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Exchange rate volatility and international trade: A general-equilibrium analysis

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Abstract

We analyze the relation between exchange-rate volatility and the volume of international trade, in a general-equilibrium stochastic-endowment economy with imperfect international commodity markets, and treating both variables as endogenous. Even in the simplest model, the sign of the relation depends on the source for the change in volatility. For instance, more volatility of the endowments and higher costs to international trade both boost exchange risk (and lower welfare); but the first *increases* the expected volume of trade, while the second *decreases* trade. Note that even the (inter-equilibria) relation between trade and welfare is ambiguous.

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Our objective in this paper is to evaluate the conjecture that an increase in exchange rate volatility is associated with a decrease in the volume of international trade. [Perée and Steinherr \(1989\)](#) argue that the existing literature on exchange rate volatility and international trade suffers from two weaknesses: first, the existing theoretical models – for example, [De Grauwe \(1992\)](#), [Franke \(1991\)](#), [Sercu \(1992\)](#), and [Viaene and de Vries \(1992\)](#) – are partial equilibrium in nature, and second, in the empirical work a linear relation between trade and exchange rate risk is postulated while the true relation

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might be non-linear.¹ The model we develop is of a general-equilibrium economy with stochastic endowments in which the exchange rate and the prices of financial securities are determined endogenously. Our major result is that in this general-equilibrium setting an increase in exchange-rate volatility may be associated with either an increase or a decrease in the volume of international trade, depending on the source of the change in volatility.

We now discuss the existing literature on the relation between exchange rate volatility and international trade, starting first with an overview of the theoretical models and then a survey of empirical work.² In the early theoretical literature, a number of models support the view that an increase in exchange rate volatility leads to a reduction in the level of international trade. These models (for example, [Clark, 1973](#); [Baron, 1976a](#); [Hooper and Kohlhagen, 1978](#); [Broll, 1994](#); [Wolf, 1995](#)) consider firms exposed to exchange risk. A typical argument in this literature is that higher exchange risk lowers the risk-adjusted expected revenue from exports, and therefore reduces the incentives to trade. However, these results are derived from partial-equilibrium models. Also, most of this literature assumes that the exchange rate is the sole source of risk for the decision-maker, and either ignores the availability of hedges (forward contracts, or non-linear hedges like options and portfolios of options) or takes the prices of the hedge instruments as given.

Taking into account the firm's option to (linearly) hedge its contractual exposure, other partial-equilibrium models such as [Ethier \(1973\)](#) and [Baron \(1976b\)](#) show that exchange rate volatility may not have any impact on trade volume if firms can hedge using forward contracts. [Viaene and de Vries \(1992\)](#) extend this analysis to allow for the endogenous determination of the forward rate; in this case, exchange rate volatility has opposing effects on importers and exporters (who are on opposite sides of the forward contract) and they find that the net effect of exchange rate volatility on trade is ambiguous. Also [De Grauwe \(1988\)](#) shows that risk aversion is not sufficient to obtain a negative link between exchange risk and expected trade because, in general, an increase in risk has both an income effect and a substitution effect that work in opposite directions ([Goldstein and Khan, 1985](#)). [Dellas and Zilberfarb \(1993\)](#) make a similar point using a portfolio-choice model.

While these models allow the firm to hedge or at least diversify its exchange risk, they still ignore the firm's option to adjust its production in response to the exchange rate. Models that focus on the firm's flexibility tend to conclude that a higher exchange risk actually stimulates trade. The reason is that, when firms are allowed to optimally respond to exchange rate changes, the revenue per unit of an exportable good ([De Grauwe, 1992](#); [Sercu, 1992](#)) or the entire cashflow from exporting ([Franke, 1991](#); [Sercu and Van Hulle, 1992](#)) become convex functions of the exchange rate. From this

¹ [Perée and Steinherr \(1989\)](#) also point out that it is not clear how one should measure exchange rate risk and that the equations for aggregate trade often ignore the competitive structure of product markets. While the appropriate definition of exchange rate volatility in our theoretical model will be clear, we do not address the issue of industrial structure.

² See [Perée and Steinherr \(1989\)](#), [Edison and Melvin \(1990\)](#), and [Côté \(1994\)](#) for a more detailed review of the theoretical models and empirical work examining the relation between trade volume and exchange rate volatility.

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