Home Bias in Equity Portfolios, Inflation Hedging, and International Capital Market Equilibrium

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We test whether the home bias in equity portfolios is caused by investors trying to hedge inflation risk. The empirical evidence is consistent with this motive only if investors have very high levels of risk tolerance and equity returns are negatively correlated with domestic inflation. We then develop a model of international portfolio choice and equity market equilibrium that integrates inflation risk and deadweight costs. Using this model we estimate the levels of costs required to generate the observed home bias in portfolios consistent with different levels of risk aversion. For a level of risk aversion consistent with standard estimates of the domestic equity market risk premium, these costs are about a few percent per annum, greater than observable costs such as withholding taxes. Thus, the home bias cannot be explained by either inflation hedging or direct observable costs of international investment unless investors have very low levels of risk aversion.

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Table 1
The home bias in equity portfolios, December 1987

Country	Market capitalization as a percentage of total	Percentage of equity portfolio in domestic equities
France	2.6	64.4
Italy	1.9	91.0
Japan	43.7	86.7
Spain	1.1	94.2
Sweden	0.8	100.0
UK	10.3	78.5
USA	36.4	98.0
Germany	3.2	75.4
Total	100.0	

Market capitalizations are Morgan Stanley Capital International Indices (1987). The sources of portfolio holdings are for the United States, Survey of Current Business; for the United Kingdom, CSO Financial Statistics (Feb. 1990); for the remaining countries, Financial Accounts Statistics (OECD) (1988–1989). The domestic proportion for Japan is for bonds and shares combined.

One of the most striking features of international portfolio investment is the extent to which equity portfolios are concentrated in the domestic equity market of the investor. Table 1 shows for eight major markets the proportion of portfolios held in domestic equities relative to the proportion of domestic equities in the world market portfolio. This "home bias" runs counter to the well-documented benefits of international diversification of equity portfolios [Grubel (1968), Levy and Sarnat (1970), Lessard (1976, 1983), Solnik (1974a), Grauer and Hakansson (1987), Kaplanis and Schaefer (1991)]. It must, therefore, be caused by some feature of international portfolio investment that offsets gains from diversification.

Adler and Dumas (1983) (hereafter AD) point out two features that appear in international portfolio theory but not in domestic portfolio theory.[1] The first is that investors in different countries consume different bundles of goods. With inflation risk and deviations from purchasing power parity (PPP), investors in different countries are induced to hold portfolios that differ by a component designed to hedge inflation risk [Adler and Dumas (1983), Stulz (1981a)]. Thus, the home bias could be explained if domestic equities provide a hedge against inflation risk for some investors.[2] Note, however, that PPP deviations solely due to nominal exchange rate changes without inflation risk cannot explain the home bias in the investor's equity portfolio. With certain inflation, hedging is achieved by using only bonds [Solnik (1974b), Sercu (1980)].[3]

[1]For the standard model without PPP deviations and deadweight costs see Grauer, Litzenberger, and Stehle (1976).

[2]If some investors exhibit a home bias. then aggregation will also force others, on average, to do the same.

[3]Black (1990) and Adler and Prasad (1990) discuss the extent to which generalizations can be made about optimal hedging of currency risk. They are, however, concerned with hedging nominal risk with bonds rather than hedging real risk with equities.

A second feature of international portfolio investment that causes investors in different countries to hold different portfolios is the costs associated with cross-border investing [Black (1974)) Stulz (1981b), Cooper and Kaplanis (1986)]. These costs include taxes such as withholding taxes, informational disadvantages, restrictions, and differential access to markets. These costs induce a home bias in equity portfolios because the net return on equities is higher for domestic than for foreign investors. French and Poterba (1991) generate a similar result by simply assuming that domestic investors are more "optimistic" than foreign investors.

Another explanation given for the home bias is the existence of nontraded goods. Eldor, Pines, and Schwartz (1988) and Stockman and Dellas (1989) develop general equilibrium models incorporating nontraded goods, in which the desire of investors to hedge against the price uncertainty of nontraded goods leads to home bias. Thus, the hedging motive is the difference in consumption bundles, as in the AD model. Furthermore, in these models it is not clear whether the hedging motive will result in a home bias for equities or bonds.[4]

This paper has three objectives: to test whether the hedging of PPP deviations caused by stochastic inflation can explain the home bias in equity portfolios, to develop a model that integrates inflation risk and deadweight costs, and to estimate the size of deadweight costs, if any, necessary to explain any home bias that cannot be explained by inflation risk. We take as our starting point the AD model of equilibrium with stochastic inflation. The nature of our tests is unusual in that most tests of international financial market integration use models of expected returns to test whether actual returns are consistent with integration [Errunza and Losq (1985), Jorion and Schwartz (1986), Wheatley (1988)]. The results of these tests are mixed. For instance, Errunza and Losq (1985) report that "The overall results are not statistically inconsistent with theoretical expectations and thus lend tentative support to the mild segmentation hypothesis." Tests using ex post returns as proxies for ex ante returns have, however, very low power [Summers (1986)]. In contrast, direct tests of the effects of international market segmentation such as Hietala (1989) find a significant effect of market imperfections on the pricing of equities.

Instead of tests based on ex post returns, we use tests based on predictions about portfolio holdings. Although information on portfolio holdings is incomplete, it is likely that observed portfolio holdings are better proxies for actual portfolios than ex post average returns

[4] All these models are single period. In a multiperiod model other hedging motives would appear, such as the desire to hedge real interest rate changes. We are not aware, however, of a testable model of international capital market equilibrium that incorporates these effects.

are for ex ante expected returns. Thus, our test has potentially high power in discovering whether inflation risk can explain the home bias in investment.

The article is organized as follows. Section 1 summarizes the AD model and derives a test of whether home bias is explained by the model. Section 2 describes the data. Section 3 presents the results of the test of the AD model. Section 3 extends the model to incorporate deadweight costs as well as inflation risk. Section 4 develops a model integrating inflation risk and deadweight costs. Section 5 estimates the size of deadweight costs necessary to explain any home bias that cannot be explained by inflation risk. Section 6 explains the implications of our results for corporate finance. Section 7 summarizes and states our conclusions.

1. The Adler and Dumas Model

We make the following assumptions that are identical to Adler and Dumas (1983):

A1. There are N countries and currencies. All returns are stated in nominal units of the Nth currency. There are N equity index assets and N - 1 risky currency assets. The ith asset has price dynamics given by

$$R_i = dY_i/Y_i = \mu_i\, dt + \sigma_i\, dZ_i, \qquad i = 1,\ldots,2N - 1, \tag{1}$$

where Y_i is the market value of index asset i in terms of currency N; dZ_i is the increment to a standard Wiener process; μ_i, s_i are constants. The assets indexed by N + 1 to $2N$ are currencies ordered in the same way as the index assets. The $2Nth$ asset is the nominally riskless asset in currency N.

A2. There are N investor types, each with homothetic utility functions. The price index, P^l, of an investor of type 1, expressed in the measurement currency follows the process

$$p^l = dP^l/P^l = \Pi^l\, dt + \sigma^l_\pi\, dZ^l_\pi, \qquad l = 1,\ldots,N, \tag{2}$$

where Π^l and σ^l_π are the expected value and standard deviation of the instantaneous rate of inflation and dZ^l_π is the increment to a standard Wiener process.

We define w^l as the vector of covariances, $\sigma^l_{i\pi}$, of the $2N$ - 1 risky asset returns with investor l's rate of inflation expressed in terms of the numeraire currency. Under these assumptions, AD show that the optimal holding of assets for investor l will be

$$x^l = \alpha_l\Omega^{-1}(\mu - r\underline{1}) + (1 - \alpha_l)\Omega^{-1}w^l, \tag{3}$$

where

x^l = $(2N - 1) \times 1$ vector of the proportions of investor l's wealth in each risky asset
α_l = investor l's risk tolerance
$\underline{1}$ = $(2N - 1) \times 1$ vector of 1's
Ω = $(2N - 1) \times (2N - 1)$ covariance matrix of the instantaneous covariances of the nominal rates of return on the various securities.

Equation (3) says that each investor holds a portfolio that consists of two components. The first is a portfolio that is common to all investors (the universal logarithmic portfolio). The second is a portfolio that hedges inflation risk for the *lth* investor.

To generate a test of whether (3) can explain the observed home bias, we now add the following assumption:

A3. All investors have equal risk tolerance: $a' = a$.

This assumption, also used by French and Poterba (1991), is reasonable if we are seeking to explain the structure of international portfolios by stochastic inflation rather than by arbitrary differences in risk preferences. In Section 3 we test whether the restrictions implied by A3 can be rejected empirically.

To use (3) in testing whether inflation hedging can explain the home bias, we first eliminate expected returns by using the aggregation condition

$$\sum_l x^l v^l = e, \tag{4}$$

where v^l is country *l's* wealth as a proportion of the world wealth for $l = 1,..., N$. e is a vector with *lth* component e^l, where e^l is country *l's* equity market capitalization as a proportion of the world market for $l = 1, \ldots, N$ and $e^l = 0$ for $l = (N + 1), ..., 2N$. This condition says that the net supply of bonds is zero and of equities is the capitalization of the relevant equity market.

Combining (3) and (4) and using $\Sigma\, e^l = 1$ gives

$$(x^l - e)/(1 - \alpha) = \Omega^{-1}\left[w^l - \sum v^l w^l\right]. \tag{5}$$

This expression states that the deviations of investor *l's* equity portfolio from the world market portfolio are proportional to a vector of regression coefficients. The multiple regression of the variable $p^l - \Sigma\, v^l p^l$, measuring deviations of investor *l's* inflation rate from average world inflation, on the vector of nominal risky security returns has coefficients equal to the right-hand side of (5).

2. Data

For estimation of the portfolio holdings and home bias we use the data in Table 1. The returns on equity markets are from the London Share Price Database (LSPD) maintained at the London Business School. The indices used are CAC General (France), Banca Com. Ital. (Italy), Tokyo SE (Japan), Madrid SE (Spain), Affarsvarlden Gen. (Sweden), FTA-All Share (UK), S and P Composite (USA), Commerzbank (Germany). Price indices are from International Financial Statistics. Exchange rates are from LSPD. We use raw currency returns (proportional changes in exchange rates) because we are interested, in (5), only in the correlations between the innovations in inflation and returns to assets, and not in the mean levels of returns. Thus, we do not need to include the rates of interest on money market deposits as these are known at the beginning of each investment period and cannot contribute to the hedging of unanticipated inflation over the period in the AD model. To estimate (6) we use monthly data for the period January 1978 to December 1987. Market capitalizations and portfolio holdings given in Table 1 are for December 1987. Thus, the empirical results concerning the covariance structure of returns and inflation that we give would have been available to the investors forming the portfolio holdings that we use.

3. Test Results

To test whether the home bias in equity investment can be explained by stochastic inflation, we run the regressions with coefficients corresponding to the right-hand side of (5):

$$\left(p^l - \sum v^l p^l\right)_t = b_{ol} + \sum_{i=1}^{2N-1} b_{il} R_{it} + u^l_t, \qquad l = 1, \ldots, N. \tag{6}$$

As a proxy for the wealth of each country we use the capitalization of its equity market: $v^l = e^l$. The lth coefficient of this regression, b_{ll}, is an estimate of $(x^{ll} - e^l)/(1 - a)$, which is the home bias for country l divided by 1 minus its risk tolerance. We substitute for b_{ll} in (6), using this relationship, and use the system of equations to estimate the risk aversion parameter, a^{-1}. This test is based on the implications of the AD model for portfolio holdings rather than equilibrium expected returns. Tests based on predictions about portfolio holdings are not typically used for domestic asset pricing models because it is clear that almost no investors hold the equity portfolio predicted by theory (the market portfolio in the case of the CAPM).[5]

[5] An exception is provided by studies examining the portfolio consequences of the tax status of investors, such as Lewellen et al. (1978).

It is well documented, however, that domestic portfolios that deviate significantly from the market portfolio in composition may exhibit very similar return characteristics [Statman (1987)]. For international portfolios the situation is different. Investors hold dramatically different portfolios based on observable investor characteristics (nationality). Furthermore, these portfolios have return distributions that are markedly different from the equity portfolio predicted by most international models with integrated markets (the global market portfolio). Thus, the differences between investor portfolios are systematic and significant, permitting their use in testing the implications of the theory.

To estimate (6) we make the substitution $b_u = \gamma_l(x^u - e^l)/(\gamma_l - 1)$ where $\gamma_l = \alpha_l^{-1}$. This gives the system

$$\left(p^l - \sum e^l p^l\right)_t = b_{ol} + \sum_{i \neq l} b_{il} R_{it} + \left(\frac{\gamma_l(x^u - e^l)}{\gamma^l - 1}\right) R_{lt} + u_t^l. \qquad (7)$$

In order to estimate the system of equations (7), we use a GMM framework proposed by Hansen (1982). This approach enables us to estimate the risk aversion coefficients, γ_l, which enter the regressions in a nonlinear way as well as correct for heteroskedasticity and serial correlation. We embed the following orthogonality conditions in the GMM estimation:

$$E(u_t) = 0, \qquad E(u_t \otimes Z_t) = 0, \qquad (8)$$

where u_t is the vector of disturbance terms and Z_t is the vector of instrumental variables. In this case we use the returns as instrumental variables. The system of equations (8) is just identified with 8 × 16 equations and 8 × 16 parameters.

Table 2 presents the results of estimating the system of equations (7) with no constraints, using the Newey and West (1987) weighted covariance matrix truncated at 12 lags.[6] The estimates of the coefficients of relative risk aversion, γ_l, are uniformly very low with small standard errors.

The hypothesis that home bias is caused by hedging inflation risk corresponds to the hypothesis that

$$b_l = \gamma_l(x^{ll} - e^l)/\gamma_l - 1). \qquad (9)$$

For the hypothesis to correspond to inflation hedging, we require $b_l > 0$, meaning that the home country equity return is positively correlated with its inflation rate, and also $\gamma_l > 0$, signifying risk aversion. We use the confidence limits for the estimate of γ_l to test for each country whether the joint hypothesis that $b_l \geq 0$ and $\gamma_l \geq 0$ can be

[6]The lag function is truncated at 12 months, corresponding to the highest-order 10 percent significant autocorrelations in the OLS residuals from the regression equations (6).

Table 2
Estimates of the coefficient of relative risk aversion, γ_l, and a test of the joint hypothesis that $b_l \geq 0$ and $\gamma_l \geq 0$, corresponding to home bias induced by inflation hedging

Country	$\hat{\gamma}_l$	SE($\hat{\gamma}_l$)	$x^{ll} - e^l$	Probability that $b_l \geq 0$ and $\gamma_l \geq 0$
France	−0.0013	0.0104	0.618	0.00
Italy	−0.0134	0.0063	0.891	0.00
Japan	0.0135	0.0190	0.430	0.00
Spain	0.0154	0.0093	0.931	0.00
Sweden	−0.0066	0.0090	0.992	0.00
UK	−0.0006	0.0284	0.682	0.00
USA	−0.0015	0.0121	0.616	0.00
Germany	0.0227	0.0086	0.722	0.00

x_{ll} is the proportion of its equity portfolio invested in the home market by country l, e^l is the proportion of world equity market capitalization of country l, α_l is the risk-tolerance parameter, $\gamma_l = \alpha_l^{-1}$ is the coefficient of relative risk aversion, and $b_l = \gamma_l(x^{ll} - e^l)/(\gamma_l - 1)$; $\hat{\gamma}_l$ is the estimate of γ_l, and SE($\hat{\gamma}_l$) is the standard error of the estimate $\hat{\gamma}_l$. Standard errors are corrected for heteroskedasticity and autocorrelation by using Newey and West (1987) with 12 monthly lags. The last column tests whether $\gamma_l \geq 1$.

rejected.[7] Table 2 shows, in its last column, the probability of this hypothesis being true. For all countries there is zero probability of the joint hypothesis being true. Thus, the hedging of inflation risk can be rejected as an explanation of the home bias. This is not very surprising in view of the strong evidence that domestic equities do not hedge inflation risk in those countries for which this extension of our understanding of international capital market behavior.

4. integrating Inflation Risk and Deadweight Costs

In Section 3 we showed that inflation risk alone is not sufficient to explain the home bias in equity portfolios. In this section we derive a model that integrates inflation risk and deadweight costs. This model is used in Section 5 to estimate the level of deadweight costs necessary to explain the part of the home country bias unexplained by PPP deviations.

To derive the integrated model, we add *to* assumptions A1-A3, the following:

A4. When investor l holds asset i, he experiences a proportional deadweight loss of $C_i^l\, dt$ in the period dt.

This assumption is identical to Black (1974)) except that it allows the costs of holding foreign assets to vary by investor and asset. The impact of A5 is to modify (1) for investor l to be

The relationship between the estimates of γ_l and b_l can be derived from $b_l - \gamma_l(x^{ll} - e_l)/(\gamma_l - 1)$. The home bias, $b^{ll} - e^l$, is positive, so $\gamma^l < 1$ implies $b_l < 0$.

$$R_i = (\mu_i - C_i^l)\ dt + \sigma_i\ dz_i. \tag{10}$$

We now define, for investor *l*, a vector c^l that incorporates the combined effects of deadweight costs and PPP deviations:

$$c^l = C^l - C_{2N}^l \underline{1} + [(\alpha - 1)/\alpha] w^l, \tag{11}$$

where C^l is a $2N - 1 \times 1$ vector of C_i^l's and $\underline{1}$ is a $2N - 1 \times 1$ unit vector.

In the Appendix we show that

$$x^l = \alpha\Omega^{-1}(\mu - r\underline{1}) - \alpha\Omega^{-1}c^l. \tag{12}$$

As before, the investor's portfolio consists of two funds. The first is common to all investors. The second fund, $\Omega^{-1} c^l$, now performs a dual role. It hedges against inflation risk and minimizes deadweight costs.

Comparing (12) with (3) shows that costs and inflation risk can have identical effects on portfolio holdings and on equilibrium returns. We can generate identical equilibria with a particular set of vectors c^l to those obtained with a set of vectors w^l. Thus, there is nothing in the general structure of portfolio holdings that we can use to discriminate between costs and inflation risk as the dominant feature of international capital market equilibrium. Since the results of Section 3 suggest that the relationship that we observe between security returns and inflation risk cannot explain the home bias in investment, the burden must fall on costs in the integrated model. We now proceed to rearrange (12) so that we can estimate the costs necessary to explain the part of the home bias unaccounted for by inflation risk.

Using (5) and substituting αc^l for $(1 - \alpha)\ w^l$ gives

$$x^l - e = -\alpha\Omega^{-1}\left[c^l - \sum e^l c^l\right]. \tag{13}$$

From (13) and (11),

$$d^l = -\alpha\Omega^{-1}\left[y^l - \sum_j e^j y^j\right], \tag{14}$$

where

$$y^l = C^l - C_{2N}^l \underline{1}, \tag{15}$$

$$d^l = (x^l - e) - (1 - \alpha)\Omega^{-1}\left[w^l - \sum_j e^j w^j\right]. \tag{16}$$

Expression (14) says that d^l, the excess home bias over that explained by inflation risk, must be caused by relative costs, y^l.

To simplify the structure of deadweight costs, C^l, we now assume that these consist of two components. One component is the cost of taking money out of the investor's home country; the second is a cost associated with investing in a foreign country:

A5. The structure of costs is

$$C_i^l = a_l + b_i \qquad \text{if } i \neq l \quad \text{and} \quad i \leq N,$$

$$C_i^l = 0 \qquad \text{if } i = l \quad \text{or} \quad i > N.$$

This assumption says that investors can lend and borrow foreign currency at zero deadweight cost, for instance through their domestic banks. Holdings of foreign equities, however, incur two types of costs. Part of these costs, a,, is specific to the domicile of the investor. This would include such things as the impact of controls on foreign investment. The other part of the costs, b_i, is specific to the country of investment and includes, for instance, withholding taxes. Thus, our model has a hierarchy of markets. Real-goods markets have costs associated with international transfers, generating PPP deviations. Equity markets have deadweight costs equal to $a_l + b_i$ associated with cross-border transactions, and money markets are free of costs.

We now focus our attention on the equity holdings of investors. We partition the inverse of the variance-covariance matrix:

$$\Omega^{-1} = \begin{bmatrix} A & B \\ D & E \end{bmatrix}, \tag{17}$$

where A is $N \times N$, B is $N \times (N - 1)$, D is $(N - 1) \times N$, and E is $(N - 1) \times (N - 1)$.

The Appendix shows that (17) then gives

$$d_l^l = -\alpha \sum_k A_{lk} \left[a_l - \sum_j e^j a_j \right] + \alpha A_{ll}(a_l + b_l)$$
$$- \alpha \sum_j A_{lj} e^j (a_j + b_j), \qquad l = 1, \ldots, N, \tag{18}$$

where d_l^l is the lth element of d_l and A_{lj} is in the ljth element of A. Expression (18) gives a system of N equations in the $2N$ unknowns (a_i, b_i). We solve these equations to give estimates of deadweight cost associated with each country i under the two extreme assumptions, $a_i = 0$ or $b_i = 0$ for all i. The former assumption says that costs are entirely associated with inward investment. The latter assumes that costs are imposed by the investor's home country.

We cannot separate the cost for domestic investors transferring funds out of a country, a_i, from costs associated with inward investment by foreigners, b_i. In our model, home bias could be caused by

Table 3
Deadweight cost estimates in percent per annum. Estimates of the deadweight costs required to generate observed portfolios as equilibrium portfolios, given the behavior of inflation risk and PPP deviations

	Value of b_i with $a_i = 0$			Value of a_i with $b_i = 0$		
Country	$\alpha = 0.2$	$\alpha = 0.4$	$\alpha = 0.6$	$\alpha = 0.2$	$\alpha = 0.4$	$\alpha = 0.6$
France	8.56	4.28	2.85	8.31	4.16	2.77
Italy	23.44	11.74	7.88	30.20	15.14	10.12
Japan	4.18	2.08	1.38	−0.71	−0.37	−0.27
Spain	25.38	12.65	8.40	27.95	13.93	9.26
Sweden	13.83	6.93	4.63	17.95	8.96	6.01
UK	5.44	2.71	1.81	5.52	2.76	1.83
USA	5.70	2.85	1.91	6.72	3.37	2.26
Germany	7.28	3.63	2.41	8.97	4.47	2.97

a_i is the cost of outward investment from country i, b_i is the cost of inward investment into country i. The costs are estimates of b_i, assuming that $a_i = 0$ for all i, and a_i, assuming that $b_i = 0$ for all i. α is the level of risk tolerance.

either of these costs being high. The aggregation condition requires that, if foreigners choose not to hold country i's assets because of high inward costs, then country i residents must hold portfolios that are overweight in domestic securities. Alternatively, however, country i residents could be choosing home-biased portfolios because the cost of outward investment is high. The mechanism that induces either effect is, of course, equilibrium returns, which do not appear in the version of the model we estimate because we have eliminated them by using the aggregation condition. We discuss the implications of the model for expected returns and corporate finance in Section 6.

5. Estimates of Deadweight Costs

Table 3 shows the estimates of deadweight costs for each country as a percentage per annum estimated by using the procedure given in Section 4. The first entry in the table implies that there must be a deadweight cost of 8.56 percent per annum for inward investment into France if the risk-tolerance parameter, a, is 0.2 to explain the observed home bias if there are no costs to outward investment. This corresponds to a risk aversion parameter of 5. For comparison, Ferson (1982) provides a range of $0 < 1/a < 5.3$ for the coefficient of relative risk aversion for the United States. The result for Japan is anomalous, being negative. This probably results from the fact that our estimate of portfolio holdings for Japan is for bonds and stocks combined, overestimating the foreign component.

These costs are estimated under two extreme assumptions: that costs are entirely associated with inward investment ($a_i = 0$) and that costs are entirely associated with the domicile of the investor ($b_i = 0$). From inspection of Table 3 it is clear that the estimates are largely unaffected by attributing the costs to inward rather than outward investment. The estimated level of costs is close to proportional to the risk aversion coefficient, 1/ a. This follows from the linearity of (18) in a and the fact that inflation hedging explains little of the home bias. Thus, any positive level of costs can be "explained" by an appropriate value of a.

An alternative way of estimating the barriers to foreign investment is to directly estimate the cost of observable barriers. The problem with this method is that a number of these barriers such as investment controls and information disadvantages are not quantifiable. Some other costs, however, such as withholding taxes on dividends and management fees can be reasonably estimated. For example, a UK pension fund investing in the United States would be subject to withholding tax on dividends. Since it is tax exempt in the United Kingdom, this withholding tax cannot be reclaimed and is a cost to foreign investment. For a dividend yield of 7 percent and a withholding tax on dividends of 15 percent, this barrier translates to 1 percent reduction in the return from foreign investment. Another quantifiable barrier is the fees that investment funds charge for foreign funds relative to domestic funds. For example, the expense ratio of U.S. diversified funds in 1989 was, on average, 1.2 percent per annum while the average expense ratio for funds (from the U.S. perspective) was 1.88 percent per annum (Forbes, September 4, 1989). Therefore, there is a cost of about 0.68 percent for U.S. funds investing overseas. In "explanation" of this, the observed home bias with this level of costs would require a value of a of 2.1. This corresponds to a risk aversion coefficient of 0.47. For countries such as Spain and Italy the risk aversion coefficient would have to be even lower to generate estimates of deadweight costs equivalent to observable costs such as withholding taxes.

6. Implications for Corporate Finance

Hamada (1969) derives the optimal financing and capital budgeting rules for an integrated domestic capital market. In this section, we discuss the implications of our empirical tests for the capital budgeting rules for international investment.

Under an equilibrium of Adler-Dumas type, where the sole international feature is PPP deviations, the required rate of return on an incremental project is independent of the identity of the firm undertaking the project. So the "cost of capital" for a particular project is identical for all firms in this equilibrium. The only difference between firms evaluating the same project in this case will be the level of net cash flow that they expect. This can differ because they have different competitive positions, or because they experience different tax effects or other costs, depending on their country of origin.

Under a pure deadweight cost equilibrium, the "cost of capital" for a project depends on the country of origin of the investing company. The difference arises because the clientele holding the market portfolio of country *i* is different from that holding the market portfolio of country *j*. In particular, the marginal cost to a typical investor in country *i* of adding an investment in country *j* to his portfolio is different from that for country *j* investors. Direct corporate investment is a substitute for this portfolio trade and, therefore, the required return reflects this difference. The evidence presented in Sections 3 and 5 suggests that deadweight costs are potentially as important a feature of the international equilibrium as are PPP deviations. Thus, international capital budgeting rules should reflect the structure of deadweight costs.

7. Summary and Conclusions

We test whether the home bias in equity portfolios is caused by investors trying to hedge purchasing power parity (PPP) deviations. The empirical evidence is consistent with this motive only if investors have very low levels of risk aversion and equity returns are negatively correlated with domestic inflation. We then develop a model of international portfolio choice and equity market equilibrium that integrates PPP deviations and deadweight costs. Using this model we estimate the levels of cost required to generate the observed home bias in portfolios. These costs are consistent with observable costs such as withholding taxes only if investors have low levels of risk aversion.

The implications of these results are that the structure of international equity portfolios cannot be explained by the Adler-Dumas model with conventional levels of risk aversion, even if observable costs to cross-border investment are included. Alternative explanations for the home bias could include the hedging of relative price risks or informational asymmetries. The various explanations for the home bias in equity portfolios have different implications for the equilibrium structure of returns and for international corporate finance.

Appendix

Derivation of expression (12)

Define the vector μ^l and the scalar r^l by $\mu^l = \mu - C^l$, $r^l = r - C^l_{2N}$. The analysis is then identical to Adler and Dumas (1983) through Equation (8) of their paper but with μ^l substitued for μ and r^l substituted for r. Equation (8) of Adler and Dumas then becomes

$$\mu_i = r + C_i^l - C_{2N}^l + \left(\frac{\alpha - 1}{\alpha}\right)\sigma_{i\pi} + \sum_k \frac{x_k \sigma_{ik}}{\alpha}. \tag{A1}$$

This is equivalent to

$$\mu = r1 + c^l + \Omega x^l/\alpha. \tag{A2}$$

Rearranging and premultiplying by $\alpha\Omega^{-1}$ gives (15).

Derivation of expression (18)

Call the first $N \times 1$ part of the vector d^l, $\underline{d}^l$ and the first $N \times 1$ part of the vector C^l, $\underline{C}^l$. Note that $C_{2N}^l = 0$ and the last $(N - 1) \times 1$ elements of C^l are zero. Starting from (14) we have

$$\underline{d}^l = -\alpha A\left(\underline{C}^l - \sum_j e^j \underline{C}^j\right), \tag{B1}$$

$$\begin{aligned} d_i^l &= -\alpha \sum_k A_{ik}\left[\underline{C}_k^l - \sum_j e^j \underline{C}_k^j\right], \\ &= -\alpha \sum_k A_{ik}\left(a_l + b_k - \sum_j e^j(a_j + b_k)\right) + \alpha A_{il}(a_l + b_l) \\ &\quad - \alpha \sum_j A_{ij} e^j (a_j + b_j) \\ &= -\alpha \sum_k A_{ik}\left[a_l - \sum_j e^j a_j\right] + \alpha A_{il}(a_l + b_l) \\ &\quad - \alpha \sum_j A_{ij} e^j (a_j + b_j). \end{aligned} \tag{B2}$$

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