 are categorized according to their exposure to exchange rates. Information about foreign trade and operations is obtained from Compustat, *Forbes* listings of multinational companies, and the Value Line Investment Survey.

Category	Number of firms	Types of firms, industries	Examples of firms
Panel A			
Exporters	67	Category leaders in any industry	Coca Cola, Boeing, Procter & Gamble, General Electric, Microsoft, Colgate, Dow Chemical, Johnson & Johnson
Panel B			
Importers	28	Large multi-product retailers, specialty retailers, and some textile companies	Sears, Wal-Mart, Circuit City, Russell Corp., Gap, Toys "R" Us, Home Depot
Panel C			
Domestic	91	Service organizations, domestic restaurant chains, newspapers, railroads, and trucking	H&R Block, Kroger, Rubbermaid, Ryder, NY Times, Yellow Roadway, Maytag

For all the companies in our sample, we estimated the "total" exposure (or elasticity) as the coefficient in the following regression:

$$R_{i,t} = \alpha_i + \beta_i \Delta FX_t + e_{i,t} \quad (1)$$

where $R_{i,t}$ is the return of stock i in period t and ΔFX_t is the change in the exchange rate over the same period, measured in foreign currency per dollar. Equation (1) was estimated using monthly data from January 1975 to December 1997.

Data for the dependent variable, measured as the individual firm's stock returns and returns on an equally weighted portfolio of exporting and importing firms, were obtained from CRSP (Center for Research in Security Prices of the University of Chicago). Changes in exchange rates were measured as the monthly percentage changes in two indices:

1) *the Major Currencies index*,[3] which currently consists of the currencies of 17 countries (including Euro-area currencies with Belgium/Luxembourg counted as one and Australia, Canada, Japan, Sweden, Switzerland, and the U.K.), with the currency weights revised each year. The Major Currencies index is superior to other indices used in previous studies that rely on too few currencies or indices that are infrequently revised.

2) *Special Drawing Rights (SDR)*. While the Major Currencies index is the primary index for the results of our study, we also used the SDR index to compare our results with prior studies and to examine the sensitivity of our results to the choice of index. The value of this index is determined by the International Monetary Fund based on a basket of currencies. Until 1980, the IMF used the currencies of 16 countries with the largest share of world exports of goods and services. From January 1981 until December 1998, the IMF used five currencies (the US$, J¥, FFr, DM, and £) and the weights assigned to these currencies in the SDR basket are revised every five years. Since January 1999, the IMF has used four currencies: US$, J¥, €, and £.

Table 2 presents the results of our regressions of portfolio returns for the subsamples of exporting and importing firms in a given month (t) against the change in the exchange rate during the same month. Like previous researchers, we found the coefficient of the exchange rate variable for exporting firms to be insignificantly different from zero at the portfolio level for both measures of exchange rates. Regressions at the individual firm level (not reported) showed statistically significant negative exposure for only 4% of the companies (in a two-tailed test at a 10% significance level) when the Major Currencies index was used to measure exchange rate changes. At the same time, however, another 4% of the firms exhibited statistically significant *positive* exposure—that is, positive stock returns with an appreciating dollar. But when exchange rate measures were based on the SDR index, none of the exporters had significantly negative exposure while 4% had significantly positive exposure.[4]

Also consistent with our dual-effect argument, the stock returns for our sample of importing firms were positively correlated with contemporaneous changes in exchange rates at the portfolio level for both measures of exchange rates.

3. Another possibility is the "Broad" index that currently comprises 36 currencies. However, the broad index includes currencies of high-inflation countries that experienced persistent depreciations. This restricts the usefulness of the nominal broad index as large nominal depreciations of a few countries swamp information on the value of the dollar against other countries.

4. We test for sensitivity of exchange rate exposure to the level of exports by reestimating the regression for a sample of firms with foreign sales of less than 25%. For these marginal exporters, the exposure coefficient is still insignificant but less negative/ >>

Table 2 **Estimates of Total Exchange Rate Exposure**

Model: $R_{it} + \alpha_i + \gamma_i \Delta FX_t + \varepsilon_{it}$

The model is estimated for each portfolio of exporting and importing firms using ordinary least squares. R_{it} is the portfolio return for month t, and ΔFX_t is the rate of change in the nominal exchange rate index (FX index) in month t. An increase in ΔFX_t represents an appreciation of the U.S. dollar. γ is the exchange rate exposure coefficient. Standard errors are in parentheses.

	FX Index	
	Major Currencies	**SDR**
Importers	0.3402* (0.198)	0.4960**(0.240)
Exporters	-0.0593 (0.151)	0.0444 (0.183)

**, * indicate statistical significance at the 5% and 10% level, respectively.

Moreover, the correlation was economically as well as statistically significant in the following sense: a 10% appreciation of the dollar translates into a 3.4-5.0% increase in the stock price of the average importer. Further, from the firm-level regressions (not reported here), we found that about 40% of the individual importers had statistically significant coefficients (depending on the exchange rate index used), and *all* the significant coefficients were positive.

In a cross-sectional analysis of the importing firms' exposure, we examined their reported currency hedging activities as an explanatory variable for differences in their foreign exchange exposures. We found that although the average exposure for the unhedged importers was indeed higher than for hedged importers, the difference was not statistically significant. A possible explanation for this result is that the importers' currency hedging transactions are designed primarily to reduce translation and transaction exposures, but not the competitive exposure that arguably has the largest valuation impact (see the introductory discussion).

Trade-Specific Foreign Exchange Exposure

Many researchers have used an expanded model specification in an attempt to control for macroeconomic factors and to distill the effect of firm-specific foreign exchange exposure.[5] In this section, we focus on explanations for the insignificant firm-specific exposure for multinationals and exporters reported in most studies. These studies typically include returns on a value-weighted market portfolio as an additional explanatory variable to improve the power and the precision of the estimation and to isolate firm-specific cash flow exposure by implicitly controlling for macroeconomic factors:

$$R_{i,t} = \alpha_i + \beta_i \Delta FX_t + \gamma_i R_{m,t} + e_{i,t} \quad (2)$$

where $R_{m,t}$ is the return on the control portfolio in period t and other variables are as described in Equation (1). Even with the expanded specification, however, there is only weak and inconsistent support at best for a significant relationship between stock returns and exchange rate changes, even when the samples are screened to find such a relationship. To the extent that the market return as a control variable does not fully incorporate the value-relevant macroeconomic factors, the extant empirical findings could be due to the offsetting dual effects that we hypothesize. Our own multiple regression results for samples of export- and import-oriented firms continue to show insignificant exposure for exporting firms and significant positive exposure for importing firms.

We believe that past researchers have confused the issues because they failed to recognize the dual-effect of exchange rates. In order to capture the *trade-specific* effect of exchange rates, domestic factors must be controlled. That is, the control firms themselves should have insignificant exposure to exchange rates. Unfortunately, almost all papers use the *value-weighted* market portfolio as the control variable. For this reason, a finding of insignificant firm-specific exposure does not imply that the trade-specific exposure is zero, only that the firm has the same exposure as the market portfolio. Since a value-weighted market portfolio is likely to be dominated by large multinational firms with expected negative exposure, the firm-specific exposure, or deviation from the negative market exposure, underestimates the true trade-specific exposure expected for exporters and overestimates the true trade-specific exposure expected for importers.

In order to reduce or eliminate the biases in the exposure coefficient estimates, the control portfolio itself should have firms with insignificant foreign exchange exposure. A possible candidate for such a control portfolio is an equally weighted index. However, there is no a priori reason to believe that the equally weighted index has insignificant currency exposure. If the index contains a large proportion of importers (or exporters), it is likely to have positive (negative) exposure, on average, introducing a bias in the

more positive than for the primary sample. The result is consistent with a larger offset of the foreign market effects by the domestic market in the marginal exporter sample, which has a higher domestic-to-foreign market ratio than sample E. Two previous studies reported less negative exposure for U.S. multinationals (with higher domestic-to-foreign market ratio) than Japanese multinationals: see C. Doidge, J. Griffin, and R. Williamson, "Does Exchange Rate Exposure Matter?," Georgetown University Working Paper (2003); and Jia He and Lilian K. Ng, "The Foreign Exchange Exposure of Japanese Multinational Corporations," *Journal of Finance*, Vol. 53(1998), pp. 733-753.

5. See, among others, Jorion (1990), Amihud (1993), Bartov and Bodnar (1994), and Doidge, Griffin, and Williamson (2003), all cited earlier.

Table 3 **Estimates of Trade-Specific Exchange Rate Exposure**

Model: $R_{it} + \alpha_i + \beta_i R_{mt} + \gamma_i \Delta FX_t + \varepsilon_{it}$

The model is estimated for each portfolio of exporting and importing firms using ordinary least squares. R_{it} is the portfolio return for month t, R_{mt} is the market portfolio return in month t, and ΔFX_t is the rate of change in the nominal exchange rate index (FX index) in month t. An increase in ΔFX_t represents an appreciation of the U.S. dollar. γ is the exchange rate exposure coefficient. Standard errors are in parentheses.

	FX Index	
	Major Currencies	**SDR**
Panel A: Market Portfolio = CRSP Value-Weighted Portfolio		
Importers	0.3440*** (0.114)	0.3902*** (0.139)
Exporters	-0.0560 (0.055)	-0.0480 (0.066)
Panel B: Market Portfolio = CRSP Equally Weighted Portfolio		
Importers	0.1733 (0.123)	0.1554 (0.150)
Exporters	-0.1870** (0.093)	-0.2174* (0.113)
Panel C: Market Portfolio = Portfolio of Domestic Firms with No Foreign Competition		
Importers	0.2313** (0.091)	0.2316** (0.111)
Exporters	-0.1428** (0.068)	-0.1591* (0.083)

***, **, * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

estimate of trade-specific exposure. We tested for these possible outcomes by estimating the multivariate model with an equally weighted index as the control portfolio.

We reasoned that a more promising choice of the control portfolio is an equally weighted index of predominantly *domestic firms with no foreign competition*, which would be expected to have insignificant foreign exchange exposure. The trade-specific exposure estimates, relative to the index with insignificant exposure, are expected to be unbiased.

Empirical Tests and Results: Trade-Specific Foreign Exchange Exposure

Table 3 presents the results from the multivariate regression in Equation (2) at the portfolio level for the subsamples of exporting and importing firms using alternative control portfolios, the value-weighted market index, the equally weighted market index, and the equally weighted portfolio of domestic firms. The portfolio of domestic firms described in Panel C of Table 1 consists of companies with insignificant foreign trade and foreign assets, typically less than 10%, and little foreign competition. Examples include domestic service organizations, restaurant chains, newspapers, and railroad and trucking.

Panel A of Table 3 shows that when the control portfolio is the value-weighted market index, the exposure coefficients are insignificant for exporters, as in other studies, and significantly positive for importers. These results are consistent with the argument that the firm-specific exposure coefficients are likely to be biased when the value-weighted index is used as the control portfolio because its own exposure is negative. The firm-specific exposure or deviation from the (negative) market exposure therefore underestimates the true negative exposure expected for exporters and overestimates the true positive exposure expected for importers, leading to insignificant exposure estimates for exporters and strongly significant estimates for importers.

Replacing the value-weighted market portfolio with an equally weighted market portfolio also appears to generate a bias. As shown in Panel B of Table 3, our study found a significantly negative exposure for exporters and an insignificant exposure for importers at the portfolio level. These findings are consistent with a positive exposure for the equally weighted index dominated by smaller firms.[6]

Finally, Panel C of Table 3 reports the exposure estimates for the subsamples of exporting and importing firms when the control portfolio was an equally weighted index of domestic firms with no foreign competition. We have argued that since this control portfolio is expected to have insignificant exposure, the trade-specific exposures measured as the coefficient of the exchange rate variables should be unbiased. Consistent with this argument, we found significantly negative exposure for exporting firms and significantly positive exposure for importing firms at the portfolio level.[7] Also worth noting, the size of the positive and significant exposure coefficient for importers was below the "overestimated" value in the regression using the value-weighted market index as the control portfolio. And the size of the negative and significant exposure for exporters was above the "underestimated" value with the value-weighted index. These results are consistent with reduced distortion in the firm-specific exposure estimations when the equally weighted domestic firm index is chosen as the control portfolio.

What's more, both these estimates of the trade-specific exposure were not only statistically but also economically significant. They can be interpreted as saying that a 10%

6. Another study also reported more positive average exposures for the equally weighted market index than for the value-weighted market index; see G. Bodnar and M. H. Franco Wong, "Estimating Exchange Rate Exposures: Issues in Model Structure," *Financial Management*, Vol. 32 (2003), pp. 35-67.

7. To test for the stability of the coefficients over subperiods, we reestimated the multivariate regressions with a control portfolio of domestic firms for subperiods of weak and strong dollars following Choi and Prasad (1995), cited earlier. While the signs of the coefficients were stable over the two periods, exporting firms were more sensitive to exchange rate changes during the weak-dollar subperiod.

Practitioner Comment

by Kefei Li, Vice President, Global Capital Markets, Morgan Stanley

Analysis and management of currency exposure has become a critical element of a comprehensive corporate risk management system for domestic companies and multinationals both here and abroad. A key contribution of this article by Pritamani, Shome, and Singal is to identify the importance of a holistic approach to foreign exchange rate exposure—one that takes account of competitive or economic exposures as well as transaction and translation exposures.

Prevailing practice generally involves hedging transaction exposures (especially those under one year) while giving low priority to economic exposures.* But under a holistic approach, these exposures might be better addressed in combination. For example, U.S. multinationals with short positions (due to their cost structure) in Euros may intentionally choose to under-hedge that exposure because a strong European economy would increase their sales in European markets, offsetting the resulting higher costs. On the other hand, an energy company in Latin America that sells exclusively to domestic clients may still be subject to currency movements because international energy prices are usually denominated in U.S. dollars, so that a declining dollar could reduce the company's earnings even if all of its sales are in the local currency. By the same reasoning, a wholly domestic U.S. company that faces foreign competition should hedge its exposure to a drop in sales associated with an appreciating dollar. In all three cases, the "optimal" hedging policy is significantly different under a holistic approach than if the transaction exposure were hedged in isolation.

The holistic approach to currency exposure could also be expanded and applied to a broad range of corporate risk management issues. We increasingly see corporations integrating cash balances, business cyclicality, and post-retirement obligations in setting their target fix/floating debt mixes. The purpose of corporate risk management should be to reduce the probability of downside scenarios in which a company's ability to carry out a value-enhancing investment strategy would be severely handicapped. Toward this purpose, the risk management framework should consider not only the economic exposure of currency movements but also other risks and circumstances, such as cash flow volatility, leverage, debt maturity, and credit ratings.** Future research that provides an overall picture of the interplay among various corporate characteristics such as growth opportunities, capital structure, and risk exposures (interest rate, exchange rate, credit, and commodity) could be of tremendous value to practitioners in designing customized hedging solutions for corporations.

Lastly, this paper should serve as a valuable reminder to investors who view multinational companies as a "back door" play on currency movements—don't ignore economic exposure in your analysis, as it could reduce or even eliminate the desired currency exposure.

*See "Benelux Corporate Treasury Survey," PricewaterhouseCoopers (2001); "The Impact of FAS 133 on the Risk Management Practices of End Users of Derivatives," Association for Finance Professionals (September 2002); and A. El-Masry, "A Survey of Derivatives Use by U.K. Nonfinancial Companies," Working paper No. 455, Manchester Business School (2006).

** Leverage, size, and liquidity can be important factors associated with the decision to hedge; see H. Nguyen and R. Faff, "On the Determinants of Derivatives Usage in Australian Companies," *Australian Journal of Management*, Vol. 27 (2002), pp. 1-24. Also, firms with greater growth opportunities and tighter financial constraints are more likely to use currency derivatives; see C. Geczy, B. Menton, and C. Schrand, "Why Firms Use Currency Derivatives," *Journal of Finance*, Vol. 52 (1997), pp. 191-208.

appreciation of the dollar results in about a 1.5% decline in stock price for exporters and a 2.3% increase in stock price for importers, on average. Regressions at the individual firm level (not reported) showed that, depending on the exchange rate index used to measure changes in exchange rates, 73-76% of exporters had negative exposures (21% significantly so), and 68-71% of importers had positive exposures (25-32% significantly so).

Conclusions and Policy Implications

In a recent published study, we presented a dual-effect hypothesis that argues that exporting firms are at least partly hedged with respect to total exposure because of the (offsetting) foreign and domestic market effects of changes in exchange rates on firm value. This hypothesis predicts insignificant foreign exchange exposure for exporters, as has been reported by a number of studies (including parts of our own). But the dual domestic and foreign market effects are "additive" for importers, resulting in significantly positive total exposure for such firms. Consistent with these predictions, our study found insignificant exposure for exporters and significantly positive exposure for importers.

To the extent that exporters are naturally hedged in the domestic market, with negatively correlated domestic and

foreign market effects, they should have less need to hedge their overall net exposure. Importers, on the other hand, with positively correlated domestic and foreign market impacts, are more exposed to total exchange rate risk and so have more reason to hedge.

Our study also concluded that the reliability of the estimate of the trade-specific foreign exchange exposure of a company's cash flows depends critically on the choice of the control portfolio. Estimates are unbiased only when the control portfolio itself is relatively free of foreign exchange exposure. Using a portfolio of equally weighted domestic firms with no foreign competition as a control portfolio, we found significantly negative residual exposure for exporters and significantly positive exposure for importers—a result that is consistent with both theory and conventional wisdom.

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Appendix: Economic Growth and Exchange Rate Changes

Monetary models of exchange rates view an exchange rate as the relative price of foreign and domestic money—a price that is determined by the relative demand and supply of these currencies. The models differ from one another in their underlying assumptions. The Flexible Price Monetary model assumes that purchasing power parity (PPP) holds and that domestic and foreign securities are perfect substitutes. The Sticky-Price model relaxes the assumption that PPP holds allowing price-stickiness in the goods market. Finally, the Portfolio Balance model relaxes the assumption that domestic and foreign securities are perfect substitutes. These theoretical models relate exchange rates to various macroeconomic variables, including GNP growth. However, empirical (cross-sectional) tests of the model specifications have generally met with limited success.[8]

Some of the problems of specification and measurement associated with direct tests of the models are avoided by the "news" approach to exchange rate determination. This approach tests the exchange rate models in a news context rather than by regressing exchange rates on the levels of economic variables suggested by the models. Exchange rate changes are regressed against unanticipated news or surprises in the relevant economic variables. In our published study, we used the news approach to estimate the relation between GDP surprises and short-term currency returns.

Relationship between GDP and Exchange Rate Changes

Since exchange rates act like asset prices, the best way to examine the relationship is to study changes in exchange rates around releases of new information pertaining to economic growth. In this way, we are able to isolate the relationship between GDP and exchange rates without the influence of changes in other factors. None of the previous work has investigated short-term currency returns around announcements of economic growth.

In our analysis, we used announcements of *past* quarters of economic growth, with the idea that any kind of surprise about GDP growth is likely to cause market participants to change their beliefs about *future* economic growth in the direction of the surprise. Thus, any observed changes in exchange rates as a consequence of surprises about past economic growth probably arise from a revision in beliefs about future economic growth. The regression model relating the surprise in GDP growth and exchange rate changes can be specified as follows:

$$\Delta FX_t = \alpha + \beta \Delta GDP_t + \varepsilon_t \qquad \text{(A1)}$$

where ΔGDP refers to the surprise in the GDP announcement and the dependent variable is the rate of change in exchange rate for that day. ΔGDP is calculated in the following way. The U.S. Department of Commerce announces actual economic growth rates for the previous quarter three times. First, the *advance* growth estimate is announced towards the end of the first month following the close of the relevant quarter. Second, the *preliminary* growth estimate is announced about two months after the close of the quarter. Last, the *final* growth rate is announced towards the

8. See, e.g., E. Pentecost, "Econometric Approach to Empirical Models of Exchange Rate Determination," *Journal of Economic Surveys*, Vol. 5 (1991), pp. 71-96.

end of the third month following the close of the quarter. The difference between actual and most recently forecasted growth rates is ΔGDP, which we measure both as the simple difference (ΔGDP_{abs}) and as a percentage change (ΔGDP_{pct}). ΔFX_t is calculated using two measures of exchange rates, the Major Currencies index and the SDR.

The sample consists of 183 months from January 1990 to March 2005. The actual growth rates and market forecasts were obtained from Dow Jones News Wire (1990-97) and from http://www.briefing.com (1998-2005). The total number of data points is 181. (No data are available for November 1995 and December 1995 as the U.S. Department of Commerce delayed economic releases due to government shut down in the fall of 1995.)

Regression results for the model in Equation (A1) are reported in Table A1. The coefficient on the ΔGDP variable is positive in all four regressions and significantly different from zero in three of the four estimates. Overall, the results suggest that exchange rates are positively associated with changes in economic growth; the dollar appreciates when the U.S. economy grows more than expected.

Table A1 **Relationship between GDP Announcements and Exchange Rate Changes**

Model: $\Delta FX_t = \alpha + \beta\ \Delta GDP_t + \varepsilon_t$

ΔFX_t is measured in terms of foreign currency units per dollar based on the Major Currencies index (Panel A) and on the Special Drawing Rights index (Panel B). The GDP changes are measured as the simple difference, ΔGDP_{abs}, and percentage change, ΔGDP_{pct}, between the most recent forecast for and actual GDP growth. The sample consists of 181 monthly GDP announcements from January 1990 to March 2005 (t-statistics are in parentheses; those marked with an asterisk are statistically significant).

Panel A: Major Currencies Index

$$\Delta FX_t = -0.0000 + 0.08130\ \Delta GDP_{abs}$$
$$(-0.07) \quad (1.49)$$

$$\Delta FX_t = -0.0000 + 0.00107\ \Delta GDP_{pct}$$
$$(-0.16) \quad (1.99)^*$$

Panel B: Special Drawing Rights

$$\Delta FX_t = -0.0000 + 0.08274\ \Delta GDP_{abs}$$
$$(-0.19) \quad (1.97)^*$$

$$\Delta FX_t = -0.0001 + 0.00083\ \Delta GDP_{abs}$$
$$(-0.23) \quad (2.02)^*$$

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