FOREIGN EXCHANGE ISSUES, CAPITAL MARKETS, AND INTERNATIONAL BANKING IN THE 1990s

Edited by
Khosrow Fatemi and Dominick Salvatore

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FOREIGN EXCHANGE ISSUES, CAPITAL MARKETS, AND INTERNATIONAL BANKING IN THE 1990s

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Preface

The international economic order that was established at the end of World War II was based on certain premises and conditions. The financial and monetary side of this *new* international economic order had its own postulations, such as the overwhelming dominance of the American economy [48% of the global gross national product (GNP)] and the stability of the American dollar.

During the two ensuing decades, the validity of some of these premises diminished, thus reducing the effectiveness of the system itself. A variety of conflicting forces finally caused the de facto demise of the old Bretton Woods system in the early 1970s, without a parallel creation to replace it.

The rapidly changing environment of international economic areas and the dynamic nature of international financial activities have precluded the development of a generalized system to replace the old one.

The need for continued analysis and evaluation of the international financial system never has been greater. Considering the enormity of the task, it is necessary to concentrate on specialized studies. The current volume follows this line of reasoning by providing an in-depth analysis of certain aspects of the international financial system. Specifically, it addresses four of the most important financial and monetary issues of the present time—namely, exchange rate, capital markets, international banking and external debt, and international financial management.

The studies included in this volume have undergone the normal process of evaluation. In addition, the authors have benefited from the feedback of participants of the First International Conference of the International Trade and Finance Association, held in Marseille, France, May 31–June 2, 1991. The objective of this volume, in short, is to contribute to the studies needed as a prelude for the creation of a new international financial system.

Khosrow Fatemi
Dominick Salvatore

Chapter 1

Introduction

Dominick Salvatore and Khosrow Fatemi

The worldwide deregulation movement of the 1980s and the resultant globalization of financial markets have led to increased efficiency in the utilization of financial capital and direct investments around the world, but also to greater interdependence of financial markets and to the development of many new financial instruments to meet changed needs and conditions. Furthermore, they pointed to the crucial need to fully understand the implications of recent changes for the functioning of the present international financial and economic systems. This volume addresses some of these important issues. Specifically, as the title indicates, it deals with the effect of recent changes in the international economy on the operation of foreign exchange markets, capital markets, and international banking in the 1990s. The volume includes the most important papers on international finance presented at the first international meeting of the International Trade and Finance Association held in cooperation with the Ecole International des Affaires in Marseilles, France, from 31 May to 2 June 1991.

RECENT CHANGES IN INTERNATIONAL FINANCE ADDRESSED IN THIS VOLUME

One of the most striking aspects of the present international financial system is the great volatility of exchange rates and the inability of empirical models of exchange rate determination to explain and forecast exchange rate movements. While exchange rate risks can generally be hedged at a cost, persistent exchange rate misalignments can and have greatly disrupted the pattern of international specialization and created serious disruptions in the international economy. An example of this was the sharp overvaluation of the U.S. dollar during most of the 1980s and the loss of competitiveness of otherwise internationally efficient U.S. manufacturing firms. Indeed, the problem does not seem to end with the elimination of the exchange rate misalignments. Economists have borrowed from physicists the term *hysteresis* to describe a situation in which trade does not return to equilibrium even after the exchange rate misalignment has been eliminated. Thus, is is important to know what the equilibrium exchange rates are and to avoid large and persistent exchange rate misalignments and excessive fluctuations. The fact is that no model has been able to correctly and consistently forecast exchange rates. There are three main reasons for this. First, most models of exchange rate determination emphasize a particular aspect of the economy to the exclusion of other important aspects. Second, exchange rate expectations in exchange rate models are generally based on unrealistic assumptions. Third, new information alters exchange rate expectations instantly and may dominate exchange rate movements. Thus, a more general and eclectic model that incorporates the best of existing models and that can be shown to better predict exchange rates is certainly a welcome development. Such seems to be the model developed by Vincent Dropsy in Chapter 2.

Exchange rate movements also reflect the changed international financial environment, and often, as during the current period of rapid changes, theoretical developments that consider the effect of such changes lag behind actual market developments. A good example of this is in the pricing of currency options in the face of foreign exchange agreements, as for example, the European Monetary System (EMS). It is important to see how arrangements that constrain exchange rate movements affect the pricing of currency options, especially as they become more inclusive and widespread in the international economy. This important aspect is examined in Chapter 3 of this volume. Chapter 4 examines the way in which the large dollar overvaluation during most of the 1980s permanently harmed the international competitiveness of U.S. firms and also interfered with international specialization and trade, because the dollar is still the most important vehicle currency of international trade and finance in the world today. Exchange rate problems, however, do not arise only as a result of misalignment. As pointed out in Chapter 5, if a country such as Japan does not allow the appreciation of the yen toward its equilibrium level from being reflected in lower import prices and higher export prices for Japan, the equilibrating effect of the yen appreciation is not allowed to take place. The same occurs if Japan takes other measures, such as a contractionary fiscal policy that neutralizes the effect of the appreciation of the yen. It is then important to understand that the problem does not lie in the fact that the international economy and international financial markets do not respond to exchange rate changes, but to these other forces that prevent exchange rates from accomplishing their equilibrating function. To examine clearly and isolate the effect of exchange rate changes from other forces simultaneously at work requires the use of counterfactual simulations. If this is not recognized and the problem is attributed instead to economic and financial markets not responding to exchange rate changes, then the wrong policies are likely to be employed.

Another important topic that has traditionally received a great deal of attention is the efficiency of the forward market for foreign exchange. While there is some evidence in support of forward market efficiency, a large body of empirical evidence has rejected the forward rate as an unbiased or efficient predictor of future spot rates. In short, no model seems to outperform a *random walk* of exchange rates in an out-of-sample period. Many conflicting explanations have been advanced for this, for example, the many risk-averse agents of foreign markets, irrational behavior of agents, financial markets that do not clear, fundamentals that exhibit strong short-term volatility, speculative bubbles, and central bank intervention. A great deal of research has taken place, but no firm conclusion has been reached as to which of these explanations is most important. Chapter 6 of this volume examines the notion that the presence of risk premium in the foreign exchange market allows the forward rate to be an unbiased predictor of the future spot rate without sacrificing the notion of market efficiency.

Another important topic of research into exchange rates deals with the theoretical arguments for and against monetary integration. While this is not, of course, a new topic of research, it has acquired great importance and immediacy today as the result of the formation of the EMS and its movement toward full monetary union. It is important, therefore, to revive the old theoretical arguments and examine them in the light of the experience of the EMS today and in terms of projections for its future. These topics are investigated in Chapter 7 by an observer who is very close to the debate.

A second major area of interest in the present international financial system that is very much in the news these days is the operation of capital markets in a global-economy context. One aspect of the topic addressed in this volume (Chapter 8), especially after the merger frenzy of the 1980s, is the optimal level of leverage or debt–equity ratio for a firm. Another important topic (discussed in Chapter 9) is whether diversification in international capital markets is beneficial. The importance of this topic in international finance in general and international capital markets in particular can hardly be exaggerated if one remembers that two decades ago U.S. pension funds had never been invested outside the United States, and investment of pension funds in many other countries was prohibited.

Today many U.S. pension funds have 10 to 15% of their assets invested internationally and the value of foreign assets that they hold has reached nearly $100 billion. A similar trend toward international investments has occurred in Europe and Japan. This has been the result of the deregulation movement of the 1980s and the increasing recognition of the benefits of international diversification in terms of risks and returns. Since 1986 foreign banks and organizations were allowed to become members of the most important stock exchanges around the world, global around-the-clock trading has become a reality, and Europe is moving toward complete financial integration. Besides examining the optimal level of leverage or debt–equity ratio for a firm and the benefits of diversification in international capital markets, the other papers in Part Two of this volume examine defeased debt in international capital markets, evidence of the co-movement of two Scandinavian stock markets, the American experience with the deregulation of savings and loans associations, "round-tripping" effects of debt–equity swaps, and emerging capital markets and economic development.

A third major area of interest is international financial management. While the basic principles of domestic and international financial management are basically the same, international financial management is more challenging and dynamic because it must consider a wider range of possibilities, opportunities, and challenges than purely domestic financial management. International financial management requires the firm to consider the impact of fluctuating exchange rates and international taxation on the management strategy of the firm. The flow of funds within the units of an international firm, the management of international accounts receivable and payable, and the management of long-term assets are much more complicated and difficult than the flow of funds within a purely domestic corporation or the management of domestic accounts. All of this has led to an explosion of interest in the facets of international financial management, some of which are explored in Part Three of this volume.

One aspect of international financial management examined in this study is the investigation of the presence of nonlinear dependence in daily stock returns on several stock exchanges of different countries. While there is no unanimity regarding the best stochastic generating model, the most commonly accepted position is that U.S. stock returns are approximately uncorrelated, but not independent, and described by distributions with fatter tails. It is not known, however, whether this is true for other capital markets around the world, which are generally much smaller and thinner than American markets. Chapter 15 examines this topic for nine countries around the world. Other international financial management topics examined in this volume are the statistical properties of nondeflated and deflated constant dollar accounting signals, the survival analysis theory to business failures, and the desirability of joint ventures in Eastern Europe.

A fourth major area of interest in international finance is international banking as it relates to the external debt of Central and Eastern European and developing countries. There is today a real danger of complete economic collapse in the countries of Eastern Europe and in the former Soviet Union after the fall of communism in the late 1980s and early 1990s. These economies urgently need massive help from the West in the form of capital and technology to restructure their economies along market lines and to integrate them into the world economy. A continuing challenge to the international banking system is also provided by the huge international debt facing many developing countries, which these countries are finding difficult to repay or even service. Large-scale defaults have been avoided so far only by coordinated efforts of debtors and creditors. The problem, however, lingers on. Defaults on such debt could make some of the largest commercial banks in the United States insolvent and possibly lead to a world financial collapse reminiscent of the 1930s. While the danger of default had somewhat diminished by the early 1990s, the persistence of the debt problem was seriously interfering with the process of economic development in many developing countries.

These topics and their suggested solutions are taken up in Part Four of this volume. It is generally agreed today that to avoid complete economic collapse in the countries of Eastern Europe and the former Soviet Union and for the debt problem to be overcome and sustained growth to resume in developing countries, a large increase in the flow of equity capital in the form of direct investments from developed countries and the opening of developed-country markets more widely to the exports of Eastern European and developing countries are required.

OVERVIEW OF THE CONTENT OF THE VOLUME

In Chapter 2, "Diversified Expectations and Speculation in the Foreign Exchange Market," Vincent Dropsy develops an eclectic model of spot and forward exchange rate determination that incorporates both economic fundamentals and expectations. He shows that this model predicts exchange rate dynamics better than purchasing power parity or the monetary approach model. Dropsy also shows the potentially destabilizing role of technical expectations and examines the possible reasons that traders consistently make forecasting errors.

In Chapter 3, "Pricing Options on a Constrained Currency Index: Some Simulation Results," Tom Berglund, Staffan Ringbom, and Laura Vajanne point out that the assumption in the classical pricing of options that the exchange rate has a lognormal distribution is not justified in the presence of an exchange rate agreement, such as the EMS. Using a simulation model, they show that allowing exchange rate movements and the probability of a jump to be mutually dependent has significant effects on the valuation of currency options. In Chapter 4, "Exchange Rate Variations and U.S. Multinational Corporations' Profits: The Case of the 1980s," Luc Moens shows with the use of an econometric model that the appreciation of the U.S. dollar during the first half of the 1980s led to permanent negative effects on the profitability of U.S. firms in tradable goods industries. This resulted because the appreciation of the dollar sharply reduced the profits U.S. firms and the internal funds needed for sustained investments in crucial areas.

Chapter 5, "Real Exchange Rates and the Sectoral Composition of Output: Some Evidence from Japan," by Sadequl Islam, examines the relationship between movements in the real exchange rate and output in the industrial sector of the Japanese economy. Empirical results suggest that the real exchange rate, the relative price of imports, and output are not cointegrated, implying no statistically significant relationship among these variables. The author points out that this may be due to the small "pass-through" between exchange rate appreciations and the price of tradable goods or to expansionary fiscal policies and technological changes that have counterbalanced the effect of the exchange rate appreciation. Chapter 6, "Time-Varying Risk Premia and the Efficiency of the New Zealand Foreign Exchange Market," by Dimitri Margaritis and Phay Hoon Teo, begins by pointing out that a risk premium in the foreign exchange market provides an alternative way of examining the proposition that the forward rate is an unbiased predictor of the future spot rate, without having to give up the notion of market efficiency. The authors tested this proposition empirically by distinguishing between an inefficient market and a time-varying premium, and they found that while time-varying premia do exist in the foreign exchange market, the attempt to model risk premia in the context of the asset price theory was not supported by the data. Chapter 7, "European Monetary Integration: Theoretical Issues and Practical Implications," by André Fourçans, examines the theoretical arguments for and against monetary integration in general and for the European Monetary Union in particular. The study supports the formation of the European Monetary Union with a common currency. This, however, requires increased monetary coordination among its members. The author recommends two basic strategies of accomplishing this. The first is for each country to set up growth objectives for its internal money supply in line with internal price stability and real growth. The second strategy consists of fixing a money supply growth for the European Community as a whole. Both strategies would be facilitated by the establishment of a central bank.

In Chapter 8, "Optimal Leverage of a Dynamically Competitive Firm," Dilip Ghosh determines the optimum leverage of a firm in terms of two alternative hypotheses—payout maximization and utility maximization—by using the income-generating process in a dynamic environment with debt and equity accumulation. The author shows that under perfectly competitive conditions, the optimum equity debt ratio of a firm can be uniquely determined in intertemporal maximization models of investor behavior and that the results are basically the same even under different behavioral hypotheses. Chapter 9, "Is Diversification in International Capital Markets Beneficial?," by Krishnan Dandapani and Jerry Haar examines the benefits of diversifying in international equity markets in terms of different performance measures for the years 1987 to 1990. The authors show that a U.S. investor could have gained substantially by investing in the international equity market during the period examined, even after adjusting for transactions and commission costs. In Chapter 10, "International Co-Movements of Capital Markets: Evidence from Two Scandinavian Stock Markets," Teppo Martikainen, Ilkka Virtanen, and Paavo Yli-Olli examine evidence on the co-movement of two Scandinavian stock markets. This is done by using an internationally extended market model for Finnish stocks, where the return of a given Finnish asset is assumed to be dependent on the return of Finnish and Swedish stock markets. This multimarket model of Finnish securities reveals that several Finnish stocks have significant Swedish risk components. These international risk components, however, do not seem to contain incremental information in explaining the cross-sectional variation of expected stock returns with respect to the systematic risk components produced by the Arbitrage Pricing Model (APM).

Chapter 11, "Defeased Debt in International Capital Markets: Benefits and Problems," by Emiel Owens and Ronald Singer, discusses the potential financial consequences of an in-substance defeasance transaction by evaluating potential levels of wealth transfer among bond and stockholders of a defeased corporation. The authors' empirical results show that the Financial Accounting Standard Board's (FASB) Statement 76 issued in the United States in 1983 resulted in no significant pattern of daily residuals around the announcement date but that the cumulative average residuals became negative throughout the postannouncement period. Because in-substance defeasance can be interpreted as a reduction in the level of debt, the negative abnormal return around the announcement date can be explained by the signaling effect associated with the general reduction in debt. Chapter 12, "Deregulation of Financial Institutions: Lessons from the North American Experience with Savings and Loan Associations," by William Dowling and George Philippatos, examines the question of whether scale economies existed in the U.S. savings and loan industry. The authors employ two distinctly different methodologies to determine (1) whether scale economies existed in the industry, (2) the ranges of asset sizes in which they were significant, and (3) whether there was a change in the cost structure of the economy. They find that cost reduction through asset expansion existed, the minimum efficient scale for savings and loan associations increased, and that substantial change in the cost structure of the industry took place.

Chapter 13, "Capital Flight and the Round-Tripping Effect of Debt–Equity Swaps," by M. T. Vaziri and Hossein Shalchi, tests empirically the relationship between round-trip capital flight and its several possible determinants using pooled data on annual observations for Brazil, Chile, Mexico, Venezuela, and Argentina for the 1980–1989 time period. Round-trip capital flight is shown to be positively related to the domestic rate of inflation and domestic currency depreciation. Growing financial constraints and government deficits, however, have tended to limit the magnitude of round-trip capital flight. Chapter 14, "Emerging Capital Markets and Economic Development," by Edgar Ortiz, presents a synthetic model that highlights the importance of the equity and bond markets on economic activity. Risk is also included as a key variable of savings and investments. The implications of the model on the mobilization of resources and economic development are examined first by assuming perfect markets and leaving government out. The model is then extended to incorporate the relationship between government and capital markets and stresses the role of the state in economic development.

Chapter 15, "Conditional Heteroskedasticity in Stock Returns: International Evidence," by Albert Corhay and Alireza Rad, investigates the presence of nonlinear dependence in daily stock returns on several stock exchanges of different countries. Although daily returns seem to be uncorrelated, the rejection of linear models suggests that the return cannot be seen as an independent increment process. Return-generating models that empirically fit the data best are processes with conditional heteroskedastic innovations. The authors show that the generalized autoregressive conditional heteroskedastic process is best in most cases. Chapter 16, "The Effects of Monetary Gains and Losses on the Univariate Time-Series Characteristics of CDA Earnings," by Hossein Shalchi and M. T. Vaziri, examines empirically the statistical properties of nondeflated and deflated constant dollar accounting earnings signals. Univariate time-series models were identified and estimated utilizing the Box–Jenkins ARIMA methodology, and the results of predictive accuracy of the ARIMA models were compared with those of the random walk with and without a trend model using different loss functions associated with forecast inaccuracy. In Chapter 17, "Survival Analysis of Business Failures," Rafael Solis presents a simplified version of the survival analysis theory (used by insurance companies throughout the world) and its application to the analysis of business mortality (failure). Specifically, the author examines the question of why the rate of failures in most businesses is highest in the early years, why the probability of failure of a business becomes smaller the longer the business survives (other things equal), and why mortality rates differ among business types. In Chapter 18, "Stakeholder Objectives and Government Incentives in Eastern European Joint Ventures," David Bangert examines the desirability of joint ventures in Eastern European countries from the perspective of the major stakeholders and the potential incentives that host governments may use to encourage joint ventures while securing minimum aspiration levels for the various stakeholders.

Chapter 19, "Export Earnings Indexed Debt: Risk Reduction and Linking External Debt to Exports," by Per Mokkelbost, utilizes financial innovation techniques associated with contingent financial claims to model the financing project needs of Central Europe. The author shows that the form of financing best suited to the high risks involved is the export-earnings-indexed-debt facility. In Chapter 20, "The International Finance Corporation and Banks: IFC Syndications of Its LDC Investments," James Baker explores the syndication of a significant portion of its loans to developing countries by the International Finance Corporation (IFC) to encourage international commercial banks and other financial institutions to participate in the development process of developing countries. Syndication is shown to be an important method for the IFC to recycle its investment funds by turning them over into new investments.

In Chapter 21, "Some Issues in External Debt, Domestic Policies, and Economic Development," M. Zaman contends that the debt servicing burden of the major debtor nations is due not only to the domestic economic policies of the borrowing nations, but also to the actions of the lending institutions and countries that provide economic aid. He goes on to say that until indebted nations drastically reform their economic policies, debt-restructuring packages will achieve only debt restructuring and not a meaningful reduction in debt burdens.

Finally, in Chapter 22, "MIGA: A New Kid on the Block," James Baker points out that to develop adequately, developing countries need more private investments. Domestic financial markets are not sufficiently developed, however, to generate the necessary private investments, and political and economic conditions in most developing countries discourage increased flows of foreign direct investments (FDI) from industrial countries. The paper examines the operation of the Multilateral Investment Guarantee Agency (MIGA), the new affiliate of the World Bank, in encouraging the flow of FDI to developing countries by providing investment guarantees to foreign investors.

Part One
Foreign Exchange Issues

Chapters 2–7 deal with foreign exchange issues. They examine diversified expectations and speculation in the foreign exchange market, pricing options on a constrained currency index, exchange variations and U.S. multinational corporations' profits, real exchange rates and the sectoral composition of output in Japan, time-varying risk premia and the efficiency of the New Zealand foreign exchange market, and the effect of European economic integration on exchange rates.

In Chapter 2, Vincent Dropsy develops an eclectic model of spot and forward exchange rate determination that incorporates both economic fundamentals and expectations and that seems to predict exchange rate dynamics better than alternative models. In Chapter 3, Tom Berglund, Staffan Ringbom, and Laura Vajanne show that allowing for dependence between exchange rate movements and the probability of a jump under an exchange rate agreement has significant effects on the valuation of a currency option. In Chapter 4, Luc Moens shows that the appreciation of the U.S. dollar during the first half of the 1980s led to permanent negative effects on the profitability of U.S. firms. Chapter 5 by Sadequl Islam shows that the real exchange rate, the relative price of imports, and output are not cointegrated, implying no statistically significant relationship among these variables in Japan. In Chapter 6, Dimitri Margaritis and Phay Hoon Teo find that while time-varying premia do exist in the foreign exchange market, the attempt to model risk premia in the context of the asset price theory was not supported by the data. Chapter 7 by André Fourçans examines the theoretical arguments for and against monetary integration in general and for the European Monetary Union in particular and supports the formation of the European Monetary Union with a common currency.

Chapter 2

Diversified Expectations and Speculation in the Foreign Exchange Market

Vincent Dropsy

Empirical models of exchange rate determination have individually failed to explain the wide currency movements observed for more than a decade. Three main reasons account for their poor performance: (1) Each model emphasizes a particular aspect of the economy with severe restrictions on the choice of explanatory variables and model specification; (2) exchange rate expectations, certainly a crucial element in the behavior of the foreign exchange market participants, are made endogenous on the basis of unrealistically strong assumptions; and (3) new information instantaneously alters expectations and thus causes unexpected changes in the exchange rate that may dominate its movements.

By concentrating efforts on these first two issues, an eclectic model was developed that takes into account the various alternative channels by which exchange rates may be influenced, namely economic fundamentals and expectations. Allen and Taylor (1989) and Frankel and Froot (1990) infer from their studies that the interaction between fundamentalists and chartists plays an important role in exchange rate dynamics.

In addition, the heterogeneity of beliefs about the right model causes foreign exchange traders and forecasters to have various expected values of current equilibrium rates and future rates. Takagi (1991) examines surveys of exchange rate expectations and finds heterogeneity and absence of rationality in these expectations in almost all studies. Various exchange rate expectations are incorporated into the eclectic model and it is assumed that they are based on two fundamental models (purchasing power parity and the monetary approach) and on technical analysis (for example, time-series methods), to approximate the role of chartists.

Moreover, the roles and expectations of the market participants may change over time, which can be embodied in the time-varying specification of the parameters in the eclectic model. The estimated path of the values of these coefficients can be interpreted in terms of learning processes of the right model by foreign exchange traders over time.

AN ECLECTIC VIEW OF THE MARKET

Exchange rates are affected by the decisions of several types of agents. The Federal Reserve Bank of New York (1989) finds that interbank trading accounts for 95% of the volume of trade in the U.S. foreign exchange markets. The worldwide daily turnover in the foreign exchange markets is estimated to exceed $500 billion and the volume of speculative and arbitrage activities of banks is about 100 times greater than the volume of trade. The traditional trichotomy of the market participants to brokers, hedgers, arbitrageurs, and speculators is extended to model this heterogeneity of agents and the diversity of their expectations in a realistic framework. The aim is to determine the possible channels of demand and supply of currencies in both spot and forward markets. All variables are expressed in logarithms, and exchange rates are given in foreign currency units per US$.

First, brokers are viewed as the intermediaries of export- and import-oriented companies. Their transactions are directly related to purchasing power parity. For example, a decrease in the real exchange rate (that is, a real depreciation of the dollar) induces an amelioration of the U.S. trade balance, and thus some demand for additional dollars. It is assumed that this excess flow demand is a linear function of the logarithmic changes in the deviations of the exchange rate from its relative purchasing power parity value (PPP). The responsiveness coefficient $\Theta_{B,t}$, thus positive, is specified as a time-varying parameter, which embodies several characteristics related to trade, such as export and import price elasticities, trade barriers, and the number of brokers at time t. Hence, the brokers' excess flow demand for \$ (in the spot market) is

$$\mathrm{ED\$}^{\mathrm{spot}}_{B,t} = \Theta_{B,t}(dP^{\mathrm{F}}_t - dP^{\mathrm{US}}_t - dS_t) = \Theta_{B,t}(\mathrm{ECS}^{\mathrm{PPP}}_t - dS_t) \qquad (1)$$

where P_t is the wholesale price index, S_t is the spot rate, $\Theta_{B,t} \geq 0$, d denotes the logarithmic change in the related variable, the superscript F signals a foreign variable, and $\mathrm{ECS}^{\mathrm{PPP}}_t$ is the change in the spot rate implied by PPP between $t - 1$ and t.

Similarly, changes in the deviation from the rate implied by the monetary approach constitute the determinant for the flow demand for dollars by a second type of brokers, who are responsible for long-term capital flows. The monetary excess flow demand for \$ (in the spot market) is

$$\begin{aligned} \mathrm{ED\$}^{\mathrm{spot}}_{M,t} &= \Theta_{M,t}[\beta m_M(dM_t^{\mathrm{F}} - dM_t^{\mathrm{US}}) + \beta y_M(dY_t^{\mathrm{F}} - dY_t^{\mathrm{US}}) \\ &\quad + \beta if_M(d\mathrm{IF}^{e,\mathrm{F}}_{t+1} - d\mathrm{IF}^{e,\mathrm{US}}_{t+1}) + \beta r_M(dR_t^{\mathrm{F}} - dR_t^{\mathrm{US}}) + \mu_M - dS_t] \\ &= \Theta_{M,t}(\mathrm{ECS}_t^{\mathrm{MON}} - dS_t) \end{aligned} \tag{2}$$

where M_t is the money supply, Y_t is industrial production, $\mathrm{IF}^{e}_{t,+1}$ is expected future inflation, $R_t = (1 + \text{interest rate})$, $\Theta_{M,t} \geq 0$, and $\mathrm{ECS}_t^{\mathrm{MON}}$ denotes the changes in the spot rate implied by the monetary approach between $t - 1$ and t.

Second, the hedgers' objective is to protect their positions against some unexpected currency movements. The flow demand for insurance against currency exposure depends on the change of its relative cost over time, that is, the change in the forward discount. It is again assumed that the demand for additional forward dollars is a log-linear function of the forward discount. The hedgers' excess flow demand for dollars (in the forward market) is

$$\mathrm{ED\$}^{\mathrm{forw}}_{H,t} = -\Theta_{H,t}[(F_t - S_t) - (F_{t-1} - S_{t-1})] \tag{3}$$

where F_t is the forward rate, and $\Theta_{H,t} \geq 0$.

Third, arbitrageurs refer to the traders who take advantage of certain assured opportunities that arise from deviations from covered interest rate parity. However, the liquidity of Eurodollar markets has decreased this spread and numerous studies have confirmed that covered interest rate parity held particularly well for offshore interest rates. Hence,

$$F_t - S_t = R_t^{\mathrm{F}} + R_t^{\mathrm{US}} \tag{4}$$

Fourth, speculators tend to play an important role in the spot and forward markets. They constantly take risks at the pursuit of financial profits, and their demand for currency is based on expectations of exchange rates. For clarity, it is assumed that their position is closed at the end of period, although they can reenter the market immediately. Thus, the possible changes in financial position of different agents at a certain date t, which corresponds to the end of a period and the beginning of a new one, are examined. Speculators can switch their respective profit-searching strategies, expectations, attitudes toward risk, and other behavioral components at that specific time t. Three types of speculators exist:

(1) **Simple spot (SS) speculators,** whose strategy consists of simply buying currency that is believed to appreciate, to make a profit when selling it later. The consequent flow demand for dollars at a certain time t is determined by two terms, which represent the current speculative motive and the closing of the past speculative transaction. The SS speculators' excess flow demand for \$ (in the spot market) is

$$\mathrm{ED}\$^{\mathrm{spot}}_{SS,t} = \sum_i \Theta_{\mathrm{SS}i,t}(S^{\mathrm{e}}_{\mathrm{SS}i,t+1} - S_t) - \sum_i \Theta_{\mathrm{SS}i,t-1}(S^{\mathrm{e}}_{\mathrm{SS}i,t} - S_{t-1}) \quad (5)$$

where $\Theta_{\mathrm{SS}i,t} \geq 0$, $\Theta_{\mathrm{SS}i,t-1} \geq 0$.

(2) **Uncovered interest rate parity (UIRP) spot speculators,** whose purpose involves the holding of interest-bearing assets instead of cash in different currencies, based on the same strategy as covered interest rate parity, but with some speculative risks involved. Their speculative demand is given by the UIRP speculators' excess flow demand for $ (in the spot market)

$$\begin{aligned}\mathrm{ED}\$^{\mathrm{spot}}_{\mathrm{UI},t} &= \sum_i \Theta_{\mathrm{UI}i,t}(S^{\mathrm{e}}_{\mathrm{UI}i,t+1} - S_t - R^{\mathrm{F}}_t + R^{\mathrm{US}}_t) \\ &\quad - \sum_i \Theta_{\mathrm{UI}i,t-1}(S^{\mathrm{e}}_{\mathrm{UI}i,t} - S_{t-1} - R^{\mathrm{F}}_{t-1} + R^{\mathrm{US}}_{t-1}) \quad (6)\end{aligned}$$

where $\Theta_{\mathrm{UI}i,t} \geq 0$, and $\Theta_{\mathrm{UI}i,t-1} \geq 0$.

(3) **Forward speculators,** who, for example, can gain from a larger expected depreciation of the franc than implied by the forward rate by buying dollars in the forward market and selling the equivalent amount in the spot market in the future. Their excess demand in both markets can thus be modeled by the forward speculators' excess flow demand for $ (in the forward market at *t*)

$$\mathrm{ED}\$^{\mathrm{forw}}_{\mathrm{FS},t} = \sum_i \Theta_{\mathrm{FS},t}(S^{\mathrm{e}}_{\mathrm{FS}i,t+1} - F_t) \quad (7)$$

The forward speculators' excess demand for $ (in the future spot market at $t + 1$) is

$$\mathrm{ED}\$^{\mathrm{spot}}_{\mathrm{FS},t+1} = -\sum_i \Theta_{\mathrm{FS}i,t}(S^{\mathrm{e}}_{\mathrm{FS}i,t+1} - F_t) \quad (8)$$

where $\Theta_{\mathrm{FS}i,t} \geq 0$.

SPOT AND FORWARD MARKETS EQUILIBRIUM

Equilibrium in the spot market is obtained when the sum of excess flow demands for dollars by all traders (that is, brokers, arbitrageurs, and speculators) is equal to zero. By substituting these terms with their respective expressions, as well as the interest rate differential by the forward premium, it is deduced that the equilibrium value for the change in the spot rate can be represented by a time-varying weighted average of the following factors:

(1) Expected current equilibrium values estimated from *fundamental* models (relative purchasing power parity, monetary approach). If speculation and the forward market did not exist, the spot rate would automatically fall in between the two fundamental equilibrium rates.

(2) Deviations of the future expected spot rate from the random walk model,

from uncovered interest rate parity (equivalently the forward rate), which is the essence of speculation in the spot market.

(3) Deviations of past expectations of the current spot rate from the actual current spot rate and from the past forward rate. Speculators are thus differentiated not only by their strategy, but also by their expectations. According to the previous description of the underlying motivations of traders, relative purchasing power parity and the monetary approach are the two fundamental models used to form expectations.

The assumption is also made that exogenous variables are perfectly anticipated, so as to concentrate on the effects of diversified exchange rate expectations. However, an important class of forecasters use technical analysis (for example, charts) to form their expectations. The potentially destabilizing influence of chartists is studied by specifying their expectations as

$$\mathrm{ECS}_{t+1}^{\mathrm{TEC}} = \Pi_t(S_t - S_{t-1}) \tag{9}$$

The sign of Π_t immediately indicates whether these expectations are stabilizing (Π_t negative) or destabilizing (Π_t positive). The latter are also called bandwagon expectations, whereas the former embody first-order distributed lag expectations. With that in mind,[1]

$$\begin{aligned} S_t - S_{t-1} = {} & \Gamma_{\mathrm{ppp},t}\mathrm{ECS}_{t+1}^{\mathrm{PPP}} + \Gamma_{\mathrm{mon},t}\mathrm{ECS}_{t+1}^{\mathrm{MON}} + \Gamma_{\mathrm{fd},t}[-(F_t - S_t)] \\ & + \sigma_{\mathrm{ppp},t}\mathrm{ECS}_t^{\mathrm{PPP}} + \sigma_{\mathrm{mon},t}\mathrm{ECS}_t^{\mathrm{MON}} + \sigma_{s,t-1}(S_{t-1} - S_{t-2}) \\ & + \sigma_{\mathrm{fd},t-1}(F_{t-1} - S_{t-1}) + \sigma_c \end{aligned} \tag{10}$$

Identically, the forward market equilibrium condition is that the sum of excess flow demands for dollars by all traders be equal to zero. By substituting these terms with their respective expressions, the forward discount is determined as a time-varying (positively) weighted average of three different expected changes in the spot rate (to which is added a lagged endogenous term to take autocollinearity into account):

$$F_t - S_t = \alpha_{s,t}(S_t - S_{t-1}) + \alpha_{\mathrm{ppp},t}\mathrm{ECS}_{t+1}^{\mathrm{PPP}} + \alpha_{\mathrm{mon},t}\mathrm{ECS}_{t+1}^{\mathrm{MON}} \tag{11}$$

Equations corresponding to the equilibria in the spot (10) and forward (11) markets, and covered interest rate parity (4), therefore, reveal the influences of economic fundamentals and expectations, based on these fundamentals and

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[1] Detailed expressions of the coefficients of the reduced-form equations are given in the appendix.