RESEARCH SEMINAR IN INTERNATIONAL ECONOMICS

School of Public Policy
The University of Michigan
Ann Arbor, Michigan 48109-1220

Discussion Paper No. 466

Trade and Exposure

Kathryn M.E. Dominguez
and
Linda L. Tesar
University of Michigan

January, 2001

Recent RSIE Discussion Papers are available on the World Wide Web at:
http://www.spp.umich.edu/rsie/workingpapers/wp.html

Trade and Exposure

Kathryn M.E. Dominguez
Ford School of Public Policy,
Department of Economics and NBER
University of Michigan
Ann Arbor, MI 48109
kathrynd@umich.edu

Linda L. Tesar
Department of Economics and NBER
University of Michigan
Ann Arbor, MI 48109
ltesar@umich.edu

January 2001

Abstract

Are firms that engage in trade more vulnerable to exchange rate risk? In this paper we examine the relationship between exchange rate movements, firm value and trade. Our empirical work tests whether exchange rate exposure can be explained by variables that proxy for the level of international activity, firm size, industry affiliation and country affiliation. The results suggest that while a significant fraction of firms in these countries is exposed to exchange rate movements, there is little evidence of a systematic link between exposure and trade. Indeed, what little evidence there is of a link suggests that firms that engage in greater trade exhibit lower degrees of exposure. This may reflect the fact that those firms most engaged in trade are also the most aware of exchange rate risk, and therefore are the most likely to hedge their exposure.

This paper is *forthcoming* in the American Economic Review: Papers and Proceedings, May 2001. We thank Linda Goldberg, Jim Levinsohn and seminar participants at the University of Michigan and the ASSA meetings for helpful comments. We gratefully acknowledge financial support from the Center for International Business Education at the University of Michigan. We are also grateful to Brandon Fleming, Chayawadee Chai-anant and Qiaoqiao Zhu for their outstanding research assistance. The views expressed in this paper are those of the authors and not necessarily those of the National Bureau of Economic Research.

Countries have historically rationalized various fixed exchange rate regimes with the argument that trade would be adversely affected by exchange rate volatility. According to this view, uncertainty about exchange rate movements makes firms less likely to export or import goods, and, to the extent that firms engage in trade, makes them incur exchange rate risk. In this paper we directly examine the relationship between exchange rate movements, firm value and trade. Specifically, the paper tests whether firm-level exchange rate exposure is related to trade flows.

I. Explaining Exchange Rate Exposure

Firms are defined as "exposed" to exchange rate risk if market-adjusted firm returns are correlated with changes in currency values. We measure exposure in the context of the CAPM. Firm returns are regressed on the market portfolio and dollar exchange rate changes, and the coefficient on the exchange rate is the resulting measure of dollar exposure. Estimates of firm-level exchange rate exposure across eight countries are reported in Kathryn M. Dominguez and Linda L. Tesar (2001); that paper reports a substantial degree of exposure. The objective of this paper is to understand the forces underlying this exposure. In particular, the paper tests whether trade is an important determinant of exchange rate exposure.

There are a number of hypotheses in the literature concerning the causes of exposure to exchange rate risk. At the industry level, industry structure may matter most for exposure. For example, in less competitive industries, prices are elevated above marginal cost, so firms will have the ability to absorb modest exchange rate changes by adjusting local currency prices and lowering "pass through". In more competitive industries we might expect close to perfect pass-through and therefore larger effects of exchange rate movements on stock returns. On the other

hand, firms in these more competitive industries that understand their vulnerabilities have incentives to hedge exchange rate risk.

The same logic applies at the firm level. It may be that firms that are highly international – in the sense that a relatively large fraction of their business involves foreign trade – are most likely to be influenced by exchange rate changes. Alternatively, it may be that the more international is a firm, the more likely that it will have an incentive to hedge exchange rate risk. Likewise, it may be that larger firms are more likely to be exposed because they are also the most likely to have international operations, or to compete with foreign companies. Again, on the other hand, it may be that large firms have better resources to engage in both natural and financial hedging activities. Surveys of U.S. financial hedging behavior suggests that larger firms are more likely to engage in hedging activities than are smaller companies (Deana Nance, Clifford Smith, and Charles Smithson, 1993). Our empirical work tests some of these hypotheses by examining whether the estimated exchange rate exposure betas can be explained by variables that proxy for the level of international activity, firm size, industry affiliation and country affiliation.

Although theory suggests a number of channels through which firms and industries may be exposed to exchange rate risk, theory offers few unambiguous exclusion restrictions. Firm size, industry affiliation and degree of internationalization are all factors that may influence whether a firm or industry is exposed. However, the precise linkage between those factors and the direction of the exposure is unclear. As a consequence, our strategy is to take a data-driven approach to learning more about what are the determinants of firm-level exposure.

The data used in the study are from Datastream and span eight countries (Chile, France, Germany, Italy, Japan, the Netherlands, Thailand and the UK) using a broad sample of firms.

The specific countries were chosen both on the basis of data availability and to include in our sample both OECD and developing countries. At the firm level we have information on market capitalization and industry affiliation. And, at the industry level we have information on bilateral trade flows from Robert Feenstra's World Trade Flows database, and export, import and imported input share data from Jose Campa and Linda Goldberg (1997) for Japan and the UK. For countries with large numbers of publicly traded firms (in our sample these include Germany, Japan and the UK) we selected a representative sample of firms (25% of the population) based on market capitalization and industry affiliation. For the remaining countries we include the population of firms. The samples include an average of 300 firms for each country; Japan includes the largest number of firms at 488; Chile has the smallest number at 199. Firms with fewer than six months of data over the period 1980 to 1999 were excluded from the sample.

The basic regression specification has the firm-level dollar exposure beta as the dependent variable[1] and firm- and industry-level information as explanatory variables.

$$\beta_{1,i} = \gamma_0 + \gamma_1 D_i^{firmsize} + \gamma_2 D_k^{industry} + \gamma_3 Trade_k + \varepsilon_i$$

All regressions include dummy variables for firm size. These are based on firm-level market capitalization where separate dummies are used for large-sized (top-third) and medium-sized (middle-third) firms(small-sized firms being the excluded category). We also include a measure of industry affiliation in most of our regression specifications. Datastream provides a fairly disaggregated set of (4-digit) industry groupings (39 categories), from which we create a set of dummy variables (the excluded category being industry 52 "general retailers"). Various measures of industry level trade are also included in the regressions.

[1] Future work will explore alternative first-stage estimates of the exposure betas.

II. Does Trade Explain Exposure?

The first cut at the data examines whether (1) the tradability of a firm's product, (2) the size of bilateral trade flows in an industry, and (3) industry affiliation help to explain firm-level dollar exposure. Table 1 presents this first set of results. Each cell in the table summarizes the results of a different country-specific second-stage regression specification (where the dependent variable, the dollar exposure beta, is estimated from a first stage augmented CAPM regression). The first column in the table indicates that knowledge of whether the firm is in an industry whose products are actively traded between countries is not useful in predicting dollar exposure, except for the UK. Likewise, information about bilateral trade flows to the US is also not good a predictor of firm-level dollar exposure except for Japan and the Netherlands. And, with the exception of Japan and Thailand, the results suggest that knowledge of industry affiliation reveals little about firm-level exposure.

The basic second-stage regression specification is somewhat restricted in that it asks not only whether firm size, industry affiliation, and trade flows play roles in foreign exchange rate exposure, but it also implicitly restricts the direction of the exposure to be the same within each of those categories. It is possible, for example, that two firms in the same industry are strongly affected by exchange rate movements, but one firm benefits from an exchange rate appreciation while another firm is made worse off by an appreciation. To see whether our right-hand-side variables contain information about the magnitude of exposure, if not the direction of the exposure, we include the dollar exposure beta in log-odds absolute value form.[2] The results of this specification are indicated in the last column of table 1. The fraction of industries with

[2] A number of studies in the literature estimate the second-stage regression using the simple absolute value of the exposure beta as the dependent variable. This imposes a truncated bias. We include the absolute value of the exposure beta in log-odds form ($\ln(|\beta|/(1-|\beta|)$ – which allows for both positive and negative values and therefore leaves the error term normally distributed, but does not restrict the sign on the exposure variable.

statistically significant exposure rises for some of the countries in this less restrictive specification.

Campa and Goldberg (1997) provide another measure of industry-specific trade orientation for two of our eight countries, Japan and the UK. They provide measures of export share, import share and imported input shares for a number of manufacturing industries in 1993. Although these data are not based on bilateral trade with the US, it offers another proxy for relative levels of trade across industries. The Campa and Goldberg data are included as explanatory variables in the basic second stage regressions together with the firm size dummy variables. The results (not reported in the tables) suggest that all three measures of trade shares are statistically significant for Japan, but not the UK. In the case of Japan, higher export shares in an industry are positively related to the firm-level dollar exposure betas in that industry, while higher import shares and imported input shares in an industry are negatively related to exposure in that industry. Given the caveat that these data are only available for two countries, it is re-assuring to note that the results for both Japan and the UK are consistent using the bilateral trade flows and the Campa and Goldberg (1997) trade shares.

Although the results reported in Table 1 do not provide strong evidence that trade flows are an important determinant of exposure, the possibility remains that there are "threshold" effects for trade. In particular, it may be that only firms in industries that are heavily involved in international trade are the most likely to be exposed. One way to test this hypothesis is to focus only on the top export and import industries in each country. Although we find that a number of firms in these top export and import categories are exposed to the dollar (for example, the automobile industry for Germany and Japan) industry affiliation generally does not help predict this exposure. Regardless of how the exposure beta is measured (signed or in log-odds absolute

value form), we find that knowing that a firm is in a "top" trade industry for a country generally does not help predict firm-level exposure.

One shortcoming of these tests for the source of exposure is that they do not control for industry structure. The results in George Allayannis and Jane Ihrig (2001) suggest that excluding information about the level of mark-ups in an industry will produce less precise estimates of exposure. Unfortunately we do not have cross-country industry-specific information about mark-ups. However, if one assumes that industry structure is constant across countries (which is reasonable in high-trade industries), it is possible to control for mark-ups by using a cross-country industry-specific regression specification. In other words, looking within an industry, is it the case that countries with more trade in that industry also have more dollar exposure?

The results of this regression are presented in table 2. The dependent variable is the industry-specific, cross-country firm-level dollar exposure beta and the explanatory variables include a constant and the average dollar value of trade (exports plus imports) with the US in that country's industry over the period 1980-1997. The industries included in the table were chosen on the basis of availability of Trade Data (from Robert Feenstra's World Trade Flows database) and a minimum number of 30 firms in each industry. The results based on the signed exposure beta specification suggest that industry-specific trade flows help predict cross-country firm-level exposure in two industries: chemicals and automobiles. When the exposure beta is included in log-odds absolute value form, the trade flows help predict the magnitude of exposure in five out of twelve industries. Somewhat counter-intuitively, however, the coefficient on the value of trade is negative in four out of the five cases in which it is statistically significant. This suggests that knowing that a firm is from a country where trade is "high" in its industry predicts that exposure

(whether positive or negative) will be lower. This, in turn, suggests that firms in highly "internationalized" industries are the most likely to hedge exchange rate exposure.

III. Conclusions

The results suggest that a significant fraction of firms in these countries is exposed to exchange rate movements but that there is little evidence of a systematic link between exposure and trade. Indeed, what little evidence there is of a link suggests that firms that engage in greater trade exhibit lower degrees of exposure. While this result sounds paradoxical, it may simply reflect the fact that those firms most engaged in trade are also the most aware of exchange rate risk, and therefore are the most likely to hedge their exposure.

Table 1–What Explains Firm-Level Dollar Exposure?

Country	Traded/ Non-traded	Bilateral Trade with US	4-digit Industry dummy	4-digit Industry log-odds
Chile	No	No	0.16	0.25
France	No	No	0.03	0.26
Germany	No	No	0.14	0.14
Italy	No	No	0.10	0.00
Japan	No	Yes	0.43	0.34
Netherlands	No	Yes	0.03	0.32
Thailand	No	No	0.27	0.20
UK	Yes	No	0.05	0.19

Note: Each cell in the table reports the results of a different country-specific second-stage regression specification that includes firm-level dollar exposure betas as the dependent variable and firm size dummy variables as independent variables. Numerical entries denote the fraction of times that the variable named at the top of the column is statistically significant at the 5% level (based on robust standard errors).

Table 2-Does Trade Explain Industry-Specific Exposure?

		rhs = Dollar Value of Trade			
Industry	Firm	Dep var=$-beta		Dep var=log-odds $-beta	
	#	Coeff	t-stat	Coeff	t-stat
Chemicals	89	1.12	2.95	-0.99	-0.46
Construction	167	0.07	-0.03	-16.94	-2.15
Forestry	30	-0.98	-0.74	-20.08	-3.99
Steel	32	-0.04	-0.19	0.09	0.09
Industrials	70	0.04	0.08	-2.57	-0.75
Electronic	131	0.63	1.21	-1.30	-1.40
Engineering	116	0.01	0.07	-1.25	-1.93
Automobiles	62	0.24	2.39	-0.39	-0.94
Household Goods	164	-0.02	-1.08	-0.53	0.64
Beverages	50	-0.03	-0.64	-0.47	-0.15
Food Producers	123	-0.05	-0.59	-11.02	-2.01
Pharmaceuticals	41	-0.23	-0.68	28.72	1.97

Note: Each coeff-tstat pair in the table reports the results of a different cross-country second-stage regression specification that includes firm-level dollar exposure betas (in signed and log-odds form) as the dependent variable and a constant and the average dollar value of trade with the US in the firm's industry over the period 1980-1997 as the independent variable. T-stats are based on robust standard errors.

References

Allayannis, George and Jane Ihrig, "Exposure and Markups", Review of Financial Studies, *forthcoming*.

Campa, Jose and Goldberg, Linda. "The Evolving External Orientation of Manufacturing: A Profile of Four Countries." FRBNY Economic Policy Review, July 1997,pp. 53-81.

Dominguez, Kathryn M. and Tesar, Linda L. "A Re-Examination of Exchange Rate Exposure." American Economic Review, May 2001, (Papers and Proceedings), *forthcoming*.

Nance, Deana R.; Smith, Cliford W. and Smithson, Charles W. "On the determinants of corporate hedging." The Journal of Finance, March 1993, 48(1), pp. 267-284.