# DÖVİZ KURU BELİRSİZLİĞİ ve ULUSLARARASI TİCARET KONUSUNDAKİ TEORİK ÇALIŞMALARIN BİR DEĞERLENDİRMESİ

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## ÖZET

Bu makale döviz kuru dalgalanmasının dış ticarete etkisi konusundaki teorik literatürü inceler. Bu literatürden çıkan genel sonuç gösterdi ki, konu ile ilgili tartışma sürmektedir. Döviz kuru riskinin uluslararası ticarete etkisinin ne olduğuna dair belirsizlik devam etmektedir. Teorik olarak geliştirilen modeller hem pozitif hem de negatif etki olabileceğini göstermiştir. Teorik modelleri geliştirenler konunun daha çok ampirik olarak açıklanması gerektiğini savunmuşlardır.

**Anahtar Sözcükler:** Döviz Kuru Riski, Uluslararası Ticaret

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**A Survey on the Theory of Exchange Rate Volatility and International Trade Literature**

The purpose of this paper is to survey the theoretical literature on the impact of exchange rate volatility on trade flows. The general conclusion from the literature is that the debate is not over yet. The ambiguity of the impact of exchange rate uncertainty still exits. At the theoretical level, researchers have been able to construct models that show how exchange rate uncertainty may apply a positive or negative impact on trade. They also argued that the problem is more an empirical issue.

**Key Words:** Exchange Rate Volatility, Trade

## 1. Introduction

After the breakdown of Bretton-Wood agreement, a new debate began to emerge in international economies since the world's major trading nations would embrace a regime of floating exchange rate determination. While liberal economists welcomed this transition, it was not embraced by others, who claimed that the transition to floating exchange rate would have an adverse effect on world trade.

These events have opened up a new research area in both theoretical and empirical international economics since early 1970s. So far, both empirical and theoretical studies have been inconclusive. The conventional view based on the idea that risk-averse exporters would reduce their output when faced with a increase in exchange rate volatility brought about by the move to floating exchange rates. Even when traders can cover themselves against foreign exchange risk, the higher costs associated with it may have the same effect as an increase in tariffs, i.e., they may slow down international trade. In this view, exchange rate volatility was defined as a risk and obstacle to international trade. (Akhtar and Hilton,1984). On the other hand, the opposite view proposed that exchange rate volatility and trade volume has been positively related. Theoretical arguments of the positive relationship consider trade as an option held by firms, and the value of this trade option rises with increased volatility. (Franke, 1991).

Recent theoretical developments in the literature supported the notion that exchange rate uncertainty could have either positive or negative effects on trade volume. For example, De Grauwe (1988) and Dellas and Zilberfarb (1993) argued that the effects exchange rate uncertainty on exports depend on the degree of risk aversion. In this case, the response of an exporter to an increase in exchange rate risk depends on whether the expected marginal utility of export income is a convex or concave function of the exchange rate. So, if producers exhibit only a slight degree of risk aversion, they will produce less for export as the higher exchange rate risk reduces the expected marginal utility of export revenues. However, if producers are extremely risk averse, they will worry about the worst possible outcome. So, an increase in exchange rate risk will raise expected marginal utility of export revenues as producers will want to export more to avoid a severe decline in their revenues.

A very risk-averse individual may export more when risks are higher to minimize the decline in revenues. On the other hand, a slightly risk-averse person considering the return on exports as less attractive may decide the export less when risks are higher. These results are based on the fact that the total effect of an increase in risk consists of a substitution effect and an income effect. The substitution effect makes firms move away from risky activities. An income effect, however, works in the opposite direction. When risk increases, total expected utility increases.

This leads firms to increase their export activities to compensate for the decline in expected revenues. For large value of risk aversion, the income effect dominates the substitution effect, and greater exchange rate risk thus leads to increase in exports. So, the theoretical studies have generated mixed results regarding the effect of exchange rate risk on trade flows.

The purpose of this paper is to review the theoretical studies in the literature. This paper also aims to identify major issues, which have contributed the development of the debate. Section 2 reviews the theoretical literature that supports the hypotheses of negative, positive and ambiguous effects of exchange rate uncertainty on trade. Section 3 discusses the importance of risk aversion assumption. Section 4 investigates the importance of single-multinational firm difference. Section 5 reviews two country setting model. Section 6 investigates the importance of hedging. Section 7 reviews the importance of pricing exports. Section 7 concludes the paper.

## 2. The Theoretical Literature

Theoretical models that exam the relationship volatility and trade show how exchange rate volatility may impact in a positive, negative, or ambiguous fashion on trade flows. These theoretical models drive

different results depending on the assumptions employed, availability of capital, the time horizon of the trader, etc.

According to the conventional view, exchange rate volatility has adverse effects on trade flows. Risk-averse/neutral exporters would reduce their output when faced with an increase in exchange rate volatility brought about by the move to floating exchange rates. In this section, theoretical background of this view will be presented.

One of the principal arguments against floating exchange rates has been that they lead to heightened risk and uncertainty in international transactions and thus discourage trade and investment flows. Uncertainty refers to a state of doubt about future rates at which various currencies will be exchanged against each other. The main point is that the timing and size of exchange rate fluctuations cannot be systematically explained by economic factors. But if there were a widely used empirical model of exchange rate behavior, some measure of prediction errors from that model might provide a good approximation of exchange rate uncertainty. Many widely used structural models do not forecast exchange rates any better than a random walk. Existing empirical models fail to explain exchange rare movements sufficiently. Meese-Rogoff (1983) documented performance of empirical models. The difficulties of predicting exchange rates are also reflected in the fact that future spot rate forecasts based on the forward rate for the relevant maturity yield large prediction errors.

This suggests that the forward rate is an unreliable and poor predictor of the future spot rate.

According to conventional view, exchange rate uncertainty is a source of concern, because currency values partly determine the price paid or received for output and, as a result, affect the profits and welfare of producers and consumers. If traders are risk averse, then exchange rate volatility can cause them to limit their activities and change prices in order to reduce their exposure to the effects of unforeseen currency movements.

Akhtar and Hilton (1984) argued that exchange rate volatility affects trade flows through two distunguieshed channels. First one is direct channel effect in which the volume of goods is affected by prices and profits that are indeterminate due to exchange rate uncertainty. For example, a firm chooses between buying a foreign-made product and a similar domestic substitute when both are equally valued in local currency terms using current exchange rate levels. The firm would prefer a domestic product over an import if it is unclear at the time of the purchase what the exchange rate will actually be when payment is due. Under same circumstances, exchange rate risk could adversely affect export volume. If hedging in forward markets can reduce exchange rate risk without significant increase in cost of doing international business, the preceding conclusion has to be modified. But it is the fact that

forward markets are not effective in completely eliminating exchange uncertainty at modest cost, even well developed forward markets can provide only limited protection. So, exchange rate volatility may directly reduce trade flows.

The second channel that is pointed by Akhtar and Hilton (1984) explains the less straightforward ways that uncertainty may affect trade. Most of these indirect effects stem from decisions, which affect trade flows over a longer period. Beyond the contract period, the ability of a firm to anticipate its future income stream could be impaired by doing business with foreign rather than available domestic sellers and buyers. If it is costly to change, the buyers will refrain from switching between domestic and foreign producers to avoid incurring adjustment expenses. Under these conditions, international trade could be discouraged.

Conventional approach views exchange rate volatility as an obstacle to international trade, similar to, for example, increased tariffs. The argument views hedging as impossible or expensive; traders are assumed to be utility-maximizing individuals, who therefore, bear undiversified exchange risk; and increased volatility means a decrease in foreign trade. So, trade and investment in export-oriented plants would be expected to decrease. Even if the exports are not risk averse, Demer (1991) produced a model which supports the negative hypothesis. In this paper, risk neutrality was assumed for a competitive firm. This firm is

uncertain about the demand due to price uncertainty caused by exchange rate risk. Demer (1991) showed that in this uncertain environment, the irreversibility of investment in physical capital leads to reduced production levels and trade volume over time.

This view has been challenged in 1990s. As an opposite argument to the Dermer's (1991) model, Franke (1991) developed a risk neutral firm's exporting strategy model that provided support for the positive hypothesis. The assumptions of the model are: firms operate in monopolistic competition, firms maximize the net present value of expected cash flows from exports and profits are an increasing function of the real exchange rate. Franke (1991) also analyzed an investment problem. The export strategy was determined by the transaction costs incurred whereby the firm weights the entry (exit) costs associated with entering (abandoning) a foreign market against the profits (losses) created by exports. Where the cash flow is convex in exchange rate, the present value of cash flows grows faster that that of entry and exit costs and the firm benefits from increased exchange rate volatility. Therefore, firms will enter a market sooner and exit later when exchange rate risk increases, the number of trading firms will also increase. So, on average, trade benefits from exchange rate risk.

Sercu (1992) looked at the same problem in a very different setting. Sercu (1992) argued that friction here is brought about not by

entry and exit costs, as stated in Franke's paper, but by standard duties and/or transportation costs. Additionally, a short-term "market period" perspective is adapted as risk-neutral firms produce in the current period for sales in the next period. Firms start producing at time zero for sales at time one, and may end up import-competing, exporting, or not trading at all depending on the end-of-period exchange rate. Sercu (1992) showed that under perfect competition and under complete monopoly an increase in exchange rate volatility has similar effects on prices and production as decreased tariffs. For the intermediate market structure, the effect is uncertain. (In this model, exchange rate risk is measured as the conditional standard deviation of the exchange rate.)

Sercu and Vanhulle (1992) reexamined the same issue in a setting that avoids some of the shortcomings of Sercu (1992) paper. Besides trying to improve assumptions, they also increased the scope of the problem. One alternative to exporting is foreign direct investment (FDI); they explore the effect of exchange rate volatility on alternative attractiveness of FDI vs. export strategies and investigate the effect of volatility on investment and disinvestments strategies for export plants. They found that when exchange rate volatility rises, an export-based strategy seems to become relatively more valuable than a FDI strategy. The implication of their model shows that the fall of U.S. foreign investment since the end of the Breton-Woods system need not be

interpreted as a sign of weakness; exploiting one's comparative advantages via exports becomes relatively more attractive when exchange rate become more volatile.

Bailey,Tavlas,Ulan (1987) argued that variability of an exchange rate may either deter bilateral trade or may stimulate it. They argued that the question is empirical rather than theoretical. De Grauwe (1988) developed a simple model that sheds some light on this issue. In the model, a competitive producer who must decide between selling in the domestic or foreign market. He also assumes that both foreign and domestic prices are fixed so the only source of risk is the local currency price of exports. Producers are assumed to exhibit a slight degree of risk aversion. Given these assumptions, the response of this producer to exchange rate risk depends on whether the expected marginal utility of export income is a convex or concave function of the exchange rate. So, slightly risk-averse producers will produce less for exports as the higher exchange rate risk reduces expected marginal utility of export revenues. However, where producers are extremely risk averse, they will worry about the worst possible outcome. In this case, increase in the exchange rate risk will increase exporter' willingness to export, because the increase will raise the expected marginal utility of export revenues as producers will want to export more to avoid a drastic decline in their revenues. In this model, De Grauwe admitted that the introduction of a

capital market would enrich the analysis, but basic ambiguity of the model still remains. Viaene and de Vires (1992) formally tested this view by incorporating a mature forward market into their analysis. Assuming that individual merchants were functioning a competitive world market, Viaene and de Vires began by proving the proposition that, in the absence of forward markets, an increase in exchange rate volatility reduces both imports and exports. A forward market was then incorporated into the equations of this model; the effect of a change in exchange rate volatility on imports and exports are opposite the each other. This result is proved to the fact that importers and exporters are, by definition, on opposite sides of the forward market as is their exposure toward movements in the exchange rate. Thus, exchange rate risk may act to the detriment or benefit of trade flows depending on net currency position of that country.

In a similar vein, Dellas and Zilberfarb (1993) modeled the uncertain nature of the impact of exchange rate risk by using a standard asset portfolio model. Their definition of volatility is different than most of the other studies where volatility is described as the variance of the exchange rate. The others specify unanticipated fluctuations in the exchange rate as constituting risk. The asset in their model is a nominal unhedged trade contract, which contains a risk element in the form of an exposure to changes in the exchange rate. The authors examined a single

individual who consumes as well as imports and exports both available goods. Their results indicated that an increase in the riskness of the return on these assets may increase or decrease investment depending on the nature of the risk aversion parameter assumed. If a convex function is assumed, then an increase in risk causes the level of exports to rise. If concavity is assumed, the reverse is true. Their results are robust to the presence of a forward market with non zero transaction costs and the introduction of production.

### 3. Does Risk Aversion/Risk Neutrality Assumption Matter?

In one of the earlier studies, Either (1973) found support for the negative effects of exchange rate volatility hypothesis right after the break down of Bretton-Woods system. Either specified the exchange rate uncertainty as the standard deviation of the spot exchange rate and modeled the decision of risk-averse importers regarding both the volume of goods to be imported and the amount of forward exchange rate cover. He suggested that exchange rate volatility determines the degree of forward cover. He argued that it is unlikely that a firm possesses profit information so the level of trade responds adversely to exchange rate volatility. Either noted that this result is robust regarding the type of currency denomination specified in the export contract. While Either's model requires risk averse assumption, Demer (1991) showed the same

results assuming a risk-neutral trader. He argued that, for a perfect competitive firm, demand is uncertain because of price variability caused by exchange rate volatility. It is shown how, in this uncertain world, the irreversibility of investment in physical capital leads to reduced production levels and trade volume over time. As Demer's risk neutral trades firm model supports the negative hypothesis, Franke (1991) using the same assumption showed the exchange rate risk has a positive effect on trade flows.

### 4. Does Single-Multinational Trading Firm Difference Matter?

Most theoretical models choose to focus on the decisions of a single trading firm. Broll (1994), in a different setting, took multinational trading firms into account due to increasing importance of this type of firms. The question in Broll's study was whether exchange rate risk was a concern for multinational firms. In his paper, Broll focused on the economic behavior of a risk-averse multinational firm, which produces in a foreign country and sells that output abroad. It was assumed that the multinational firm had monopoly power in the foreign market and faced exchange rate risk. Exchange rate risk is specified as the difference between the spot exchange rate and the expected exchange rate. Broll found that exchange rate risk is not diversifiable; production is shown to

decline in the foreign country as a result of exchange rate uncertainty. However, where mature foreign currency forward markets are accessible, then the probability distribution of the spot exchange rate bears no impact on the decision function of the multinational enterprise with respect to foreign investment and foreign labor demand.

Gagnon (1993) modeled the traders who buy goods in one country and sell in another to maximize discounted expected utility. These traders are assumed to be risk averse so, they exhibit concave utility functions as well as face convex cost structure in response to adjusting the level of trade because of contracting and marketing costs. In this model, both exchange rate variability (the unconditional variance) and exchange rate uncertainty (the conditional variance) are shown to reduce trade flows.

In a similar vein, Wolf (1995) focused on multiplicative risk structure that arises from exchange rate risk. In his paper, he considered a utility-maximizing and risk-averse competitive import agent. This agent was assumed to face uncertainty about not only changes in the exchange rate during the period in which decisions are made (measured as the variance of the exchange rate) but also uncertainty about the imported commodities price. He explicitly proved that the variance of exchange rate has a negative effect on the level of imports.

**5. Does Exchange Rate Volatility Matter in a Two Country-Setting Model?**

Generally, theoretical models of exchange rate volatility consider the decision of the firm. In 1992, Kumar took a different approach and introduced a two-country general equilibrium model in which two countries produce two goods (manufactured and agricultural) with a single input (labor). The assumptions of this model are: purchasing power parity holds, incomplete hedging opportunities, risk aversion and foreign currency invoicing, and home-country comparative advantage in manufacturing while the foreign country has a comparative advantage in agricultural sector. Kumar argued that an increase in exchange rate volatility is equal to a negative technological change. In the home country, resources flow from the manufactured goods into agricultural goods sector since the latter is not exposed to exchange rate risk and vice versa in the foreign country. Hence, he found that an increase in exchange rate risk reduced the intercountry differences in relative productivity and also reduced the level of international trade. On the other hand, level of intra-industry trade increased.

**6. Does Hedging Help to Avoid Exchange Rate Risk and Encourage Trade?**

If hedging instruments are costlessly available, then firms'

production and exports are not affected by exchange rate volatility. This was first proved by Ethier (1973). This theoretical result known as the separation theorem, is the logical foundation of the hedging hypothesis. Over the last twenty years, hedging instruments have rapidly proliferated. Using both early and more recent data Frankel and Wei (1994) found a negative coefficient before the mid-1980s, but the negative effect has disappeared since then. Wei (1999) argues that this pattern is in principle consistent with the hedging hypothesis: currency hedging products were not as developed in the 1970s and early 1980s as they are now. Wei (1999) argues that this observation together with the separation theorem supports the idea that increasing availability of hedging is responsible for the diminished effect of exchange rate volatility on trade. However, Wei (1999) also argues that we should note a number of dimensions of hedging hypothesis. First, the use of hedging instruments is not costless. The cost is also not constant, it goes up as volatility increases. Second an increase in volatility may affect trade (often depress) indirectly through its effect on the forward rate (Vianene and de Vries, 1992). Third, hedging instruments are often available only for short horizons (one month to a year), which may be shorter the planning horizon of many exporters and importers. Fourth, traders may care about real exchange rate risk, whereas available hedging instruments are designed to hedge against nominal exchange rate risk.

Adam-Muller (1997) modeled optimal export and hedging decisions taken by a risk-averse firm, which simultaneously faces hedgeable exchange rate risk and non-hedgeable revenue risk abroad. Thus, the firm's exchange rate exposure itself is random. The firm's must decide on exports, as well as on forward covering of its foreign currency revenue. If a currency forward market exits and there is no revenue uncertainty, optimal production decisions will be separable from the firm's utility function and distribution of exchange rate (Holthausen, 1979). This separation property generally breaks down if non-hedgeable risks are introduced. Adam-Muller (1993) considered two exceptions.

Despite the fact that exchange rate risk can be hedged with forward contracts, optimal output is smaller when compared to the deterministic revenue case. This is due to additional uncertainty arising from the randomness in foreign exchange revenue. For any forward position, the firm is still exposed to unhedgeable revenue risk. Separation does not hold and distribution of risk and risk aversion has an impact on output. In addition, revenue uncertainty generally affects the forward position. Even if the forward market is unbiased, the firm does not necessarily hedge its expected foreign currency revenue completely, due to the existence of revenue uncertainty effect.

## 7.Does Pricing of Exports Matter?

International trade in commodities is different from domestic trade in several important ways: the choice of currency of invoice and the length of time over which the transactions takes place. In a regime of fixed exchange rates or flexible exchange rates, but fully anticipated changes, these differences have no real consequences on the behavior of exporters and importers of commodities. However, when exchange rate volatility increases, various types of institutions and payment mechanisms emerged to reduce the adverse effects of exchange rate uncertainty on international transactions.

Either (1973), Clark (1973), and Baron (1976) analyzed exporting and importing firms in an environment of exchange rate uncertainty. They assumed that exchange rate uncertainty resulted in commodity price uncertainty because prices were quoted in foreign currency. In practice, however, empirical investigations of Grassman (1973, 1974, 1976), Magee (1974), Page (1977), and Carse, Williams and Wood (1980) showed that exporting (importing) firms set prices either in their own currency or in the buyer's currency. Grassman (1973) found that in 1968, 66 % of Swedish exports contract to the U.S. were denominated in Kroners and 25 percent in dollars; 95 % of the Swedish imports from the United States. had contracts denominated in dollars.

For the period from 1971 to1973, Magee (1974) examined the currency of denominations of contracts of Japanese and German exporting firms to the United States. He found that 79 % of German exports were invoiced in Deutche Mark and 17 % in dollars. For Japanese exports, 63 % were invoiced in dollars and 37 % in yen. Page (1977) and Carse, Williams and Wood (1980) investigated the invoicing practices of British exports in the 1970s. They found that 76 % of U.K. exports were invoiced in pounds and 17 % in the importer's currency. Thus, the empirical evidence suggests that both the exporters and importers currencies are used for invoicing.

Theoretical investigations on the choice of currency of invoice are still growing. One of the early studies of Baron (1986) examined an exporter who sells his product only in foreign markets. Assuming that all decisions (production, price and exporting) are made simultaneously, and output and price were chosen ex-ante, he focused on the impact of risk aversion on the exporter's decision when the price is quoted either in seller's or in the buyer's currency. Giovannini (1988) also examined the choice of the invoice currency of exports, focusing on the deviations from the law of one price induced by price discrimination across domestic and foreign markets.

Magee and Rao (1980) and Bilson (1983) also examined the issue of choosing the currency of invoice. They assumed that the quantity of

the traded goods is exogenously given and focused on the effects of risk aversion on the composition of the contract. The general feature of the theoretical studies mentioned above is that production; pricing and exports decisions are all made at the same point in time. Ben-Zvi and Helpman (1989) took a different approach. They argued that international transactions are better described by the following sequence of events. First firms select output or capacity, then prices are set, followed by the arrival of orders from buyers, finally commodities are shipped. Magee (1974) presented empirical evidence, to support this sequence of decision making in international transactions.

In a similar approach to Ben-Zvi and Helpman (1989), Zilcha–Donnenfeld (1991) adopted the sequential approach regarding the firm decisions about output, pricing, and shipping of goods across market. They specifically focused on the pricing-cum-invoicing strategies available to the firm and examined how the exporting firm decisions are affected by exchange rate risk. Their model was able to capture the dynamic aspects of the exporting firm's behavior. Such as the effect of changes in the expectations about the exchange rate that result from arrival of new information, on the sequence of decision making about production, pricing, and distribution of output across markets. Their model paid special attention to the differences that arise in output, prices, and profitability under two invoicing strategies. They showed that pricing

exports in importer's currency entails a recommitment price, whereas pricing exports in exporter's currency does not entail price precommitment. They stated the conditions leading the dominance of invoicing exports in the importer's currency over the alternative invoicing strategy. They found that because of exchange rate uncertainty and the time gap between the pricing and purchasing periods, invoicing in the importer's currency results in higher profits, larger output, and lower prices relative to the case where foreign sales are invoiced in the exporter currency. The optimality of this invoicing strategy is driven by *No-Regret* requirement. However, if the firm serves the domestic market first, invoicing strategy plays less important role.

## 8.Conclusion

The purpose of this paper was to survey the theoretical literature on the impact of exchange rate volatility on trade flows. The general conclusion from the literature is that the debate is not over yet. The ambiguity of the impact of exchange rate uncertainty still exits. At the theoretical level, researchers have been able to construct models that show how exchange rate uncertainty may apply a positive or negative impact on trade. They also argued that the problem is more an empirical issue.

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