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# Exchange Rates and International Macroeconomics

Edited by

**Jacob A. Frenkel**

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## Preface

This volume contains papers and comments presented at a conference on Exchange Rates and International Macroeconomics, held in Cambridge, Massachusetts, on 20–21 November 1981 and sponsored by the National Bureau of Economic Research.

When invited to organize the conference, I was asked to prepare the text for a “call for papers” announcement specifying the range of topics that would be considered. In contemplating the proper scope of such a conference I decided to consider a broad range of topics. Accordingly, the announcement stated that:

The conference will be broad enough to accommodate a wide variety of issues relating in one way or another to international macroeconomics. Appropriate for the conference are papers dealing with the following topics: exchange rate determination, interactions between commodity prices and exchange rates, efficiency of the foreign exchange market, the role of information, labor-market institutions and indexation, structural adjustment and international competitiveness, the economics of managed floating, rules for crawling pegs, stabilization policy and balance-of-payments adjustment, international capital markets, international reserves and world inflation, aspects of international monetary reform such as: design of an optimal reserve investment and international consistency of national pegging arrangements, and the role of policy coordination. Other possible topics that can be interpreted as related to international macroeconomics will be considered. Priority will be given to empirically oriented research, but submission of theoretical papers on these topics is welcome also.

Papers will be selected on the basis of abstracts of about 500 words or, when possible, complete papers, with preference being given to papers by younger members of the profession. Any research that will not have been published at the time of the conference may be submitted.

The response to this call for papers was overwhelming. Within a few weeks several hundred papers and abstracts were submitted for consideration of possible inclusion in the conference program. The quality of the submissions was exceedingly high and without doubt sufficient papers could have been selected to fill up the programs of three or four high-quality conferences. As always in such circumstances, the final selection had to be somewhat arbitrary even though one must admit that personal taste always plays an important role in "arbitrary" selection processes. In making the selection, I attempted to have some blend of empirical and theoretical research even though this volume gives a somewhat larger share to empirical contributions. Each paper was assigned to formal discussants whose comments are also included in this volume.

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# 1            An Introduction to Exchange Rates and International Macroeconomics

Jacob A. Frenkel

This introduction begins with a reader's guide to the book, containing a summary of each chapter and an outline of the discussants' comments. It concludes with a brief discussion of some open questions in the analysis of exchange rates and international macroeconomics, represented by four examples of suggested research issues.

## 1.1 A Reader's Guide

In chapter 2, Peter Isard develops a useful framework for discussing the limitations of existing empirical models of exchange rate determination. He starts by manipulating the interest parity condition to develop some accounting identities that relate observable exchange rates to three unobservable expectational terms: an expected future real exchange rate, an expected inflation differential, and an expected premium for bearing exchange risk. He then focuses attention on issues relevant for modeling how news is transmitted to exchange rates through revisions in the three expectational terms. Given the presumption that exchange rate movements are predominantly unexpected—or, equivalently, that they predominantly reflect revisions in expectations in response to news—Isard argues that the poor performance of the empirical exchange rate models of the 1970s is not surprising.

To model exchange rate expectations, Isard represents the expected future real exchange rate by a model of the expected *long-run* real exchange rate or purchasing power parity (PPP) level. The question “How long is it expected to take for the real exchange rate to converge to

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its PPP level?" is viewed to be roughly equivalent (as would be the case under risk neutrality) to the question "How long is it expected to take for real interest differentials to vanish?" The latter question is addressed through several comparisons of nominal interest rate term structures and measures of inflation expectations. Isard presents data which suggest that the adjustment lasts between two and five years. Based on this evidence, he recommends using the five-year forward rate and the long-term (five years) interest differentials as the relevant variables in exchange rate equations. Isard argues that his modeling strategy avoids reliance on arbitrary assumptions about the expected dynamics of adjustment to long-run PPP, which are explicit or implicit in traditional attempts to explain the "response" of exchange rates to changes in short-term interest differentials.

The paper devotes considerable attention to assessing the types of news that contributed to the major swings in the German mark/U.S. dollar (spot and five-year forward) exchange rates during 1980–81. Major swings in the exchange value of the dollar during 1981 coincided strikingly with major shifts in the outlook for U.S. fiscal policy. Isard argues that available survey data on long-term U.S. inflation expectations support the view that revisions in inflation expectations "explained" the major share of the exchange rate response to fiscal policy news. In addition, the arithmetic of the accounting identities suggests that part of the exchange rate response to fiscal policy news may have reflected changes in the risk premium in response to substantial revisions in expectations about the cumulative size of U.S. budget deficits over a five-year horizon.

An important message from the 1980–81 experience is that attempts to quantify the news on the basis of autoregressions may be largely inadequate. In particular, the fiscal policy news during 1981 was not accompanied by contemporaneous jumps in prices, activity levels, money supplies, or budget deficits, so its influence on exchange rates—whether transmitted through revisions in inflation expectations or changes in the risk premium—cannot be captured with autoregressions. Moreover, it is also apparent that long-term nominal dollar interest rates were not a good proxy for long-term U.S. inflation expectations during 1980–81; long-term real dollar interest rates changed considerably. Thus, the quantification of expectations poses a major hurdle for empirical attempts to explain the behavior of exchange rates.

In their comments on Isard's paper Sebastian Edwards and Jeffrey Frankel discuss several conceptual and empirical issues. Edwards demonstrates the numerous channels through which news affects the exchange rate and proposes alternative ways for testing the key empirical relation. Frankel's discussion focuses on the relative qualities of short- and long-

term rates of interest as the relevant variables in exchange rate equations. He argues that since both rates are related to each other, they should both, in principle, be equally acceptable indicators of monetary conditions. Frankel concludes his discussion by pointing out some puzzles in the pattern of the relations among the short-term interest rate, expected inflation, the exchange rate, and the long-term interest rate in the United States during 1981.

In the third chapter, Richard Meese and Kenneth Rogoff analyze the reasons for the poor performance of a variety of exchange rate models. This chapter complements their earlier work in which they have compared the out-of-sample fit of various structural and time series exchange rate models, and have found that the random walk model performs as well as any estimated model at one- to twelve-month horizons for 1970s dollar/mark, dollar/pound, dollar/yen, and trade-weighted dollar exchange rates. The structural models included the flexible-price and the sticky-price monetary models, as well as a sticky-price asset model which incorporates the trade balance. The various models performed poorly, even though their forecasts were purged of all uncertainty concerning the future paths of their explanatory variables by using actual realized values.

Meese and Rogoff present evidence that the poor performance of the structural models may not be attributed to inconsistent or inefficient parameter estimates. They rule out such a possibility on the grounds that these models fail to yield any improvement over the random walk model in mean absolute or root-mean-squared error over one to twelve months out of sample for a broad range of theoretically plausible coefficient values, even when autoregressive error terms are introduced. They argue therefore that it is unlikely that more efficient estimation techniques, such as imposing all the cross-equation rational expectations restrictions, would yield parameter estimates which would perform much better. While the various models do not outperform the random walk model over periods of one to twelve months out of sample, they perform better over longer forecast horizons.

The three models considered by Meese and Rogoff share the same asset market specification, which is based on uncovered interest parity and a conventional real money demand equation with income and short-term interest rates. The models differ in their assumptions about purchasing power parities. Since all three models perform poorly, their joint failure is likely a result of the asset market specification. While, in principle, the breakdown of empirical exchange rate models may be the result of volatile time-varying risk premiums, volatile long-run real exchange rates, or poor measurement of inflationary expectations, the authors argue that the main problems seem to lie in the specifications of the demand for money. They conclude by noting that if this is indeed the

case, then the same improvements which resuscitate domestic empirical money demand equations should also lead to similar improvements in empirical exchange rate equations.

In his comments on the Meese and Rogoff paper, Nasser Saïdi notes that since the residual errors for various exchange rates are likely to be correlated, a joint estimation of the various exchange rate equations could improve the forecast accuracy of the structural models. He also notes that since forecasts for horizons longer than one period follow a moving average process, tests for evaluating the forecasts of alternative models are more meaningful when based on one-period ahead forecasts rather than on multiperiod forecast horizons. As for the source of the failure of the structural models, Saïdi highlights the inadequate modeling of expectations formation. In particular, he believes that the distinction between anticipated and unanticipated movements in the exogenous driving variables has not been given sufficient attention in existing structural models.

Commenting on the same paper, Michael K. Salemi analyzes Meese and Rogoff's findings by pointing out that in contrast with the results for short-term horizons (up to twelve months), long-term forecasts based on the three structural models are more successful than the forecasts based on the random walk model. Salemi suggests the possibility that in the short run the exchange rate behaves like a speculative asset, but over longer runs the exchange rate is related systematically to a range of economic variables that is broader than the one assumed by the typical asset models. Salemi concludes his comments by noting that the results reported by Meese and Rogoff do not reject the conceptual framework underlying the asset-market approach to exchange rate determination. Rather, they shed doubt on some specific formulations of that approach.

In the fourth chapter, Lars P. Hansen and Robert J. Hodrick study three alternative statistical models of the relationship between expected return and risk in the forward foreign exchange market. If the forward exchange rate deviates from the expected future spot rate, there is expected profit on contracting in the forward market. The risk one bears in writing such contracts is caused by covariance of the nominal profit on the contract in terms of its currency of denomination with the intertemporal marginal rate of substitution of that money which is the nominal counterpart of the intertemporal marginal rate of substitution of consumption. This latter concept is the key ingredient used in defining risk that emerges from real intertemporal asset-pricing models. Each of Hansen and Hodrick's statistical models of the risk-return relationship in the forward foreign exchange market can be viewed as a restriction on linear time series representations, and each is interpreted by examining the first order conditions of the intertemporal optimization problems of international investors under the assumption of rational expectations. Hansen

and Hodrick estimate these models from a semiweekly sample of spot and one-month forward exchange rates for the period from February 1976 to December 1980.

Their first statistical model relies on the auxiliary assumption that exchange rates and the intertemporal marginal rate of substitution of money are jointly lognormally distributed. Under this assumption the expected deviations between the logarithms of future spot rates and current forward rates should be constant. They report empirical results that shed doubts on the adequacy of this model. These results suggest that time variation in risk premiums in the forward market should be taken seriously.

The second statistical model examined by Hansen and Hodrick relies on the assumption that the conditional covariance between the profit on the forward contract and the intertemporal marginal rate of substitution of money is constant. In this case, time variation in the risk-free nominal return should capture the time variation in the risk premiums. Statistical analysis of this model indicates that little, if any, of these movements is explained by movements in the risk-free nominal return.

The authors then examine a final statistical model which is patterned after the single beta capital asset-pricing model that has played an important role in the empirical finance literature. In this model risk premiums are linked to the covariance of the return on an asset with the return on a benchmark asset that is on the mean variance frontier. From the intertemporal asset-pricing models it is known that the return on the aggregate wealth portfolio will not, in general, be an appropriate benchmark. From theory it is known that appropriate candidates for benchmark returns are explicitly linked to the intertemporal marginal rate of substitution of money. Such returns, however, are difficult, if not impossible, to observe. Consequently, in their statistical model Hansen and Hodrick postulate that the "betas" on the forward contracts are constant through time, while they allow the conditional expected return on the unobservable benchmark return to vary over time. Under these assumptions they estimate a time series version of a latent variable model in which severe cross-equation restrictions apply to the parameter estimates. In estimating the statistical model, they are unable to reject these restrictions, and they find evidence for nontrivial risk premiums in at least two and possibly three of the five forward markets considered.

Although the statistical analysis cannot be construed as providing tests for intertemporal equilibrium models of forward foreign exchange markets, because they have placed assumptions directly on endogenous variables, the results are sufficiently encouraging to promote the important endeavor of integrating the theory of intertemporal asset pricing with international monetary theory.

In their discussion of the Hansen-Hodrick paper, Craig S. Hakkio and

Kenneth J. Singleton make econometric and methodological comments. Hakkio notes that Hansen and Hodrick's analysis builds on an intertemporal arbitrage condition derived from a nonmonetary model of a representative individual. He suggests that the application of this framework to a monetary model of the aggregate economy may be sensitive to the way in which money is introduced into the model as well as to the conditions which make aggregation valid. In interpreting the results, Hakkio recommends a more detailed analysis of the specific causes which underlie a rejection of various models. He concludes his discussion by noting that Hansen and Hodrick's findings should be interpreted as evidence against the constant risk premium hypothesis rather than against the efficient market hypothesis.

Singleton elaborates on some theoretical properties of the models investigated by Hansen and Hodrick and discusses ways of testing nonlinear, intertemporal models of exchange rate determination that do not impose the restrictive assumptions underlying their linear relations. Singleton argues that in the absence of more information about the underlying assumptions which lead to the linear exchange rate representations, there are various possible ways of interpreting Hansen and Hodrick's findings. Specifically, Hansen and Hodrick present the nominal risk-free relation and the latent variable representation as if they represent very different theoretical models of exchange rate determination. While admitting this possibility, Singleton notes that since so little structure is imposed on the empirical representations of the theoretical models, one representation could also be interpreted as a special case of the other.

In the fifth chapter, Peter R. Hartley analyzes the hypothesis that expectations of exchange rate movements are formed rationally. He argues that this hypothesis implies that forecasts of future exchange rates are based on any publicly available information which is known to be useful for predicting exchange rate movements, and he tests the hypothesis within the context of the simple monetary model of exchange rate determination.

The simple monetary model predicts that movements in the rate of exchange between two currencies will be determined by current and anticipated future movements in the supplies of, and demands for, the two currencies. Hartley supposes that changes in money supplies and incomes follow stable autoregressive processes, and therefore, if agents use this fact, anticipated future movements in money supplies and incomes depend on past movements in the same variables. Anticipated movements in exchange rates then depend on past movements in money supplies and incomes. If expectations are rational, there are cross-equation restrictions on the autoregressive parameters describing the money supply and income growth processes and on the parameters in the exchange rate equation.

Hartley's equation relating the change in exchange rates to present and past changes in money supplies and incomes has an error term which is an amalgam of the error terms in the money demand functions for two countries and deviations from purchasing power parity, and there is no reason to expect this error term to be white noise. If the error term follows a stable autoregressive process, then unanticipated changes in the exchange rate depend on unanticipated money and income growth rates and an error term which is serially uncorrelated (so long as the forecast horizon and observation interval coincide). Rationality of expectations again implies a set of cross-equation restrictions on the parameters of the forecasting equations for money and income growth rates and on the parameters in the unanticipated change in the exchange rate equation.

Hartley argues that tests of rationality can be strengthened by simultaneously estimating equations explaining unanticipated changes in exchange rates between several overlapping pairs of currencies. If expectations are rational, then the forecast of, for example, U.S. money growth rates that agents use when attempting to predict changes in the dollar/pound exchange rate should be the same forecast they use when attempting to predict changes in the dollar/mark exchange rate. Rationality implies restrictions across the parameters of the forecasting equations and both exchange rate equations. He argues further that the term structure of the forward exchange rate can also be used in exchange rate equations for different forecasting horizons and that the rationality implies another set of cross-equation restrictions.

Hartley applies these tests to data from the 1970s. Although the cross-equation restrictions implied by the model are not rejected, the estimated coefficients have large standard errors, and thus many alternative hypotheses are also consistent with the data. He then estimates joint forecasting equations relating Eurocurrency interest rates to money and income growth, and unanticipated exchange rate movements to unanticipated movements in interest rates. Rationality again implies cross-equation restrictions on the estimated parameters which are not rejected.

In commenting on Hartley's paper, Debra Glassman notes specific aspects of data from the foreign exchange market. She argues that each day of the week has its own characteristics which might be relevant in a detailed empirical study of exchange rates. For example, on Monday there might be substantial catching up with the news of the weekend, while on Friday the weekly U.S. money supply figures are released. In addition, since there are subperiods with differing characteristics of the foreign exchange market, Glassman suggests that a further pursuit of the heteroscedasticity correction is warranted. She concludes her comments by noting that Hartley's procedure tests the joint hypothesis of rational expectations along with a specific specification of the model. To separate the two, she suggests that the expectations hypothesis can be fruitfully

tested by using other data on exchange rate forecasts, like those supplied by professional services and those implicit in futures, options, and stock markets.

Maurice Obstfeld's comments on Hartley's paper focus on alternative strategies for estimating exchange rate equations. Specifically, Obstfeld discusses the trade-off between asymptotic efficiency, on the one hand, and robustness and tractability, on the other, by comparing Hartley's maximum likelihood approach to an alternative, instrumental variables approach. Obstfeld notes that in Hartley's framework consistency of maximum likelihood estimates requires some strong exogeneity assumptions that may not be valid. He argues that under such circumstances it is desirable to have an estimator that is consistent under a broader set of assumptions, even if that estimator is inefficient relative to the maximum likelihood estimate. Obstfeld describes an instrumental variables estimator which permits the weakening of Hartley's assumptions while easing the computational difficulties. In addition, the instrumental variables approach has the attractive feature of taking into account the possible conditional heteroscedasticity of the disturbances.

In the sixth chapter, Stanley W. Black studies the use of monetary policy for internal and external balance in ten industrial countries. Black assumes that the monetary authorities behave as if they maximize an intertemporal welfare function depending on internal and external target variables, such as inflation, unemployment, and the level of reserves, subject to an implicit, perceived econometric model of the private economy. Policy reaction functions then relate the policy instruments directly under the authorities' control to the target variables. The appropriate instruments in each country include discount rates, reserve ratios, open market operations, discount quotas, and credit controls. Black allows for information lags as well as lags in the adjustment of instruments that are adjusted only discretely, such as discount rates and credit controls. These lags are allowed for by using threshold and logit regression models.

Black's results show that the instruments of monetary policy respond significantly in predictable ways to customary measures of internal and external balance. Cross-country comparisons in the context of the discount rate equations, which are reasonably homogeneous across countries, show that inflation receives a relatively high weight in the policy reaction functions of Belgium, Germany, Italy, France, and the United States, while it receives lower weights in Britain, Canada, the Netherlands, Japan, and Sweden. A cross-sectional regression equation shows that, after taking account of orientation of monetary policy toward external targets and differing vulnerability to oil price increases, the observed average inflation rate is negatively correlated with the policy weight that the reaction function assigns to the inflation target. In addition, Black shows that: (i) the importance attached to inflation and



unemployment objectives varies inversely across countries; (ii) there appears to be little relationship across countries between the importance of unemployment objectives and observed rates of unemployment; (iii) there is an inverse correlation across countries between the importance of internal and external objectives for monetary policy; (iv) there is an inverse correlation between the flexibility of the exchange rate and the relative importance of external compared to internal objectives; and (v) conservative election victories have often led to tighter monetary policies.

In commenting on Black's paper, Leonardo Leiderman discusses the robustness of the empirical findings as well as the methodology. His methodological comments raise issues concerning the derivation and the specification of Black's postulated reaction functions. Leiderman points out some difficulties of interpreting the estimated coefficients of the reaction function. These difficulties stem from the fact that each estimated coefficient represents the joint influence of the effect of the policy instrument on a target variable and the weight of the target in the objective function. As a result the estimated coefficients are generally functions of the structural parameters and of the parameters reflecting policy preferences, and disentangling the two may not always be possible.

Alan Stockman's comments on Black's paper also focus on methodological and empirical issues. He argues that the view of policy as an isolated action undertaken in response to a particular set of circumstances may be inappropriate. Instead, policy should be analyzed within a more general framework which views a specific policy action as part of a broader policy rule. On the empirical side, Stockman questions the robustness of the estimates, as well as whether they reflect structural or reduced-form coefficients. He suggests that some of these questions could be resolved by following a procedure that imposes and tests the cross-equation restrictions that are imposed by the model.

The seventh chapter by Guillermo A. Calvo provides an analytical framework for the analysis of exchange rate policies for an economy with staggered contracts. An important methodological innovation in this paper is the development of a continuous time formulation of the staggered contracts model. The model is that of a small open economy that is governed by rational expectations and in which the prices of home goods are set intermittently in a dissynchronized manner. This formulation enables Calvo to analyze in detail the dynamic evolution of an economy with slow price adjustment.

The central concern of the paper is the characterization of circumstances in which unanticipated devaluations exert contractive influences on the economy. As a general rule, circumstances like those must be associated with situations in which there is a multiplicity of rational expectations equilibria. Calvo shows that this characteristic is robust: it