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The Portfolio-Balance Model of Exchange Rates and Some Structural Estimates of the Risk Premium

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Summary

This paper focuses on the portfolio-balance model as a framework for addressing several unresolved issues about the behavior of exchange rates. A major objective is to contribute to an understanding of the relative importance of the different channels through which current account imbalances may influence exchange rates. A second objective is to provide structural estimates of the risk premium on a currency--defined as the difference between the expected rate of appreciation and the forward premium for that currency.

The risk premium is shown to depend on budget deficits, current account imbalances and official foreign exchange intervention. Observed forward premia have been small relative to the changes in exchange rates that have occurred since March 1973. By itself, that fact does not necessarily imply that exchange rate changes have been predominantly unexpected, since risk premia may be large. However, our interpretation of the empirical evidence, using the portfolio-balance model, suggests that risk premia can only explain a small proportion of the discrepancies between forward premia and observed changes in exchange rates. The conclusions that are suggested therefore are that risk premia have not played a prominent role in exchange rate determination and that exchange rate changes have been largely unexpected by market participants.

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I. Introduction

The next section begins by spelling out the portfolio-balance framework and stressing that in its streamlined form it does not determine both the level and the expected rate of appreciation of the exchange rate. The portfolio-balance framework is a model that relates excess demands for stocks of outside assets to the expected yields on these assets. The relative levels of current and expected future exchange rates are determined as elements of expected yields, but by itself the portfolio-balance model does not determine the nominal values of either.

In Section III the expected rate of appreciation of the exchange rate is viewed as the sum of an observable forward premium plus an unobservable exchange-risk premium. The risk premium is related to asset stocks and wealth variables, and it is shown that changes in the risk premium depend on budget deficits, current-account imbalances and official foreign-exchange interventions. Section IV begins with the widely recognized fact that observed forward premiums have been small relative to the changes in exchange rates that have occurred since March 1973. By itself, that fact does not necessarily imply that exchange rate changes have been predominantly unexpected, since risk premia may be large. Accordingly, we interpret empirical evidence on the size of the risk premium, as derived from the portfolio-balance model, and find that it appears to explain only a small portion of the discrepancies between forward premiums and observed changes in exchange rates. This suggests (i) that current account imbalances have had small wealth effects on exchange rates, (ii) that there are only small errors in using forward premiums to represent expected rates of change in exchange rates, and (iii) that observed exchange-rate changes have been predominantly unexpected and cannot be explained by the portfolio-balance framework in isolation.

Section V discusses alternative assumptions that can be appended to the portfolio-balance framework to explain unexpected jumps in observed exchange rates in terms of revisions in expectations about future exchange rates. If future exchange rates are expected to be consistent with any of a variety of notions about long-run current-account equilibrium, unexpected imbalances in observed current accounts may be associated with unexpected jumps in observed exchange rates. 1/ This viewpoint suggests the importance, however, of distinguishing between transitory and permanent shifts in current account positions, and of using a model of long-run current account positions to evaluate the extent to which rational market participants will revise their expectations about future (real) exchange rates in response to unexpected information about current account positions or their underlying determinants.

Section VI concludes the paper by discussing some directions for future research, emphasizing the need to renovate the portfolio-balance model in

1/ The simple textbook model of an exchange rate that balances the current account flow within a single period is thus replaced with the notion of an expected future exchange rate that balances the current account flows that are expected in the long run (or on average over time).

order to pursue an understanding of the interactions between exchange risk and political risk.

II. The Portfolio-Balance Framework

In the spirit of the original portfolio-balance models of McKinnon and Oates (1966) and McKinnon (1969), and the two-country formulation by Girton and Henderson (1973), consider a two-country, two-currency world in which there are two composite private sectors with distinguishable portfolio preferences. The net portfolio holdings of the two private sectors combined consist of interest-bearing and non-interest-bearing claims on governments.

Let MB and MB* denote the monetary bases of the home country and the foreign country--i.e., the stocks of non-interest-bearing outside assets respectively denominated in home and foreign currencies. Let B and F respectively denote the stocks of interest-bearing outside assets denominated in home and foreign currencies. These stocks are measured net of the claims of official agencies on each other. The net holdings of private residents of the home country (H) and the foreign country (F) are respectively denoted by MB_H, B_H, F_H and MB_F^*, B_F, F_F, such that

(1) $MB_H = MB$

(2) $B_H + B_F = B$

(3) $F_H + F_F = F$

(4) $MB_F^* = MB^*$

W_H and W_F denote the "wealths" of private home residents and private foreign residents, respectively, valued in home and foreign currency units

(5) $W_H = MB_H + B_H + sF_H$

(6) $W_F = MB_F^* + B_F/s + F_F$

where the exchange rate s is measured as domestic currency per unit of foreign currency. 1/

The stocks of base money and bonds are determined by the interactions of monetary policies, government budget deficits, and official exchange-market interventions. B is equal to the cumulative budget deficit of the home government ($\int DEF$) minus cumulative open market purchases of bonds in

1/ This portfolio structure follows the tradition of assuming that the allocation between money and bonds is independent of the expected yields on equities and other assets, which are complicated to model. In addition, by assuming that current account flows measure the shifts of money and bond portfolio between domestic and foreign residents, we follow a preference for treating equities as substitutes for bonds rather than substitutes for goods.

exchange for base money issued by the home monetary authority (MB) minus cumulative purchases of home-currency bonds by official foreign-exchange intervention authorities in the home and foreign countries combined ($\int INT$)

$$(7)\quad B = \int DEF - MB - \int INT$$

Similarly,

$$(8)\quad F = \int DEF^* - MB^* + \int INT^*$$

where DEF^* is the foreign budget deficit and INT^* is the quantity of foreign bonds that are sold to purchase INT units of home bonds

$$(9)\quad INT^* = INT/s$$

We limit capital gains and losses to those associated with exchange-rate movements by assuming that B and F are one-period bonds; stocks of government debt are viewed to be refinanced at the beginning of each period.

We make the following behavioral assumptions about the stocks of assets that are held in private portfolios. No distinctions are drawn between actual and desired portfolio holdings. The division of home-country private wealth between home money, home bonds and foreign bonds is assumed to depend on the own rate of interest on home bonds, r; the expected home-currency yield on foreign bonds, $r^* - \pi$, where r^* is the own rate of interest on foreign bonds and π is the expected rate of appreciation of home currency; and a vector of other variables, Q, which conventionally includes an index of transactions demand.

$$(10)\quad MB_H = m_H\,(r,\ r^* - \pi, Q)W_H$$

$$(11)\quad B_H = b_H\,(r,\ r^* - \pi, Q)W_H$$

$$(12)\quad sF_H = sf_H\,(r,\ r^* - \pi, Q)W_H$$

Similarly, the division of W_F between foreign money, home bonds and foreign bonds depends on the own rate of interest on foreign bonds, the expected foreign-currency yield on home bonds, and a vector of other variables, Q^*.

$$(13)\quad MB_F^* = m_F(r^*,\ r + \pi, Q^*)W_F$$

$$(14)\quad B_F/s = (1/s)b_F(r^*,\ r + \pi, Q^*)W_F$$

$$(15)\quad F_F = f_F\,(r^*,\ r + \pi, Q^*)W_F$$

By definitions (5) and (6), the portfolio shares must add to unity:

$$(5a)\quad m_H + b_H + sf_H = 1$$

$$(6a)\quad m_F + b_F/s + f_F = 1$$

The residents of each country are assumed to be risk averse and accordingly to view home and foreign bonds as imperfect substitutes. 1/

We can substitute behavioral assumptions (10)-(15) into the market clearing conditions (1)-(4) to solve for the variables that clear asset markets. We consider the case in which asset stocks are predetermined and interest rates and exchange rates are variable. By constraints (5a) and (6a), only three of the four market-clearing conditions are independent. Thus, we can solve the system for only three of the four variables s, π, r and r^*. For example, if we regard interest rates as being determined in money markets, independently of exchange rates in this model, then both the current level of the exchange rate and its expected rate of appreciation cannot also be determined endogenously. The portfolio-balance framework can be solved for the relative levels of current and expected future exchange rates, but it cannot determine the nominal values of either.

III. The Exchange-Risk Premium

We are interested in solving the portfolio-balance model for π, the rate of appreciation of home currency that must be expected for asset markets to clear. It is convenient to write the solution in the form

$$(16) \quad \pi = r^* - r + \phi$$

where ϕ is in general a function of all of the variables (other than π) on which portfolio behavior depends. The interest differential r^*-r can be viewed as the forward premium in favor of home currency. 2/ ϕ is the exchange-risk premium that must be expected, over and above the interest differential or forward premium, for asset holders to be indifferent at the margin between uncovered holdings of home bonds and foreign bonds. In a risk-neutral world, ϕ would be identically zero.

To gain insights into ϕ in a risk averse world we can begin with a utility-maximizing portfolio selection framework, 3/ imposing restrictions that generate well-behaved portfolio demand functions. In the present context, however, we have relatively weak judgments about appropriate utility functions and relatively strong judgments about the important

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1/ Conditions (10)-(15) do not treat the degree of substitution as a variable. In particular, we are implicitly assuming that subjective perceptions of the variance of π either are constant or do not affect desired portfolio shares.

2/ This equivalence is well established for Eurocurrency differentials; see Aliber (1973); Dooley (1974); or Herring and Marston, (1976).

3/ Some contributions to this approach include Merton (1971), Solnik (1973), Kouri (1975), Kouri and Macedo (1978), Breeden (1979), Frankel (1979), Stulz (1981), and Dornbusch (1982).

properties of a well-behaved system of portfolio demand functions. Accordingly, we impose these latter judgments directly by considering the following simplified version of the portfolio-balance model.

(10a) $MB_H = m_H(r,0)W_H$ with $0 < m_H < 1$

(11a) $B_H = b_H(\phi)[W_H - MB_H]$ with $b_H' = \partial b_H/\partial\phi > 0$

(12a) $sF_H = (1 - b_H)[W_H - MB_H]$

(13a) $MB_F^* = m_F(r^*, 0^*)W_F^*$ with $0 < m_F < 1$

(14a) $B_F/s = b_F(\phi)[W_F - MB_F^*]$ with $b_F' = \partial b_F/\partial\phi > 0$

(15a) $F_F = (1-b_F)[W_F - MB_F^*]$

Money holdings depend on domestic interest rates, transactions demand variables and wealths, while the shares of wealth that are not held as money are divided between home and foreign bonds as functions of the differential expected yield, $\phi = r - r^* + \pi$.

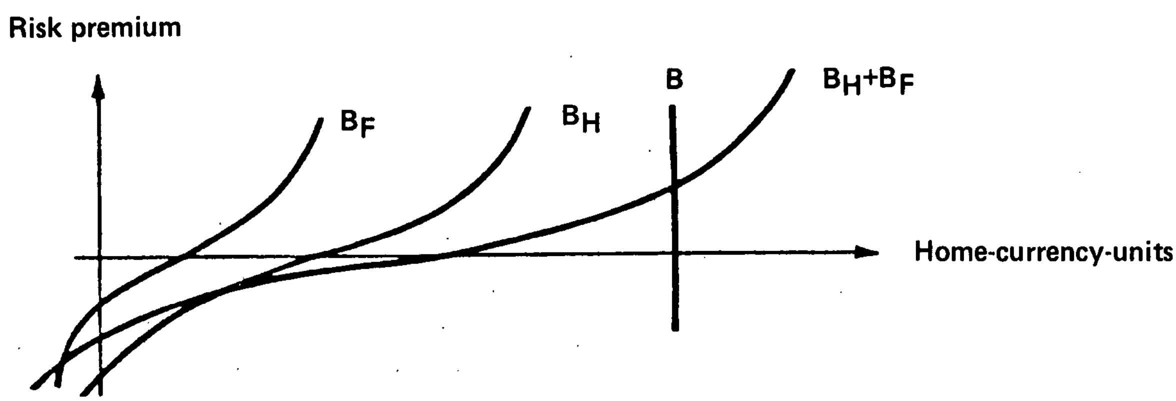
In solving for π we can choose conditions (1), (2) and (4) as our three independent market-clearing conditions. Conditions (1), (4), (10a) and (13a) determine interest rates as functions of asset stocks, wealths and transactions demand variables. Conditions (11a), (14a), (1) and (4) can be substituted into condition (2) to yield

(17) $B = b_H(\phi)[W_H - MB] + b_F(\phi)[sW_F - sMB^*]$

Condition (17) can then be inverted to solve for ϕ, the amount by which the rate of appreciation of home currency must be expected to exceed the interest differential if existing stocks of outside assets are to be willingly held uncovered. This condition is pictured in Chart 1: the quantity of home bonds supplied by public sectors is fixed at the level B, independently of the risk premium; and the home and foreign private demand curves for home bonds are positively sloped, since b_H' and b_F' are positive. Accordingly, for given levels of private wealths the market-clearing level of the risk premium rises with the share of public debt that is denominated in home currency units--i.e., an increase in the stock of home bonds (matched by a reduction in the stock of foreign bonds) shifts the vertical supply curve to the right and raises the risk premium that is necessary to induce home and foreign portfolio managers to increase their combined demand (i.e., to slide along the $B_H + B_F$ curve) by the increment in supply. Similarly, given the stock of home bonds, an increase in either home wealth or foreign wealth (through new public debt issues of foreign-currency bonds) shifts either the B_H or the B_F curve to the right, and the associated rightward shift in the $B_H + B_F$ curve leads to a fall in the risk premium. These effects can be expressed formally by taking the total differential of condition (17) and rearranging terms to arrive at:

CHART 1

MARKET FOR HOME-CURRENCY-DENOMINATED BONDS



$$(18)\quad d\phi = \frac{dB - b_H d(W_H - MB) - b_F d(sW_F - sMB^*)}{(W_H - MB)b_H' + s(W_F - MB^*)b_F'}$$

where b_H', b_F' and hence the denominator are positive.

If we look behind the determinants of wealths we can derive an equivalent expression for $d\phi$ in terms of budget deficits, current account imbalances and intervention flows. Conditions (1), (2), (5) and (7) imply

$$(19)\quad W_H = \int DEF - \int INT + sF_H - B_F$$

while conditions (3), (4), (6) and (8) similarly imply

$$(20)\quad sW_F = s\int DEF^* + s\int INT^* - sF_H + B_F$$

Conditions (7), (19) and (20) can be differentiated and substituted into the numerator of (18). In addition, if we let CAS denote the home country's current-account surplus, which must satisfy the balance-of-payments identity

$$(21)\quad CAS = sdF_H - dB_F - INT$$

condition (18) can be shown to be equivalent to 1/

$$(22)\quad d\phi = \frac{(1-b_H)(DEF-dMB) - b_F s(DEF^*-dMB^*) - (b_H-b_F)CAS - INT - (b_H F_H + b_F F_F)ds}{(W_H-MB)b_H' + s(W_F-MB^*)b_F'}$$

Ceteris paribus, the expected rate of appreciation of home currency must increase (relative to the interest differential) to induce private portfolio managers to increase their holdings of home bonds by DEF-dMB, and must decrease to induce private portfolio managers to increase their holdings of foreign bonds by DEF*-dMB*. A home-country current-account surplus that shifts the residence of private wealth toward the home country will reduce the risk premium on home currency, _ceteris paribus_, if and only if private residents of the home country have a relatively stronger preference for home bonds than private residents of the foreign country--i.e., if and only if $b_H - b_F > 0$. An intervention purchase of one unit of home bonds reduces the expected yield differential necessary in order to induce wealth holders to hold the reduced supply of home bonds. In this case there is no redistribution of wealth (assuming no change in s) so that only the changes in portfolio shares b_H' and b_F' are important in determining the change in ϕ. It is also interesting to note that an intervention purchase of one unit of home bonds has the same effect on the risk premium as simultaneously reducing DEF-dMB and increasing both s(DEF*-dMB*) and CAS by one unit each. Thus, the instantaneous effect on the risk

1/ We have also used conditions (3) and (8) in deriving the factor that multiplies ds in the numerator of condition (22).

premium of any change in the structure of fiscal deficits or current accounts can be offset by some intervention transaction. Moreover, an appreciation of foreign currency ($ds > 0$) reduces the risk premium on home bonds because it raises the home-currency valuations of both home and foreign wealths relative to the stock of home bonds (recall condition 18). Finally, the magnitudes of these effects on the risk premium are inversely proportional to the degree of asset substitutability, as reflected by the parameters b_H' and b_F'. For the limiting case in which home bonds and foreign bonds are perfect substitutes, $b_H' = b_F' = \infty$ and ϕ never changes.

IV. To What Extent Have Observed Exchange Rate Changes Been Expected?

Having characterized the risk premium, we now focus on the extent to which portfolio managers could plausibly have expected the changes in exchange rates that have been observed since March 1973. It is widely recognized that observed changes in exchange rates have been predicted very poorly by forward premiums, 1/ but as represented by condition (16), the interest differential or forward premium is only one component of the expected change in the exchange rate. It is conceivable that the expected rate of change in the exchange rate predominantly reflects the risk premium, rather than the forward premium, and that the risk premium is also a good predictor of the observed changes in exchange rates that are not predicted by forward premiums. This possibility can be tested empirically by regressing actual changes in the dollar/deutsche mark exchange rate (net of the forward premium) on a general expression that characterizes the unobservable behavior of the risk premium. In doing so it is important to extend the market-clearing condition (17) to include the net holdings of dollar bonds in countries outside the United States and Germany:

$$(17a)\quad B = b_H(\phi)[W_H - MB] + b_F(\phi)[sW_F - sMB^*] + b_R(\phi)W_{ROW}$$

The three terms on the right-hand side of (17a) respectively represent the net dollar bond holdings of private U.S. residents, private German residents and private and official residents of the rest of the world. W_{ROW} is the dollar valuation of the net money and bond holdings of the

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1/ See Mussa (1979). With regard to end-of-quarter data on the dollar-Deutsche mark rate during the 1973-78 period, for example, the coefficient of correlation between the percentage forward premium (measured as the Eurocurrency interest differential) and the subsequently observed percentage change in the exchange rate was .19; the root-mean-squared error of predictions based on the forward premium exceeded the mean absolute value of the observed changes; and in 10 of the 24 quarters the forward premium mispredicted the direction of exchange-rate change. Moreover, the average absolute value of the change in the exchange rate was 4.9 per cent per quarter during this period, seven times the average absolute value of the forward premium.

rest of the world and $b_R(\phi)$ is the share of this wealth that is held in the form of dollar-denominated interest-bearing assets.

Our regression analysis is based on an approximate solution of this market-clearing condition for ϕ. This is obtained by replacing each of the portfolio-share functions by a first-order Taylor approximation around some point ϕ_0

$$b_H(\phi) = \overline{b}_H + b_H'[\phi-\phi_0]$$

$$(23)\quad b_F(\phi) = \overline{b}_F + b_F'[\phi-\phi_0]$$

$$b_R(\phi) = \overline{b}_R + b_R'[\phi-\phi_0]$$

Under this substitution the solution to (17a) is

$$(24)\quad \phi = \phi_0 + \frac{B - \overline{b}_H[W_H-MB] - \overline{b}_F[sW_F-sMB^*] - \overline{b}_R W_{ROW}}{b_H'[W_H-MB] + b_F'[sW_F-sMB^*] + b_R' W_{ROW}}$$

If all three portfolio-share functions are assumed to exhibit the same elasticity ε with respect to the risk premium at ϕ_0

$$(25)\quad \phi_0\, b_H'/\overline{b}_H = \phi_0\, b_F'/\overline{b}_F = \phi_0\, b_R'/\overline{b}_R = \varepsilon$$

Condition (24) can then be expressed as

$$(26)\quad \phi = \phi_0 + (\phi_0/\varepsilon)(B-\overline{B})/\overline{B}$$

where we define the notation

$$(27)\quad \overline{B} = \overline{b}_H[W_H-MB] + \overline{b}_F[sW_F-sMB^*] + \overline{b}_R W_{ROW}$$

to represent the aggregate world demand for dollar bonds when the risk premium equals ϕ_0.

In specifying our regression hypothesis, we view the observed rate of appreciation of the exchange rate (x) as the sum of the expected rate of appreciation (π) plus an unexpected rate of appreciation (u). Given the decomposition of π in condition (16), we can write

$$(28)\quad x + r - r^* = \phi + u$$

Adding the behavioral model (26) together with time arguments, the regression hypothesis can be expressed as

$$(29)\quad x(t) + r(t) - r^*(t) = \phi_0 + (\phi_0/\varepsilon)[B(t)-\overline{B}(t)/\overline{B}(t)] + u(t)$$

where ϕ_0 and ϕ_0/ε are the parameters to be estimated and the unexpected changes u(t) are treated as unexplained residuals or error terms. The dependent variable is measured ex post as the observed percentage change in the exchange rate between the end of quarter t and the end of quarter t + 1 minus the three-month percentage forward premium (or Eurocurrency interest differential) at the end of quarter t. We approach the regression analysis with the perspective that forward premiums have been poor predictors (or very small components) of observed changes in spot rates (recall footnote, p. 8), and the object of the regression is to assess the extent to which our model of the risk premium explains observed changes in exchange rates over and above forward premiums. For this purpose we focus on a variety of goodness-of-fit statistics. Moreover, because data on the currency compositions of our wealth variables are not available, we test the regression hypothesis over a range of constructions of $\bar{B}$ that correspond to a broad range of plausible assumptions about $\bar{b}_H$, b_F and $\bar{b}_R$. The observations of exchange rates, forward premiums, asset stocks and wealth variables represent 24 end-of-quarter data points during the 1973-78 period. Data sources are described in the Appendix.

Our regression estimates scan the plausibility set of the triplet ($\bar{b}_H$, $\bar{b}_F$, $\bar{b}_R$) using a grid of the 200 combinations of $\bar{b}_H$ = .95, .90, .85, .80, .75; $\bar{b}_F$ = .05, .10, .15, .20, .25; and $\bar{b}_R$ = .1, .2, .3, .4, .5, .6, .7, .8. The Cochrane-Orcutt procedure is used in all cases to correct for first-order serial correlation. Table 1 shows how the goodness-of-fit statistics and coefficient estimates vary as the prespecified portfolio-share parameters are varied one at a time from the point ($\bar{b}_H$, $\bar{b}_F$, $\bar{b}_R$) = (.85, .15, .4). Also tabulated are two cases which generated maximum or minimum values of each of the goodness-of-fit statistics over the entire set of grid points. Each of the goodness-of-fit statistics and the estimates of ϕ_0 and ϕ_0/ε change very gradually and smoothly as the three portfolio-share parameters are varied in any direction (either one at a time or in combination), leaving us confident that scanning a finer grid would not have generated cases with substantially better fits.

The basic conclusion that we draw from the regression analysis is that the risk premiums associated with our particular representation of the portfolio-balance model explain only a small part of the discrepancies between observed percentage changes in exchange rates and forward premiums. For all of the grid points we examined, the root-mean-squared prediction error exceeds the mean absolute value of the dependent variable; and the highest coefficient of correlation between the estimated risk premiums and subsequent percentage changes in the exchange rate (over and above forward premiums) is .393. The estimated risk premiums correctly predict the direction of at most 18 of the 24 observed changes in exchange rates (relative to forward premiums), and their average absolute value is less than two-fifths of the average absolute magnitude of observed percentage changes in exchange rates. Under the null hypothesis that the least squares estimates of ϕ represent expected changes in the exchange rate, the mean estimated risk premium over the sample period is -.62 per cent per quarter in all cases, 1/ an average (over time) expectation that the dollar would depreciate against the mark at a rate roughly 2.5 per cent per year in excess of the forward premium on the mark--i.e., by about .1 cent per month. The estimated elasticity of portfolio shares with respect to the risk premium is remarkably low in all cases; to the extent that this elasticity may be underestimated, however, the magnitudes of the estimated market-clearing risk premiums may correspondingly be overestimated and thus explain an even smaller portion of observed changes in exchange rates. 2/

Our failure to explain more than a small part of observed changes in exchange rates can be attributed in part to the limitations of our particular representation of the portfolio-balance model and in part to the fact that observed changes in exchange rates can differ from the changes expected by portfolio managers. In Dooley and Isard (1982a) we have employed a different estimation procedure using a modified version of the model described above, 3/ but the resulting estimates of the risk premium are again capable of explaining only a small part of observed changes in exchange rates. Thus, we have failed to find empirical evidence that portfolio managers have expected the major portion of observed changes in exchange rates.

V. Extensions of the Portfolio Balance Framework

Section II has emphasized that the portfolio balance framework in its streamlined form determines the relative levels of current and expected future exchange rates but cannot explain the absolute levels of either. A number of papers have "resolved" this difficulty by assuming that exchange rate expectations are static or autoregressive, but several approaches for modelling expected future exchange rates "rationally" have also been suggested in the literature. One approach is the method of repeated substitution, which was used by Mussa (1976) in an analytic model

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1/ The fact that the mean estimated risk premium is constant (up to two significant digits) in all cases merely reflects the fact that the mean of the fitted values from any regression is generally a close approximation to the mean of the dependent variable, which is identical in all of our cases.

2/ None of these conclusions is very sensitive to the initial value of the rest of the world's wealth, which we are forced to estimate arbitrarily. See the data appendix.

3/ In particular (i) we disaggregated the rest of the world into OPEC and non-OPEC wealth holders in order to pay particular attention to the dramatic growth of OPEC wealth since 1973, and (ii) we assumed that desired portfolio shares reflected the type of risk-averse behavior pictured by the shapes of the B_H and B_F curves in Figure 1, in contrast to the linear curves that are implied by assumptions (23) above. That is, we assumed that successive unit increases in the risk premium lead to positive but successively smaller increments in the shares of financial portfolios that are allocated to dollar-denominated bonds.

Table 1. Goodness-of-Fit Statistics and Parameter Estimates

Prespecified Parameters			Goodness-of-fit Statistics				Regression Estimates						
$\bar{b}_H$	$\bar{b}_F$	$\bar{b}_R$	RMSE 1/	RHO_1 2/	Signs 3/	Scale 4/	Mean ϕ 5/	ε	ϕ_0	ϕ_0/ε	$t\phi_0$	$t\phi_0/\varepsilon$	RHO_2 6/
.85	.15	.1	1.10	.289	14	.320	-.62	.025	-2.04	-81.5	-1.33	-1.22	-.077
.85	.15	.2	1.09	.308	15	.330	-.62	.029	-2.39	-80.9	-1.44	-1.33	-.075
.85	.15	.3	1.09	.315	16	.324	-.62	.034	-2.56	-73.8	-1.48	-1.37	-.077
.85	.15	.4	1.09	.316	16	.317	-.62	.040	-2.62	-64.9	-1.49	-1.37	-.082
.85	.15	.5	1.09	.313	15	.308	-.62	.046	-2.62	-56.6	-1.48	-1.35	-.087
.85	.15	.6	1.09	.310	14	.299	-.62	.052	-2.59	-49.6	-1.46	-1.32	-.092
.85	.15	.7	1.09	.306	14	.294	-.62	.058	-2.55	-43.8	-1.44	-1.30	-.096
.85	.15	.8	1.09	.313	16	.305	-.62	.064	-2.54	-34.3	-1.48	-1.33	-.109
.85	.05	.4	1.09	.326	16	.310	-.62	.043	-2.71	-62.2	-1.54	-1.42	-.091
.85	.10	.4	1.09	.323	15	.315	-.62	.041	-2.69	-64.5	1.53	-1.41	-.086
.85	.15	.4	1.09	.316	16	.317	-.62	.040	-2.62	-64.9	-1.49	-1.37	-.082
.85	.20	.4	1.09	.304	16	.317	-.62	.039	-2.48	-63.1	-1.43	-1.31	-.080
.85	.25	.4	1.10	.289	15	.311	-.62	.039	-2.28	-59.0	-1.35	-1.22	-.080
.95	.15	.4	1.13	.163	14	.192	-.62	.067	-0.90	-134.6	-0.741	-0.308	-.119
.90	.15	.4	1.12	.241	15	.277	-.62	.037	-1.72	-91.8	-1.11	-0.918	-.091
.85	.15	.4	1.09	.316	16	.317	-.62	.040	-2.62	-64.9	-1.49	-1.37	-.082
.80	.15	.4	1.08	.341	16	.323	-.62	.049	-2.84	-57.5	-1.62	-1.51	-.095
.75	.15	.4	1.08	.341	17	.332	-.62	.060	-2.72	-45.2	-1.62	-1.50	-.110
.80	.25	.1	1.08	.353	15	.357	-.62	.029	-2.85	-99.6	-1.66	-1.61	-.066
.75	.25	.1	1.06	.393	18	.354	-.62	.037	-3.34	-90.0	-1.89	1.83	-.080

1/ RMSE is the ratio of the root-mean squared prediction error to mean absolute value of the dependent variable.

2/ RHO_1 is the coefficient of correlation between the estimated risk premium and the dependent variable.

3/ Signs is the number of observed changes in the dependent variable (out of 24 total observations) that are correctly predicted in sign.

4/ Scale is the average absolute value of the estimated risk premium divided by the average absolute value of the dependent variable.

5/ Mean ϕ is the mean of the estimated risk premium.

6/ $t\phi_0$ and $t\phi_0/\varepsilon$ are t-statistics associated with the regression estimates ϕ_0 and ϕ_0/ε.

7/ RHO_2 is the coefficient of first-order autocorrelation in the residuals from the regressions after the Cochrane-Orcutt correction.

of exchange rate determination and earlier by Sargent and Wallace (1973) in a study of hyperinflation, and which has been applied empirically by Dooley and Isard (1982a) in estimating a model of the Deutschmark/dollar exchange rate. Under this approach, the exchange rate at time t is expressed as a linear function of the time t expectation of the exchange rate at time t + 1, along with other explanatory variables. This implies that the time t expectation of the exchange rate at time t + 1 is a linear function of the time t expectation of the exchange rate at t + 2, along with time t expectations of the other explanatory variables. Thus, by repeated substitution, the exchange rate at time t can be expressed as a linear function of the time t expectation of the exchange rate at the time t + T, for any T, along with time t expectations of the time paths of the other explanatory variables. One of the difficulties in employing this procedure empirically is the necessity of truncating the repeated substitutions at some choice of T, and hence of arbitrarily tying down the time t expectation of the exchange rate at t + T. Rodriguez (1980) has suggested an analytic model in which the truncation error converges to zero as T approaches infinity, but the speed of convergence can be shown to vary inversely with the degree of substitutability between domestic and foreign-currency denominated assets, and convergence can be ruled out in the important benchmark case of perfect substitutability (see Dooley and Isard, 1982b).

A second "rational expectations" approach for extending the portfolio balance framework is to tie expectations about the long-run real exchange rate to a steady state value that solves a goods market or balance of payments equilibrium condition. This was the approach taken in the influential papers by Dornbusch (1976) and Kouri (1976), and has been discussed by Mussa (1980) and Isard (1983). Many contributions to the literature assume that expectations about the long-run level of the real exchange rate are time invariant, which is a strong form of the long-run purchasing power parity assumption. Such an assumption facilitates regression analysis by absorbing the expected long-run real exchange rate into the constant term. The assumption of time-invariant expectations about the long-run real exchange rate sidesteps the issue, however, of specifying the conditions on which long-run expectations are based, which in turn precludes a scientific evaluation of the assumption. In principle, it seems important to seek a sensible specification of the long-run balance of payments constraint. In this context, Dooley (1982) has emphasized that the constraint should be viewed basically as reflecting the political risk that debtor countries will not fully repay borrowings from creditor countries, rather than any direct increases in exchange risk associated with the currency denomination of borrowings, since countries with persistent balance of payments deficits generally do not denominate their international borrowings in their own currencies. An implication is that the interaction between exchange risk and political risk deserves further attention in the portfolio balance framework. 1/ Hooper and Morton (1982) provide estimates of an exchange rate equation

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1/ See Aliber (1973) and Dooley and Isard (1980) for previous studies that have addressed the issue of political risk.

that is specified to reflect the notion of a long-run balance of payments constraint, although no specific form of the constraint is assumed.

VI. Conclusions

There is now a growing body of evidence rejecting the joint hypothesis that exchange markets are efficient and exchange risk premiums are non-existent. Much of the evidence is based on studies of time series data on spot and forward exchange rates and interest differentials, 1/ rather than tests of structural exchange rate equations. The time series evidence, however, has heightened interest in obtaining structural estimates of the exchange risk premium and, more generally, of the parameters of portfolio balance models that describe the extent to which exchange rates respond to exchange-market interventions and the creation of outside assets through fiscal budget deficits. This study has found weak evidence of a risk premium based on a structural model, but provides little insight into the values of the relevant portfolio demand parameters.

Part of the difficulty in obtaining structural estimates of portfolio demand parameters may reflect deficiencies in specifying the portfolio balance framework. This paper has emphasized that the portfolio balance model in its streamlined version can be solved for the expected rate of change of the exchange rate, but that an additional constraint is required to solve for the absolute levels of current and expected future exchange rates. A relatively attractive method of extending the portfolio balance framework is to base expectations of the long-run real exchange rate on the solution to a long-run goods market or balance of payments constraint. As Dooley (1982) has argued, however, the essence of any long-run balance of payments contraint must involve political risk, which has received little emphasis in portfolio balance models developed to date. An additional deficiency of portfolio demand systems, including those derived from utility-theoretic approaches, is that the structural models are not internally capable of explaining why it is rational for residents of different countries to have different portfolio preferences. A convincing answer would again seem to involve considerations of political risks, rather than the traditional "explanation" of differences in transactions costs.

In addition to extending the portfolio balance model to recognize the role of political risk and to provide a solid anchor for long-run exchange rate expectations, it seems important for studies of exchange rate behavior to distinguish carefully between expected and unexpected changes in explanatory variables. The empirical results of this paper support the view that observed changes in exchange rates have been predominantly unexpected--i.e., have predominantly reflected unexpected

1/ Examples include Geweke and Feige (1979), Hansen and Hodrick (1980, 1983), Cumby and Obstfeld (1981), Hakkio (1981), Meese and Singleton (1982) and Dooley and Shafer (1983).

changes in (or revisions in expectations about) explanatory variables. In view of the limited attempts that have been made to specify exchange rate equations in this spirit, it is not surprising that empirical exchange rate models of the seventies have been found to predict poorly out of sample, even under perfect foresight of explanatory variables. 1/

The empirical results presented in this paper also support the view that current account imbalances do not have substantial "wealth effects" on exchange rates, which is an implication of the evidence that risk premiums are small. In view of the important deficiencies of the portfolio balance framework as developed to date, however, the supporting evidence must be regarded as very tentative. Until the portfolio balance model is renovated to provide an understanding of the interdependencies between exchange risk and political risk, it would seem difficult to reach a clear judgment on the relative importance of the different channels through which current account imbalances may influence exchange rates. 2/

1/ Attempts to model "the news" include Dornbusch (1980), Frenkel (1981), Isard (1980) and Longworth (1982). Evidence on the poor predictive power of the empirical models of the seventies is presented by Meese and Rogoff (1982, 1983), Haache and Townend (1981) and Backus (1982).

2/ See Blackhurst (1981) for a recent survey of the literature on the relationship between the current account and the exchange rate.

The data

Exchange rates are measured on the last Friday of the quarter, taken from Federal Reserve data files. Interest rates are 90-day Eurocurrency rates measured on or near the last day of the quarter, taken from Morgan Guaranty's World Financial Markets and the Bank of America's data file. DEF represents the change in the stock of U.S. Federal securities held by the public, as published in the Federal Reserve Board's Annual Statistical Digest and monthly Bulletin. Forward premiums are constructed to equal Eurocurrency interest differentials. CAS is the U.S. current account surplus published in the Survey of Current Business. MB, represented by Federal Reserve data, is adjusted for breaks due to changes in reserve requirements. DEF* represents the German Federal budget deficit, taken from the Monthly Report of the Bundesbank, Reihe 4. MB* and the German current account surplus, CAS*, are from the same source. Private U.S. wealth W_H is constructed as $400 billion + $\int$(DEF + CAS). Private German wealth W_F is constructed as DM 200 billion + $\int$(DEF* + CAS*). The initial values of W_H and W_F are estimated from end-of-1972 stocks of Federal debt, monetary bases, and net claims on foreigners, as published in the Federal Reserve Board's Annual Statistical Digest and monthly Bulletin and the Monthly Report of the Bundesbank. The dollar value of the wealth of the rest of the world, W_{ROW}, is constructed by subtracting the combined U.S. and German cumulative current-account surpluses from an estimated initial value W^o_{ROW}.

$$W_{ROW} = W^o_{ROW} - \int(CAS + sCAS^*)$$

We rely on the market-clearing conditions of the model to provide estimates of W^o_{ROW} under the alternative assumptions (i) that the risk premium was zero at the end of 1976, which was the middle of a long interval of relatively small fluctuations in the dollar-mark rate, or (ii) that on average during the entire sample period the dollar-bond market cleared at a zero risk premium. In case (i) we solve for W_{ROW} (1976Q4) and then W^o_{ROW} by setting $\overline{B}$(1976Q4) = B(1976Q4) in equation (27); in the second case we solve for the W^o_{ROW} that is consistent with the assumption the $\overline{B}$-B has a zero mean over the entire 24-quarter sample. In each case W^o_{ROW} is estimated as a function of the prespecified values of the triplet ($\overline{b}_H$, $\overline{b}_F$, $\overline{b}_R$). Table 2 is based on the former choice of W^o_{ROW}. However the goodness-of-fit statistics and mean (ϕ) estimates are quite insensitive to this choice of W^o_{ROW}, and the estimates of ε are lower in case (ii) than in case (i).

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