INTERNATIONAL HOME BIAS IN INTERNATIONAL FINANCE AND BUSINESS CYCLES

Karen K. Lewis

Working Paper **6351**

NBER WORKING PAPER SERIES

INTERNATIONAL HOME BIAS IN INTERNATIONAL FINANCE AND BUSINESS CYCLES

Karen K. Lewis

Working Paper 6351
http://www.nber.org/papers/w6351

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 1998

This work has been supported by a grant from the National Science Foundation to the National Bureau of Economic Research. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

International Home Bias in International Finance
and Business Cycles
Karen K. Lewis
NBER Working Paper No. 6351
January 1998
JEL Nos. F3, F4, G15

ABSTRACT

Domestic investors hold a substantially larger proportion of their wealth portfolios in domestic assets than standard portfolio theory would suggest. This phenomenon has been called "equity home bias." In the absence of this home bias, investors would optimally diversify away domestic output risk. Therefore, in a world without investor home bias, consumption growth rates would tend to comove across countries even when output growth rates do not. Empirically, however, consumption growth rates tend to have a lower correlation across countries than do output growth rates. Moreover, consumption growth in each country appears to be highly correlated with its own output growth relative to the world. This phenomenon may be called "consumption home bias." In this paper, I evaluate existing explanations for these two types of home bias.

Karen K. Lewis
Department of Finance, 2300 SH-DH
Wharton School
University of Pennsylvania
Philadelphia, PA 19104-6367
and NBER
lewisk@wharton.upenn.edu

Do individuals hold the optimal portfolio? Do they do a good job of hedging risks? Since the answer to these questions are clearly very important for understanding how the economy behaves, economists have been interested in these questions for a long time. If individuals indeed hedge risk optimally, then resources are allocated to their most efficient uses. If not, however, many other questions arise. Why not? What is the explanation for these inefficiencies? And what do these explanations say about how the economy behaves?[1]

For some time, international economists have believed they know the answer to a subset of these questions: do individuals do a good job of hedging risks *across countries?* Here the answer appears to be "no." This answer has come from both financial and macroeconomic models. At least since the 1970s, financial economists have noted that the proportion of foreign assets as a proportion of wealth held by domestic investors is too small relative to the predictions of standard portfolio theory.[2] More recently, macroeconomic models based upon complete markets that assume agents can trade Arrow-Debreu claims on international assets have implied that the marginal rate of substitution in consumption should be equalized across countries. Under the auxiliary assumption of isoelastic utility, these models imply that consumption growth rates should be equal across countries, an implication dramatically rejected in the data.[3] The link between these two empirical observations appears consistent: if individuals hold too little claims on foreign assets, then they will not optimally share risk and marginal rates of substitution will not be equalized.[4]

The observation that individuals hold too little of their wealth in foreign assets has been called "home bias." This phenomenon may also be related to the observation that consumption

---

[1]Some of this discussion is at the heart of the current asset pricing puzzles such as the equity premium puzzle. For a recent survey of the domestic equity premium puzzle, see Kocherlakota (1996).

[2]See, for example, Levy and Sarnat (1970).

[3]See Leme (1984), Scheinkman (1984), and Backus, Kehoe, and Kydland (1992).

[4]As I describe below, this link is neither necessary nor sufficient. If individuals can borrow and lend internationally, risk-sharing in consumption can be largely duplicated through consumption smoothing behavior even in the presence of no international trade in equities.

growth rates do not move together across countries as much as international risk-sharing would suggest. Below, I collectively call this lack of risk-sharing, "home bias" but also distinguish "equity home bias" in the finance literature from "consumption home bias" in the macroeconomics literature. The purpose of this essay is to examine and integrate these two literatures to provide a more complete perspective of the home bias phenomenon.

To understand the nature of the "equity home bias" as noted in finance models, consider Figure 1. This figure plots the mean returns and standard deviations for an artificial mutual fund of the U.S. stock market as measured by the S&P 500 and a non-US international fund measured in dollars called the "Europe, Australia and Far East" or EAFE fund.[5] This index is often used as a non-US world stock market index, a convention that I follow below. Moving from the southwest to the northeast, the line plots the mean returns and standard deviations from holding an increasing proportion of foreign stocks. This is a simplified version of the so-called "efficient frontier" which solves for the portfolio with the minimum standard deviation for a given return and therefore does 'not constrain the foreign stock composition. Nevertheless, the basic conclusions are similar to those with an "efficient frontier." In particular, the mean of the S&P 500 is lower than a portfolio such as point C with the same standard deviation where some foreign stocks are held. Thus, if investors prefer higher returns to lower returns, point C is clearly preferable to 100% US stocks. In fact, as long as investors like higher returns and lower variance, the minimum variance portfolio at B must be preferable to the US portfolio alone.

Explicit utility functions pick out the optimal points along the frontier. With indifference curve U_0, the individual will optimally choose point O. With relatively low risk aversion as implied by this utility function, this portfolio will imply an even higher proportion of foreign stocks than point C. Indeed, all points above point B are superior to the S&P 500 as noted above. Nevertheless, recent estimates put the share of US holdings of foreign equities at about 8%, which

---

[5]This index is a monthly dollar index including reinvested dividends from Morgan Stanley. This series as well as the other country indexes described below were kindly provided by Richard Marston.

would imply point A.[6] Clearly, this point is suboptimal with any set of preferences. Stated in this way, equity home bias is the phenomenon that domestic investors' foreign equity holdings are at a point such as A instead of somewhare above point B.

"Consumption home bias" concerns the lack of risk sharing observed in consumption co-movements across countries. To understand the basic intuition, consider a simple example where production is exogenously given in each country. If individuals in each country share risk from their country-specific production processes, then they hold securities that pay out claims against eachother's production processes. In a complete markets world economy, these claims represent Arrow-Debreu securities that encompass all states of the possible production outcomes. Thus, in equilibrium, individuals in different countries equalize their marginal utilities in each state of production outcomes. Furthermore, if utility is of the power form (e.g., CRRA), then this risk-sharing further implies that consumption growth rates are equalized across countries and production states.

Panel A of Table 1 shows the correlations between consumption growth and output growth for each of the Group of Seven (G-7) countries using data from the Penn World Tables.[7] The upper right half of the matrix reports the correlations of consumption growth. The matrix also shows the same correlations for output growth rates in the lower right half. As this table shows, consumption correlations are low, typically less than 0.5. On the other hand, output correlations are generally higher. Backus, Kehoe, and Kydland (1992) noted this pattern of correlation and pointed out its counter-intuitive implications. If countries experience different output shocks, then output may potentially have low correlations across countries. However, risk-sharing implies that individuals in different countries would diversify this risk by purchasing claims on other countries' output streams. In this case, consumption growth rates would have a high correlation even when

---

[6]This estimate is from Bohn and Tesar (1996) and is based upon aggregate US equity flows cumulated over time. French and Poterba (1991) give similar estimates of foreign equity holdings.

[7]The Group of Seven countries are: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. The Penn World Tables data are described in Summers and Heston (1991).

output growth rates do not. Clearly, the evidence in Table 1 shows the opposite pattern. Consumption growth rates have a lower correlation than output. This pattern is difficult to reconcile with risk-sharing stories.

Panel B of Table 1 shows an alternative way to view this phenomenon. Aggregate world consumption and output growth rates are subtracted from their individual country consumption and output counterparts to obtain idiosyncratic, country-specific consumption and output growth. These idiosyncratic consumption growth rates, Δc_t^i for country i at time t, are regressed on idiosyncratic output growth rates, Δy_t^i for country i at time t:

$$\Delta c_t^i = b_1 \Delta y_t^i + e_t^i.$$

Under perfect risk-sharing, idiosyncratic consumption growth will be uncorrelated with the idiosyncratic output growth. Therefore, risk-sharing implies that $b_1 = 0$.

Panel B of Table 1 shows the results of these regressions for the Group of Seven countries. As the numbers show, the hypothesis is strongly rejected. Idiosyncratic consumption appears to move quite closely with idiosyncratic output in a country. Estimates of b_1 range from 0.645 for the U.S. to 1.024 for the U.K. The table also shows an aggregate estimate for 72 countries from the Penn World Tables.[8] This coefficient estimate is also clearly significantly different than zero. I call this sensitivity of consumption-in-excess-of-world-consumption to output-in-excess-of-world-output the "consumption home bias."

In this essay, I examine explanations for the equity home bias and the consumption home bias. With some exceptions, these explanations tend to span two different literatures; the first in financial economics, the second in macroeconomics. Below, I first examine the finance literature. I then discuss the macroeconomics literature. Finally, I provide a synthesis of the two.

I. Home Bias Observed in International Equity Markets

The home bias in international capital markets was first noted in the finance literature. In

---

[8]Following recent empirical work on risk-sharing, I chose those countries with data quality rated C- and better. See, for example, Obstfeld (1994b) and Tesar (1995).

this literature, stock returns are treated as exogenous. In keeping with this tradition, I will maintain this assumption in my discussion of the equity home bias.

More recently, the equity home bias has also be viewed as an outcome in general equilibrium models grounded in the macroeconomic literature. This type of home bias is closely linked to the consumption home bias literature that I discuss in part II of this essay. For this reason, I discuss the equity home bias arising from general equilibrium models in part II.

Also, I focus here upon equity markets and do not discuss international bond markets. This focus is maintained only for expositional simplicity. Much of the early literature on home bias noted the tendency for domestic residents to hold too small a proportion of foreign stocks *and* bonds.[9] The gains to holding foreign assets increase once domestic investors are allowed to hold foreign bonds as well as stocks. Thus, by focusing upon stocks alone, I am minimizing the importance of home bias. Allowing for bonds only deepens the puzzle.[10] Nevertheless, I will show that it is difficult to explain home bias on the basis of equity markets alone.

Below, I use a simple mean-variance model to explain the equity home bias puzzle. To understand the relationship between these means and variances in international markets, Panel A of Table 2 provides summary information about some of these variables. These returns are for market indexes of the Group of Seven countries and the non-US index EAFE from Morgan Stanley over the period January 1970 to December 1996. The US index and the EAFE index are the same series used to construct Figure 1. Dividends are reinvested to obtain the local stock market index and, thus, the local returns include dividends and capital gains (or losses). The index is also converted into dollars so that the dollar returns contain both local stocks market and currency gains or losses.

The top row of Panel A gives the mean returns in percent per annum over the sample period. These means range from 5.81% for Italy to 14.03% for Japan. The row also gives the mean

---

[9]See, for instance, Solnik (1974b).

[10]Ignoring bond markets can be important when they can provide alternative means of smoothing consumption. I address this issue in Part II.

return for the "Europe, Australia and Far East" EAFE index or EAFE.

The next row provides the standard deviations of these annualized returns. The standard deviation for the US market, given by the S&P 500, is the lowest. The lower standard deviation for the US comes from the fact that the returns on foreign stocks have two components of risk: the variability of the stock market in the respective country and the variability of the exchange rate of the US dollar againt the foreign currency.

Panel A next reports the correlation matrix of all seven countries and the EAFE. As this evidence suggests, the correlations between home and foreign equity are all less than one, and often less than 0.5. The correlation between the US market and the EAFE is only 0.48. This low correlation is the source of much of the gains to international diversification.

In this part of the essay, I begin by describing the standard equity home bias puzzle using a simple two country example. For this purpose, I treat the US market as the domestic asset and the EAFE as the foreign asset. The variance-covariance matrix for "home" US and "foreign" EAFE are given in row 4 in Panel A of Table 2.

Following the simple home bias description, I examine various explanations. I summarize and synthesize these findings before addressing the consumption home bias puzzle in the next section.

A. The Bias Implied by a Standard CAPM Model

The basic model derives from the standard mean-variance framework in the tradition of Sharpe (1964) and Lintner (1965), modified to include foreign securities.[11] Suppose domestic investors have access to two risky assets, a domestic equity and a foreign equity. The domestic investor chooses the proportion of his wealth portfolio that he holds in foreign equity, χ^f (and therefore also the proportion that he holds in domestic equity, $1-\chi^f$.) His objective function is given by:

$$V = V(E_t W_{t+1}, \mathrm{Var}_t(W_{t+1})) \qquad \text{where } V_1 > 0, \text{ and } V_2 < 0. \qquad (1)$$

[11]The following model may be viewed as a simplified version of the international capital asset pricing models under purchasing power parity such as in Solnik (1974a), Stulz (1981b), and Adler and Dumas (1983).

where W_t is real wealth at time t, $E_t(\cdot)$ is the expectations operator conditional upon information known at time t, and $Var_t(\cdot)$ is the conditional variance-covariance matrix operator. Thus, the investor's objective function is increasing in the mean of wealth but decreasing in its variability. So this investor will maximize (1) with respect to the vector of portfolio shares, $\underline{\chi}_t \equiv (\chi^h, \chi^f)'$ where $\chi^h + \chi^f = 1$. Then if the return vector is defined as $\underline{r}_t \equiv (r^h_t, r^f_t)'$, the mean and variance of wealth can be written as:[12]

$$E_t W_{t+1} = W_t (1 + \underline{\chi}_t' E_t \underline{r}_{t+1}) \qquad (2)$$

$$Var_t(W_{t+1}) = W_t^2 \, Var_t(\underline{\chi}_t' \underline{r}_{t+1}) = W_t^2 \, \underline{\chi}_t' \, Var_t(\underline{r}_{t+1}) \, \underline{\chi}_t.$$

Substituting $E_t W_{t+1}$ and $Var_t W_{t+1}$ into (1) and maximizing the resulting expression with respect to $\underline{\chi}_t$, implies the first-order condition:

$$E_t \underline{r}'_{t+1} = \gamma \, \underline{\chi}_t' \, Var_t(\underline{r}_{t+1}) \qquad (3)$$

where γ is the parameter of relative risk aversion.[13] Note that the portfolio variance, $\underline{\chi}_t' Var_t(\underline{r}_{t+1})$, has a non-linear relationship with mean-returns as portfolio shares, χ^i_t, vary. This non-linearity comes from the lack of perfect correlation between home and foreign equity returns noted in Table 2, Panel A.

The first-order condition provides the solution for the optimal portfolio along the risk-return trade-off given in Figure 1. In particular, solving equation (3) in terms of the portfolio shares, χ^i, provides the tangency between indifference curves and the risk-return trade-off.

$$\underline{\chi}_t' = \gamma^{-1} E_t \underline{r}_{t+1}' \, Var_t(\underline{r}_{t+1})^{-1} \qquad (4)$$

Table 2, Panel B shows the optimal portfolio shares based upon US and foreign (EAFE) returns. The table reports these calculations under various assumptions about risk aversion. As

---

[12]As the following analysis makes clear, returns r^i are measured in real terms. This definition is inconsistent with using nominal dollar returns as in Figure 1 and Table 2. However, as I discuss in Section I.B.2 below, inflation risk is small relative to equity and currency risk, and cannot account for home bias. Therefore, I ignore this distinction for the sake of simplicity. However, I emphasize the distinction where important below.

[13]For general utility function U(W), this measure of relative risk aversion is approximately the Arrow-Pratt measure: - U"W/U'. Taking a Taylor-series expansion of E(U(W)) and differentiating with respect to E(W) and Var(W) shows that $\gamma \approx$ - U"W/U'. This parameter will be constant only for small changes of W or for certain utility functions.

these numbers illustrate, the optimal shares of foreign assets are all fairly close to 39%. For low risk aversion, the investor would choose 39.75%. As risk aversion increases, the foreign share increases slowly to 39.45%, the minimum variance point as given in Figure 1. These optimal allocations are concentrated around the minimum variance point because investors are facing highly variable returns while the difference in expected returns between the US and the foreign portfolio are only about 1%. I will return below to the potential investor preference of reducing risk over increasing returns as motivations for diversifying into foreign equity.

While the optimal portfolio share is about 40% foreign, the observed foreign portfolio shares as reported in Bohn and Tesar (1996) is only 8%. Clearly, no degree of risk intolerance can justify such a low level of foreign portfolio allocation. Thus, these numbers suggest the strong presence of home bias.

B. Segmented vs Integrated Markets: Examining the Pricing Relationships

This framework presumes international capital markets are integrated so that domestic investors can hold foreign equities. Various studies have focused upon the question of whether these markets are not integrated, but are instead segmented.

1. Models Assuming Integration in Capital Markets and Goods Markets

One approach to examining this question empirically has been to test whether international equity returns are consistent with an international capital-asset pricing model as presumed in the analysis above. This model follows when the optimal portfolio shares hold in equilibrium. The international capital-asset pricing model determines the relationship between individual equity returns and the returns on the market portfolio. In the international context, the market portfolio returns, r_t^M, are given by the equilibrium holdings of portfolio shares times their respective returns:

$$E_t r^M_{t+1} \equiv \chi_t' \, E_t \underline{r}_{t+1} = \gamma \, \chi_t' \, Var_t(\underline{r}_{t+1}) \, \chi_t = \gamma \, Var_t(r^M_{t+1}). \qquad (5)$$

Taking the individual solution for home equity returns from (3), we have:

$$E_t r^h_{t+1} = \gamma \, \chi_t' \, Var_t(\underline{r}_{t+1}) = \gamma \, Cov_t(r^h_{t+1}, r^M_{t+1}). \qquad (3')$$

Taking the ratio of (3') to (5) and rearranging gives:

$$E_t r^h_{t+1} = \{Cov_t(r^h_{t+1}, r^M_{t+1})/Var_t(r^M_{t+1})\}\ E_t r^M_{t+1} \qquad (6)$$
$$= \beta^h\ E_t r^M_{t+1}$$

where $\beta^h = Cov_t(r^h_{t+1}, r^M_{t+1})/Var_t(r^M_{t+1})$. Many tests of the international capital asset pricing model have examined whether domestic returns depend upon a world market portfolio according to their "betas."

Note that this international CAPM treats the returns as the same whether viewed by domestic or foreign investors. Indeed, this assumption was behind the simple framework developed in Section A. Implicitly, for real returns to be equal across countries regardless of where the residents live, purchasing power parity must hold. That is, the price of goods once converted into the same currency must be the same. As we will see below, modifications of this assumption imply that returns need not depend upon a single beta with respect to the world market portfolio.

1.a Some Empirical Tests of the Model Based Upon a World Market Portfolio

The international CAPM described above imbeds the assumption that capital and good markets are integrated. To see why, note that individual investors are assumed to have the same portfolio demand for home and foreign assets, χ_t^h and χ_t^f. Therefore, domestic and foreign investors see real returns in the same way. For this assumption to be true, returns must have the same purchasing power in each country. Thus, not only must nominal returns be equalized, but goods markets must be equalized as well through purchasing power parity.

How good at explaining returnsis this international CAPM? A relatively long literature has examined this question reasoning that if the international CAPM can explain equity returns then this evidence would provide indirect evidence of international market integration.

Early empirical research on the international CAPM such as Solnik (1974b) and Stehle (1977) looked at the relationship in (6) based upon unconditional returns, finding mixed results. These studies tested for the pricing relationship between local returns and international returns rather than using measures of asset shares.

Engel (1993), Engel and Rodriguez (1993), and Thomas and Wickens (1993) use asset share data to estimate models similar to (6), but impose the constraint that the portfolio shares, χ, equal

the total outstanding supplies. These studies reject the over-identifying restrictions of the model. However, Engel (1993) finds that the model helps explain excess returns.

Other studies have used the international CAPM as a benchmark to examine the risk relationships between equity returns in different countries. Harvey (1991) considers whether the behavior of equity returns for seventeen markets can be explained according to their covariance with the world equity return as in equation (6) where the world return is used as the market return. He finds that for most countries except Japan the model appears to explain country returns relatively well.

1.b Latent Variable Tests without Imposing a World Portfolio

The tests described above assume that the return on the world market portfolio, r^M, can be observed. In a famous criticism of the CAPM, Roll (1977) argues that the market portfolio cannot be observed since in principle this portfolio should include all of wealth, not just equity wealth. In response to this criticism, Gibbons and Ferson (1985) develop a latent variable test that treats the market portfolio as an unobserved latent variable.

To see how this relationship holds, note that if equation (6) holds for any return, r^i, then substitituting out r^M and taking the ratio of any return, r^i, over a benchmark return r^b implies:

$$E_t r^i_{t+1} = (\beta^i/\beta^b)\, E_t r^b_{t+1}. \qquad (7)$$

Thus, the model predicts that returns should move together in proportion to their betas. This so-called "single beta" model is typically tested by assuming that $E_t r^b_{t+1}$ is a linear function of some information variables.

Ferson and Harvey (1993) examine the predictability of a single beta asset pricing model for equity returns in eighteen countries also assuming no exchange rate risk. As described above, their model measures the world portfolio indirectly as a linear combination of international risk factors. As in Harvey (1991), they find that the model has explanatory power for returns. However, they also find that these returns are better explained by multiple beta models that incorporate factors intended to capture exchange rate and other local sources of risk. Despite these other risk sources, the greatest source of risk priced in their model appears to be a global equity market risk

component.

Campbell and Hamao (1992) test single factor latent variable restrictions across the US and Japan and find that they are rejected, although domestic equity returns and interest rates appear to be important predictors for foreign equity returns. They find that the US and Japanese stocks helped forecast eachother. They reject a single latent variable model for the 1970s, but not the 1980s. They interpret their findings as evidence for market integration.

Cumby (1990) tests for a single latent variable among stock returns across a set of countries and finds that the restrictions were rejected.[14] Other studies have tested the relationship using both foreign exchange returns and stock returns, generally rejecting the restrictions.[15]

1c. Summary and Segway

Overall, the evidence for the international CAPM assuming integrated markets appears to be mixed at best. Tests of the international CAPM based upon asset share data tend to reject the model. Tests based upon relationships among returns tend to be more mixed, but generally find little support for a single beta model. The most positive evidence can be found in terms of explanatory power. Returns often have explanatory power for predicting other returns. However, it could be argued that this behavior is explained by reasons having nothing necessarily to do with the international CAPM.[16]

On the other hand, there is an important underlying assumption behind this model. The model assumes that real returns are perceived the same by all investors regardless of their country of residence. Investors will choose different portfolios once this restriction is relaxed since these

---

[14]He uses consumption data to help identify the betas. I will return to this approach in Part II on Consumption Home Bias below.

[15]See, for example, Bekaert and Hodrick (1992), Giovannini and Jorion (1987a) and Lewis (1988).

[16]For example, King and Wadhwani (1990) find international transmission effects between equity markets following the October 1987 crash and argue that these effects result from traders with imperfect information rationally trying to learn the true equity values. For evidence of co-movements between stock markets of different countries without reference to a pricing model, see also Eun and Shim (1989).

investors will try to hedge their respective inflation risks. In contrast to the single beta model described above, this inflation hedge demand can give rise to multiple beta models. I describe this issue next.

2. Models Assuming Integration in Capital Markets but Not Goods Markets

An important departure from the assumption that all investors perceive the same real returns is to allow goods prices to differ across countries. Although complete goods market arbitrage implies that these prices should be equalized according to purchasing power parity, a large empirical literature has decisively rejected the hypothesis of purchasing power parity except perhaps in the very long run.[17]

Allowing for deviations from purchasing power parity introduces a demand for international securities to hedge domestic inflation risk. This hedge demand differs across countries and breaks the link across equity returns that implies the single beta model described above. One implication of this model is that returns will follow multiple beta models, consistent with some of the empirical findings in the literature noted above.

2a. The Effects of Purchasing Power Parity Deviations on Returns

I will illustrate the basic effects of deviations from purchasing power parity on the international CAPM by modifying the simple two-country model found in equation (4). Instead of assuming that these returns are the same across the home and foreign investors, I now distinguish equation (4) as the solution to the optimal portfolio for the domestic investor only.

Imposing the constraint that the optimal shares of domestic and foreign equities sum to one, the domestic investor's optimal portfolio share of foreign stocks is given by:

$$\chi_t^f = \frac{(E_t r_{t+1}^f - E_t r_{t+1}^h)/\rho}{(\sigma_h^2 - 2\,\sigma_{hf} + \sigma_f^2)} + \frac{(\sigma_h^2 - \sigma_{hf})}{(\sigma_h^2 - 2\,\sigma_{hf} + \sigma_f^2)} \qquad (8)$$

where σ_h^2 and σ_f^2 are the variances of the domestic and foreign real stock returns to the domestic investor, respectively. The covariance between these returns is given by σ_{hf}.

---

[17]For a recent survey, see Froot and Rogoff (1995).

As described by Adler and Dumas (1983), there is a straightforward interpretation of this demand function. The first term on the right-hand side represents the demand arising from higher potential returns from the foreign stock. The lower is risk aversion, the lower is ρ, and hence the greater the response of demand to higher expected returns. On the other hand, as ρ increases, the importance of relative returns across countries declines. In the limiting case when ρ equals infinity and investors are infinitely risk averse, this first term disappears and the demand for foreign equities reduces to the second term.

This second term is the portfolio share that minimizes the variance of the wealth portfolio. Thus, in general, the demand for foreign stocks depends upon a combination of the risky portfolio share given by the first term and the minimum variance portfolio given by the second term.

Consider now the demand for foreign stocks by residents in the foreign country. The portfolio optimization will follow the same steps as the domestic resident, except that foreigners will view real returns in units of their own domestic price level. I will define r^{*h}_t and r^{*f}_t as the real returns to the foreigners of the home equity and foreign equity, respectively. Then these returns have the following (approximate) relationship with the domestic returns: $r^{*i}_t = r^i_t + \pi_t - \pi^*_t - \Delta s_t$, where π and π^* are the inflation rates in the home and foreign countries, respectively, and where Δs_t is the first-difference of the logarithm of the price of foreign currency in terms of domestic currency.[18] Notice that under purchasing power parity, $\pi_t - \pi^*_t - \Delta s_t = 0$, so that the distinction between domestic and foreign real returns is unnecessary, a point I have emphasized above.

Defining the foreigner's portfolio share of foreign equity as χ^* and the deviation from purchasing power parity as $\epsilon_t \equiv \pi_t - \pi^*_t - \Delta s_t$, the analogue of equation (8) to the foreign investor is:

---

[18]If R is the nominal return in local currency returns, then $r^h_t = R^h_t - \pi_t$ and $r^{*h}_t = R^h_t - \Delta s_t - \pi^*_t$. Similarly, $r^f_t = R^f_t + \Delta s_t - \pi_t$ and $r^{*f}_t = R^f_t - \pi^*_t$. Thus, $r^i_t = r^{*i}_t + \pi_t - \pi^*_t - \Delta s_t$.

$$\chi_t^{*f} = \frac{(E_t r_{t+1}^{f} - E_t r_{t+1}^{h})/\rho}{(\sigma_h^2 - 2\,\sigma_{hf} + \sigma_f^2)} + \frac{(\sigma_h^2 - \sigma_{hf})}{(\sigma_h^2 - 2\,\sigma_{hf} + \sigma_f^2)} - \frac{\mathrm{Cov}(\epsilon_{t+1},\, r_{t+1}^{f} - r_{t+1}^{h})}{(\sigma_h^2 - 2\,\sigma_{hf} + \sigma_f^2)} \qquad (9)$$

The first two components represent the same portfolio demands as for the the domestic investor. These components are, respectively, the speculative portfolio and the hedge portfolio components. However, foreigner demand for foreign equity also includes a third component that depends upon the covariance between the deviation from purchasing power parity, ϵ, and the excess return of the foreign relative to the domestic return. This last term represents the demand to hold the equity combination that hedges purchasing power parity deviations. Positive innovations to ϵ holding constant returns to home residents, r^i, will increase returns to foreigners. To hedge against this risk, foreign investors will move their portfolio away from foreign equities if the covariance between ϵ and home excess returns is positive. Therefore, this component enters into the demand equation with a negative sign. The sum of the last two components represents the minimum variance portfolio from the point of view of the foreign investor.

Equating the total demand for the foreign stocks with the total supply for foreign stocks determines the equilibrium relationship among stock returns. Defining ω_t and ω_t^* as the shares of domestic and foreign wealth in the total world wealth, respectively, the market clearing condition is given by: $\omega_t\, \chi_t^{f} + \omega_t^{*}\, \chi_t^{*f} = 1$. Substituting equations (8) and (9) into this identity and solving for returns implies:

$$E_t r_{t+1}^{f} - E_t r_{t+1}^{h} = \rho\, \omega_t^{*}\, \mathrm{Cov}_t(\epsilon_{t+1},\, r_{t+1}^{f} - r_{t+1}^{h}) - \rho\, (\sigma_h^2 - \sigma_{hf}). \qquad (10)$$

Thus, international returns depend upon the foreign inflation hedge portfolio weighted by the foreign share in world wealth. Adler and Dumas (1983) show how this result generalizes when there are multiple countries. In this case, world equity returns depend upon a matrix of exchange rate changes weighted by a vector of country shares in world wealth.

2b. Implications for Empirical Results

When returns depend upon country-specific inflation hedge portfolios, it is clear that the simple single beta model described in equation (6) no longer holds. Rather, returns may be driven by risk-factors that are specific to individual countries. Indirect evidence for this type of model can be found by the typical finding that single beta models of international stock returns are typically rejected in favor of two or three factor models.

A further implication for this model is that exchange rate risk is likely to be important for explaining returns. Dumas and Solnik (1993) estimate a conditional version of the model using returns in both equities and deposits allowing for time-varying covariances.[19] They find that the hypothesis of zero price on exchange rate risk is rejected, so that exchange rate variability appears to have explanatory power for equity returns. They also find that a version of the international CAPM is not rejected by the data.

Using data on actual portfolio holdings, Cooper and Kaplanis (1991) test for the importance of the inflation hedge portfolios. They calculate the potential home bias conditional on the hedge portfolios. They then test whether this hedge portfolio is significantly different than observed portfolio shares. They find, however, that the home bias predicted by inflation hedge portfolios is small and close to zero. They strongly reject the hypothesis that these portfolios can explain the home bias puzzle.

3. What Do Tests Conditional on International Equity Market Integration Say About Home Bias?

Overall, the evidence for the international CAPM has been mixed. The over-identifying restrictions of most versions of this model are rejected. On the other hand, returns often have significant explanatory power for other returns. Moreover, multiple factor models have had more

---

[19]They use the method described in Harvey (1991). This framework assumes that conditional variances are a linear function of a set of information variables.

success than the single factor models, particularly when the estimation accounts for exchange rate risk. What the evidence says precisely about the CAPM is not clear, however.

What this evidence says about equity home bias is even less clear. While the empirical studies can oftentimes be interpreted as evidence against market integration, this evidence does not directly bear on the question of why there is home bias. Unless the reason why markets are segmented or integrated can be found, this literature does not provide an answer to this question. For example, many of the empirical models depend upon specifying a world market portfolio. Construction of the market portfolio assumes that the representative investor holds his predicted share of this market portfolio. If individuals are not holding portfolio shares as implied by the model, there is no reason to presume that asset returns will also conform to the model without knowing why markets are not integrated.

C. Other Avenues for Diversification

One set of explanations for the home bias puzzle maintains that domestic investors have alternative methods for diversification that provide the same benefits as holding foreign stocks. According to this line of reasoning, other assets may provide the diversification potential without requiring domestic investors to look abroad for securites with the requisite attributes. Others maintain that the lack of marketable trade in certain parts of wealth can affect the importance of diversification possibilities. I describe some of these arguements here.

1. The International Diversification Potential of Domestic Stocks

A common lay explanation for the home bias puzzle is that US investors don't need to hold foreign stocks to gain the foreign diversification potential in their portfolio. After all, it is reasoned, the US has many large multinational firms. These firms have foreign operations and, thereby, provide the equity holder with returns that depend upon foreign economies.

While this arguement seems plausible, it does not hold up empirically. This point was shown

by Jacquillat and Solnik (1978). These authors examine the betas of multinationals on domestic stock market indices. While there is some variation, the evidence generally suggests that multinationals have betas with respect to their national market indexes that are close to one. Therefore, the multinationals provide little better diversification than the domestic market.

This basic conclusion was maintained with more recent data by Solnik and de Freitas (1988). These authors examined the components of stock returns internationally and found national effects to be one of the most important factors of risk.

When viewed in light of the evidence described earlier, this result is perhaps not surprising. Many multinational firms are part of the domestic stock market index. Therefore, the low correlation between these indexes and foreign stocks must arise from the importance of foreign stocks themselves, not multinational stocks that are correlated with the domestic index. The international diversification gains require holdings of foreign assets that are not a part of the domestic index.

Heston and Rowenhoerst (forthcoming) provide complementary evidence. They use factor analysis from arbitrage-pricing theory to examine the sources of risk in a large data set of individual stocks across different countries. They find that the country effect is the most important factor explaining the source of risk in the stocks, similar to the results from Solnik and de Freitas (1988). They find that this source of risk is greater than plausible alternatives such as industry effects.[20] Their evidence suggests that truly diversified portfolios require holding stocks from different countries.

2. *The Effects of Non-Marketable Wealth on International Diversification*

Implicit in the capital asset pricing model is the assumption that wealth can be measured, as noted earlier. In a well-known criticism of this assumption Roll (1977) argues that much of

---

[20]Their study was response to Roll (1992) who argued the opposite was true.

wealth is not marketable and hence measures of the market portfolio must necessarily be mismeasured.

Baxter and Jermann (1997) note that ignoring non-marketable wealth can have important implications for the standard home bias intuition. In particular, human capital is a significant fraction of wealth and is not included as part of the domestic market. Under a variety of assumptions about human capital measurement, Baxter and Jermann (1997) show that domestic human capital returns are highly correlated with the domestic stock market returns but negatively correlated with foreign stock returns. Since human capital is non-marketable, the observation implies that domestic investors should not only hold the foreign stock, they should short the domestic portfolio to put more of their wealth into the foreign stock. Therefore, the home bias puzzle is even worse than the standard puzzle posed above.

In sum, avenues of diversification other than foreign stocks do not appear to explain the puzzle and may even worsen it.

D. The Gains from Diversification

An alternative explanation for the equity home bias puzzle is that the gains from diversifying are insufficient to warrant the costs involved with diversifying the portfolio.[21] The apparently large gains from international diversification were noted at least as early as Levy and Sarnat (1970). These potential gains have been explored an a relatively large international finance literature including more recently Grauer and Hakansson (1987).

To understand the source of these gains, consider Figure 1 again. In moving from the position corresponding to 100% domestic stocks to the portfolio shares corresponding to point C, the investor will gain an expected 80 basis points per year without sacrificing higher variance.

---

[21]This point was articulated by Cole and Obstfeld (1991) in a general equilibrium model calibrated to consumption data. The paper will be discussed in more detail below in part II.

Alternatively, by moving from 100% US stocks to point B, the domestic investor will reduce the standard deviation of his portfolio by about 5 percentage points and increase his expected return by 50 basis points. Clearly, all portfolio shares represented by points C to 100% foreign stocks correspond to gains in terms of higher expected returns. From B to C, these gains arise from lower variability as well.

The decision of what foreign portfolio share the domestic investor should choose depends upon his utility function.[22] Solving for this optimal allocation with different values of relative risk aversion, Lewis (1996b) finds that the gains vary from 20% to near 100% of lifetime (permanent) consumption. Therefore, the costs of holding foreign stocks must be extremely large to dissuade an efficient domestic investor from foreign diversification.

If true, the magnitude of these gains clearly refute the arguement that the gains are not worth the costs of foreign investing. This reasoning leads to the next potential explanation for equity home bias.

E. The Costs of Foreign Investment

An alternative way to look at the diversification problem is to assess the costs, rather than the gains. Papers such as Black (1974) and Stulz (1981b) consider the effects of international governmental taxes and other barriers to trade upon equity holdings.

To understand how taxes or costs can affect foreign holdings, consider the optimal holdings of foreign holdings as implied by equation (8). Suppose now that taxes or costs on foreign holdings can be represented by a proportional fee, τ, per period on the holdings of foreign equities. Clearly, this characterization represents an over-simplification of all possible taxes or costs, but it

---

[22]An alternative approach is to examine the portfolio combination where the risk-free rate line is tangent to the portfolio opportunity set in Figure 1. This approach give the so-called "tangency portfolio." Since I am focusing upon equities and not bonds, I do not directly address the tangency portfolio in this survey. However, some empirical estimates of the extent of equity home bias use the tangency portfolio, a point I discuss below.

conveniently demonstrates the effects of taxes. In this case, the expected returns on the foreign equity are $E_t r^f_{t+1} - \tau$, so that equation (8) can be rewritten:

$$\chi_t^f = \frac{(E_t r_{t+1}^f - \tau - E_t r_{t+1}^h)/\rho}{(\sigma_h^2 - 2\,\sigma_{hf} + \sigma_f^2)} + \frac{(\sigma_h^2 - \sigma_{hf})}{(\sigma_h^2 - 2\,\sigma_{hf} + \sigma_f^2)} \qquad (11)$$

Clearly, as the costs or taxes increase as measured by τ, the domestic holdings of foreign stocks decrease.

General recognition that international capital market restrictions exist has led to studies concerning the theoretical effects and empirical evidence of segmented markets. Stulz (1981b) analyzes the effects of taxes on gross holdings of foreign assets, finding that some foreign assets will not be held by domestic residents in equilibrium.[23] Errunza and Losq (1985) develop and test a restricted version of the Stulz (1981b) model in which domestic investors cannot hold foreign equities but foreign investors can hold both domestic and foreign equities. They apply this model to U.S. (domestic) relative to developing country (foreign) markets and find that parameter restrictions implied by the hypothesis of mild segmentation caused by the taxes are not rejected. Errunza and Losq (1989) theoretically consider the effects of capital flow restrictions on the holdings of equity positions and their welfare implications.

Since market segmentation induced by governmental taxes and restrictions seems most likely to exist between the developed countries and developing or so-called "emerging markets," recent research has examined the behavior of equities in the emerging markets. Bonser-Neal, Brauer, Neal, and Wheatley (1990) analyze the effects of government liberalizations on the pricing of "country funds," mutual funds comprised of the assets in specific countries. For five developing countries with foreign investment restrictions, they consider the ratios between the price of the

---

[23]Black (1974) examines the effects of proportional taxes on net holdings of risky foreign assets. In this model, sufficiently high barriers to investment induce large short holdings of foreign assets but not an equilibrium in which foreign assets are not held at all by domestic residents.

funds in the international market relative to the net asset values (NAVs) of their underlying component equities within the country. Bonser-Neal, et al find that the price-NAV ratios fall significantly either in anticipation or following liberalizations of investment restrictions. They interpret this evidence as demonstrating that government-imposed barriers have been effective in segmenting international capital markets. Hardouvelis, La Porta, and Wizman (1993) also find that cross-border investment restrictions are significant in explaining the difference between prices and NAVs of country funds.

Harvey (1993) provides a broad empirical examination of returns in twenty emerging markets. He finds that standard international asset pricing models based upon integrated capital markets fail to explain the returns and predictability of country returns, concluding that models based upon market segmentation seem more likely to explain these returns. However, he does not directly relate this market segmentation to governmental restrictions. On the other hand, Claessens and Rhee (1993) investigate the stock performance in emerging markets in relation to their accessibility by foreign investors, finding that they reject market integration.

Taken together, the evidence suggests that government restrictions can be important for explaining why the portfolios of domestic residents in developing, relatively unrestricted countries may be biased away from holdings of equities in emerging markets. On the other hand, this arguement is more difficult to make for the developed countries that do not face these restrictions. As we have seen, the US demonstrates a strong "home bias" in equity holdings with developed countries yet it does not impose significant restrictions of capital account movements.

Additional evidence of this implausibility is provided in Tesar and Werner (1992). They calculate the turnover rate on foreign equity held by domestic residents as well as the turnover rate on domestic equity held by foreign residents. Table 3 reports their results together with the total turnover. While the total turnover rate averages less than one, the turnover rates for international

equity flows is *higher*. Therefore, the flows of capital on international equity transactions tend to be higher than those on domestic flows. Significant restrictions on international transactions would suggest the opposite pattern. Although this evidence does not provide any standard errors and therefore should be interpreted with caution, it suggests that international equity transactions are not significantly impeded among these countries.

Costs of foreign equity holdings are in general difficult to assess since investors differ in terms of their relevant costs. For some investors with knowledge and access to the stock market, total costs may be small and include only minimal brokerage fees. On the other hand, other investors may perceive the costs of foreign equity investment to include significant information costs of understanding foreign markets.

Whatever the relevant costs are, it seems likely that these costs have been declining over time. As noted in the literature above, many emerging market governments have reduced taxes and other restrictions on foreign investment. Indeed, a general liberalization in capital market restrictions has reduced the taxes to foreign investments for residents in most industrialized countries as well. Furthermore, increased competition in the mutual fund industry has reduced the cost to domestic residents of investing in foreign and international mutual funds. As a result, the costs captured by τ in equation (11) are generally perceived to be declining over time and, at any rate, it is difficult to argue that they exceed the potential benefits of 20% to 100% of lifetime consumption.

F. Uncertainty in Portfolio Performance

The gains from international diversification have typically been calculated from the expected returns and variances given by the point estimates of historical means and variances. However, as Table 2 demonstrates, the mean returns for the different markets are quite volatile. Indeed, casual inspection would suggest that the mean of the U.S. market is not statistically significantly different

than the other equity markets. In particular, the mean and standard deviation on the U.S. market are 11% and 52%, respectively, while the same mean and standard deviation on the non-U.S. world index, the EAFE, is 12% and 58%.[24] To put this arguement in the context of Figure 1, the evidence suggests that while points corresponding to 100% domestic equity and 100% foreign equity imply different means and variances, the hypothesis that they are statistically no different cannot be rejected. Indeed, the hypothesis that the mean returns are equal to zero cannot be rejected either. Therefore, it would seem necessary to examine the degree of uncertainty in the estimates of the mean returns as well as the variances of returns to determine whether home bias really does exist.

A number of recent papers have examined just this issue. Bekaert and Urias (1996) use an estimation approach that examines whether the sources of uncertainty contained in foreign returns is captured or "spanned" by domestic returns, finding that the gains from diversification are much less pronounced than previously supposed. In particular, Bekaert and Urias (1996) examine the gains from the point of view of U.S. and U.K. domestic investors of holding closed-end foreign country funds. They find that the country funds are spanned by the U.S. market and, hence, cannot reject the hypothesis that there are no gains to foreign investment. However, this same hypothesis is rejected for the U.K. Thus, the Bekaert-Urias results would seem to suggest that home bias cannot be explained by statistical uncertainty for the residents of the U.K.

While these papers have focused upon the ability of domestic returns to mimick foreign returns, Gorman and Jorgensen (1996) examine directly the question of whether the deviation between observed portfolio weights and optimal portfolio weights are statistically different from eachother. They examine optimal portfolio allocations from the point of view of residents in each

---

[24]The volatility is somewhat lower when returns are measured as annual averages rather than as monthly changes as I do here.

of the G-5 countries (U.S., U.K., Germany, France, and Japan). Gorman and Jorgensen solve for the optimal portfolio choice by residents in each of the G-5 countries into the stock markets of the other four of this set of countries. They also allow for forward foreign exchange positions. They examine a number of different scenarios finding somewhat mixed results. For example, when solving for the optimal domestic weight relative to foreign weight, Gorman and Jorgensen generally reject the hypothesis of no home-bias, except for the U.S. However, when allowing for multiple allocations and frictions such as bid-ask spreads, the additional sources of uncertainty imply that the hypothesis of no home bias cannot be rejected.

According to the evidence suggested in these papers, there may be no home bias because foreign diversification does not lead to a statistically significant improvement in portfolio improvement. This line of reasoning is important and deserves further investigation to understand the robustness of the results to some of the particular assumptions in the studies. For example, Bekaert and Urias (1996) focus upon country funds since these funds tend to have low transactions costs. However, the premium above net asset value on these closed end funds tend to move with the U.S. market, a feature which may help explain the finding that these returns are spanned by the U.S. market.[25] Similarly, Gorman and Jorgensen (1996) examine exclusively the Group-of-Five countries and do not allow for holdings in other markets.[26] Furthermore, Gorman and Jorgensen (1996) solve only for the tangency portfolio where the risk-free rate is tangent to the efficient frontier. While this point is often not significantly different from observed foreign equity holdings, their analysis does not examine whether other parts of the efficient frontier that dominate are

---

[25]I thank Richard Marston for pointing out this possibility.

[26]As shown in Table 2, the two members of the Group of Seven countries that are not represented in the Gorman-Jorgensen study, Canada and Italy, both have lower equity returns than the other five. Higher foreign returns together with diversification potential makes home bias more likely for these countries. Indeed, some authors such as Lewis (1996b) have noted the tendency for a *negative* equity premium for Italy.

significantly different from observed holdings.

Nevertheless, this literature is useful as it puts the home bias hypothesis to the litmus test of whether it is statistically significant or not.

G. Synthesis

Two decades of research on equity home bias has yet to provide a definitive answer as to why domestic investors do not invest more heavily in foreign assets. One literature has examined the degree of integration in markets implied by the international capital asset pricing model. This literature has provided useful information about stock market comovements and about the potential importance of currency risk in the absence of purchasing power parity. However, since the null hypothesis of international market integration is usually imbedded into the empirical studies, rejection of these hypotheses does not directly provide evidence about *why* home bias appears to exist.

Intuitive explanations for home bias are similarly unsuccessful in addressing the puzzle. Stories that rely on alternative ways to hedge risk without resorting to holdings of foreign assets either do not improve the portfolio performance over international diversification, as in the case of multinationals, or else worsen the puzzle, as in the case of non-marketable risks such as human capital. The arguement that the potential gains are not worth the costs of diversification also appear to lack credibility. The gains appear enormous, on the order of 20% - 100% of permanent consumption, while the costs apparently do not keep domestic investors from turning over foreign securities at a rate 3 to 7 times the turnover rate of domestic securities.

The most promising explanation is suggested by recent empirical studies that examine the degree of uncertainty in the optimal choice of foreign security holdings. Although a simple comparison of historical means and variances of domestic and foreign stock returns suggest the investor should place a significant fraction of his or her wealth in foreign stocks, these calculations

do not include the uncertainty of the estimates of means and variances. Gorman and Jorgensen (1996) show that once this uncertainty is included, the hypothesis that foreign investments are not better performers than domestic investments cannot be rejected. This line of research suggests that the hypothesis that "equity home bias" does not exist cannot be rejected. The robustness of these results remain to be determined.

In the meantime, there are at least two different and interesting ways to take this research. First, while the evidence is compelling that returns may be too volatile to imply statistically significant differences in mean returns, the primary gains from holding foreign stocks come from their variance reduction properties. As noted above, as long as the correlation between domestic and foreign stocks is significantly less than one, standard portfolio theory implies that the variance of the portfolio can be reduced. Examining the potential for variance-reduction can help side-step the sometimes murky issues of testing for portfolio weights.[27]

The second direction for research may be to examine not just the levels of foreign portfolio holdings, but the trends. Casual investigation suggests that allocations into foreign securities may be increasing, at least among institutional investors. As Table 4 shows, the proportion of foreign securities held by mutual funds, while small, has been increasing over the last decade. Furthermore, pension funds have been raising their allocation in foreign stocks in some countries. Figure 2 illustrates this pattern. If the gains were not deemed to be present in foreign securities, then it seems unlikely that this trend would be generally increasing.

A further observation that seems inconsistent with the standard CAPM used to determine the equity home bias is that movements of capital flows are large. Indeed, this movement is implicit in the Tesar and Werner (1992) turnover rates. The standard investment analysis used to motivate

---

[27]For example, Gorman and Jorgensen (1996) solve for the optimal allocation under a variety of assumptions such as no short sale constraints.

equity home bias assumes that the domestic investor follows a "buy and hold" strategy. That is, he acquires foreign assets and holds them unconditionally over a long run period.

On the other hand, the large movements of capital in and out of emerging markets during the early 1990s suggests that many investors are not following "buy and hold" strategies. Table 5 shows that over the 1990s, cross-border equity flows across countries and, particularly, into developing countries has been quite volatile. During the period from 1990 to 1993, total portfolio investment into emerging markets from developed countries grew from $18.3 billion to $92.3 billion. Following the increase in U.S. interest rates beginning in early 1994, this pattern appeared to reverse somewhat, declining to $42.9 billion net increase in 1995. This pattern is even more pronounced when focusing upon the Western hemisphere. Capital inflows grew from $17.4 billion in 1990 to peak at $51.6 billion in 1993, only to drop off to $10 billion in 1995.

The table shows that similar variability can be found looking at equity flows into various parts of the world. These movements are substantially more variable when viewed as net movements into mutual funds based in the United States invested in different part of the world. In late 1994 and early 1995, some international funds experienced significant net outflows.

These different flows in response to such variables as changes in U.S. interest rates and individual country events such as the Mexican peso crisis of December 1994 suggest that domestic investors may be trying to follow market timing strategies. If domestic investors are following market timing strategies, then the distribution of the stock returns themselves suggest complicated issues for optimal portfolio choice. For instance, the standard mean-variance analysis treats these means and variances of international stock returns as constant, as they are in the long run. However, over short run periods, the distributions of stock returns and currencies are known to display time-varying variances and means. Therefore, investors considering rebalancing in response to changing events may face significantly greater risk than that implied by looking at long run means

and variances.

One way to reconcile the capital flows with the simple home bias framework above with the lack of evidence for significantly different returns across domestic and foreign markets may be that the standard investment analysis has traditionally focused upon unconditional moments of returns. However, the model also has predictions about the conditional moments, $E_t(\underline{r}_{t+1})$ and $Var_t(\underline{r}_{t+1})$. Conditional moments would suggest movements in foreign asset allocation over time. Nevertheless, it seems unlikely that conditional moments are sufficiently volatile to explain the large international capital movements observed in practice. Indeed, the number of empirical studies that have rejected the over-identifying restrictions of the conditional version of the international CAPM would suggest this model cannot explain the movements either.

As such, equity home bias in portfolio levels remains a puzzle. The tremendous volatility in equity movements may be viewed as an additional piece of this already difficult-to-solve puzzle.

II. Home Bias Observed in International Consumption Movements

Above, I showed that international equity markets appear to have a domestic investor home bias. In the finance literature where this bias was first noted, equity returns are treated as exogenous. In the 1980s, the international macroeconomics literature began to examine investor home bias as well. In this literature, asset prices are typically treated as endogenous. Furthermore, the underlying focus of this literature has been upon consumption behavior since the equity returns are determined by consumption allocation decisions across time and states of nature.

In this part of the essay, I examine the home bias literature grounded in macroeconomics. I somewhat arbitrarily categorize this research under "consumption home bias" because it treats stock returns as endogenous, oftentimes indirect functions of consumption. I begin by stating more carefully the consumption home bias puzzle noted in the introduction. I then show how the consumption home bias puzzle may be related to the equity home bias puzzle, with some caveats.

I then describe some explanations and empirical evidence for this puzzle. Finally, I provide a synthesis.

A. The Bias Implied by a Standard Complete Markets Model

To illustrate the basic consumption home bias puzzle based upon complete markets, I start with a standard social planner problem. I consider the social planner's problem of maximizing utility over J countries with representative agents having utility functions, $u(C^j(s^t))$, where j indexes the countries, $j = 1, ..., J$, and s^t is the state of the economy realized at time *t*. C^j is an aggregate consumption good assumed to be tradeable. Since utility is a function of tradeable consumption alone, this framework implicitly assumes that individuals care only about this good. However, the following analysis would not be affected by allowing consumers to care about non-tradeable goods or leisure, as long as utility were separable in tradeable consumption. I will return to the case where non-tradeables are non-separable below.

Given these assumptions, the social planner maximizes:

$$\text{Max} \quad \Sigma_{j=1}^{J} \lambda^j \Sigma_{t=1}^{\infty} \rho^t \Sigma_{s^t} \pi(s^t)\, u(C^j(s^t)) \qquad (12)$$
$$\{C^j(s^t)\}_{j=1}^{J},\ \forall\, s^t$$

$$\text{s.t.} \quad \Sigma_{j=1}^{J} C^j(s^t) \le \Sigma_{j=1}^{J} Y^{j,C}(s^t)\ \forall\, s^t$$

where λ^j is the social planner's weight on country *j* utility, ρ is the discount rate, and $\pi(s^t)$ is the probability of state s^t. Furthermore, $Y^{j,C}(s^t)$ is country *j*'s output level of tradeables in state *s* at time *t*. While the $Y^{j,C}$ may be viewed as endowments, this view is not necessary since in a production economy a social planner would optimize output efficiently over time and the resulting output levels would have to satisfy the constraints in equation (12).

The first-order conditions with respect to consumption are:

$$\rho^t \lambda^j u_C(C^j(s^t)) = \mu(s^t) \qquad (13)$$

where u_C is the marginal utility with respect to tradeables and $\mu(s^t)$ is the Lagrangian multiplier on the consumption constraint in (12) over the probability of the state. Taking the ratio of first-order conditions with respect to consumption at time *t* relative to those at *t-1* gives,

$$\frac{\rho\, u_C(C^j(s^t))}{u_C(C^j(s^{t-1}))} = \frac{\mu(s^t)}{\mu(s^{t-1})} \qquad (14)$$

Equation (14) says that the ratio of current to future marginal utility of tradeables is equal across countries. To simplify notation below, I adopt the notation that for any variable η, $\eta_t \equiv \eta(s^t)$.

I next follow standard practice and assume that utility has an isoelastic form such as:

$$u(C_t) = C_t^{(1-\gamma)}/(1-\gamma) \qquad (15)$$

Taking the derivative of equation (15), substituting the result into (14) and taking the logarithm implies:

$$\Delta c^j_{t+1} = \Delta c^i_{t+1}, \qquad \forall\ i,j \qquad (16)$$

where Δc^j_t is the growth rate of consumption in country *j*. Thus, complete markets together with any power form of utility implies that consumption growth rates should be equalized across countries. This basic conclusion was pointed out by Scheinkman (1984) and Leme (1984).

The evidence reported in Table 1 soundly rejects this notion. Panel A shows that the correlation of consumption growth rates across countries tend to be small. In fact, they are generally smaller than output growth rates with the exception of the UK-US correlation where consumption and output correlations are roughly the same. Backus, Kehoe, and Kydland (1992) pointed out the basic pattern observed in Table 1, even though they use quite different data than the Penn World Tables data reported here.

Panel B shows the regression of the country consumption growth rate minus the world growth rate on the output growth rate minus the world growth rate. The hypothesis that these variables are uncorrelated is soundly rejected in all cases.

This observation leads to the obvious question: why don't individuals diversify risks across countries so that consumption is more highly correlated? This question is plausibly related to the question: why don't domestic investors hold more foreign stocks? I next make this connection more transparent.

B. Consumption and Equity Markets: Examining the Pricing Relationships

To understand the connection between consumption behavior and the equity home bias puzzle, I start with a simple general equilibrium framework that integrates both consumption and equity prices. As a point of departure, I first assume that all goods are tradeable as in the social planner's problem above. Under this assumption, optimal international equity market integration implies that consumption growth rates are equalized.

I then examine empirically some of the pricing relationships implied by this framework. As with the international CAPM, if the pricing relationships are consistent with the model, then this evidence suggests that markets are integrated. However, here the evidence shows that the variability of intertemporal marginal rates of substitution in consumption is insufficient to explain either the mean or the variability of equity returns, a well-known finding in the domestic equity market. In future sections, I show that this relationship has important implications for perceived gains in international diversification.

B.1 International Equity Markets and Consumption in a Simple General Equilibrium Model

Consider again the world endowment economy described above with one tradeable, non-durable good. Each of the J countries produces this good in the amount of Y^j_t. The stream of payments of the endowments of these goods can be purchased by buying a share of equity in country j at price z^j_t. This equity pays out endowments as dividends.

B.1a The Closed Economy Model

For later discussion, it is useful to first consider the price of these stocks in the absence of

trade in world markets. For country *j*, the domestic investor's decision is restricted to buying shares in domestic equity or other domestic assets. Maximizing the expected present value of utility,

$E_o \Sigma_{t=0}^{\infty} \rho^t U(C^j_t)$

with respect to consumption of the good, C^j, and the share of domestic equity gives the first-order condition:[28]

$$U'(C^j_t)\, z^j_t = \rho\, E_t\{U'(C^j_{t+1})\, [Y^j_{t+1} + z^j_{t+1}]\} \qquad (17)$$

or, solving (17) in terms of z, the domestic equity price is:

$$z^j_t = E_t \Sigma_{\tau=1}^{\infty} q_{t+\tau}\, Y^j_{t+\tau} \qquad (18)$$

where $q_{t+1} \equiv \{\rho\, U'(C^j_{t+1})/U'(C^j_t)\}$. Note that q_t is the real intertemporal marginal rate of substitution in consumption.

The first order condition given in (17) is quite general and does not depend upon the specific assumptions of this model. The real stock price is the sum of the expected intertemporal marginal rates of substitution in consumption arising from the future dividend payments. Due to the generality of this first-order condition, this stock price formulation underlies many studies of equity markets.[29]

Under the specific assumptions of the endowment economy, the price can be further solved in terms of the production state.[30] In equilibrium, the quantity of shares must equal one and, in the absence of investment, consumption equals production: $C^j_t = Y^j_t$. Therefore, in equilibrium, $q_{t+1} = \{\beta\, U'(Y^j_{t+1})/U'(Y^j_t)\}$. In the absence of trade in international equity markets, each country holds all of the stock of its own country and will consume its own output.

---

[28]This first-order condition can be found by maximizing the lifetime utility over the shares of domestic equities, θ_t, subject to the constraint that $C^j_t + \theta_t z^j_t \leq \theta_{t-1} Y^j_t + \theta_{t-1} z^j_t$.

[29]For example, Hansen and Singleton (1983) and Shiller (1981) test restrictions implied by this pricing relationship using US stock returns.

[30]In the presence of production, the same first order conditions will hold, but consumption will not equal output due to capital formation.

B.1b The Open Economy Model

Now consider the price determined by perfectly integrated world capital markets. In this case, investors in country j may choose among foreign equity holdings in countries $i = 1, ..., J$. The stock of each country i has a price in the world stock market of $\underline{z}^i$. In this case, as long as countries have the same iso-elastic utility function, then they will all hold the same portfolio.[31] The common portfolio can be characterized as a world mutual fund.

Determining the actual portfolio holdings as well as the consumption levels requires solving for the wealth levels and, hence, the stock prices of each country. First, defining the price of the world mutual fund as $\underline{z}_t$ and its dividend stream as $\underline{Y}_t = \Sigma_{j=1}^{J} Y^j_t$, the same steps may be followed as for the closed economy case to yield the mutual fund price:

$$\underline{z}_t = E_t \Sigma_{\tau=1}^{\infty} \underline{q}_{t+\tau} \underline{Y}_{t+\tau} \qquad (19)$$

where now $\underline{q}_{t+1} \equiv \{\rho\, U'(\underline{Y}^j_{t+1})/U'(\underline{Y}^j_t)\}$. Thus, $\underline{q}$ is the intertemporal marginal rate of substitution in consumption derived from world output at time t and $t+1$. Similarly, the price of each country's stock on world markets is:

$$\underline{z}^j_t = E_t \Sigma_{\tau=1}^{\infty} \underline{q}_{t+\tau} e^j_{t+\tau} \qquad (20)$$

Each country j will sell its endowment stream on world markets and receive $\underline{z}^j$. Country j will in turn buy shares $\underline{\theta}^j$ in the mutual fund at price $\underline{z}$. Therefore, country j will hold shares equal to $\underline{\theta}^j = (z^j/\underline{z})$. Correspondingly, consumption for country j will be given by: $C^j_t = \theta^j \underline{Y}_t$. Each country shares in world consumption according to its share of wealth as valued by the world stock market.

This result leads to the same implication for consumption co-movements across countries found above. For integrated stock markets under iso-elastic utility, countries share in the world consumption growth rate and therefore have the same consumption growth rates. As such, the finding of home bias in the portfolios of domestic investors would suggest we should expect home bias in consumption growth rates as well. The reason is intuitively clear. If domestic residents do not hold sufficient claims on foreign output, then domestic country-specific consumption movements

---

[31]See the discussion in Ingersoll (1987).

would likely be positively correlated with country-specific output movements as well.

Despite the plausibility of this intuition, home bias by domestic investors in equity markets is neither necessary nor sufficient to generate home bias in consumption movements as long as there are other international asset markets. As I discuss below in Section E, these other markets such as bond markets may act as alternative means of smoothing consumption. However, home bias appears to operate in these markets as well.

B.2 Empirical Evidence on the Pricing Relationships

While the endowment economy described above is too stylized to take to the data, the basic asset pricing relationships hold in much more general circumstances. I next describe two sets of empirical studies that have tested implications of the first-order conditions underlying international equity pricing.

B.2a Latent Variable Tests Revisited

In examining the pricing relationships behind the international CAPM used to assess equity home bias, I described latent variable tests (see Section I.B.). In that context, I showed that the international CAPM under purchasing power parity implies that equity prices move in proportion to eachother according to the ratio of their betas with the world market return. Here I show that these same tests also apply when examining the first-order condition for general equilibrium equity pricing based upon consumption. In this context, the latent variable is not the "market return", but rather the intertemporal marginal rate of substitution in consumption.

To see why, note that the first order condition of intertemporal maximization underlying (17) implies that the following relationship holds:

$$E_t(q_{t+1} R^j_{t+1}) = 1 \qquad \forall j. \qquad (21)$$

As before, q_{t+1} is the intertemporal marginal rate of substitution in consumption. I here define R^j_{t+1}

as the gross rate of return on any asset *j* realized at time *t+1*.[32] Since relation (21) holds for any asset with return *j*, it also holds for the risk-free rate, defined as R^{rf}.

$$E_t\{q_{t+1} (R^j_{t+1} - R^{rf}_{t+1})\} = E_t\{Q_{t+1} er^j_{t+1} \} = 0 \quad (22)$$

where $er^j_{t+1} \equiv R^j_{t+1} - R^{rf}_{t+1}$ is the excess return on asset j over the risk free rate. Since the conditional expectation of the risk-free rate is known at time *t*, equation (22) can be rewritten as:[33]

$$E_t(er^j_{t+1}) = -Cov_t(R^j_{t+1},q_{t+1}) R^{rf}_{t+1} \quad (23)$$

Since (23) holds for any asset, we may substitute out the risk-free rate with any asset *b* to get:

$$E_t(er^j_{t+1}) = [Cov_t(R^j_{t+1},q_{t+1})/Cov_t(R^b_{t+1},q_{t+1})] E_t(er^b_{t+1}) \quad (24)$$

Since all returns depend upon their conditional covariances with the marginal rate of substitution in consumption, they must move in proportion to eachother according to the ratios of these conditional covariances.

The first order conditions with respect to consumption predict that returns will move in proportion to each other according to the proportion of their covariance with q, the intertemporal marginal rate of substitution in consumption. Therefore, the latent variable tests discussed in Section I.B could also be interpreted as evidence in favor or against the first order condition (21).

The latent variable test motivated by general equilibrium pricing was pioneered in foreign exchange studies by Hansen and Hodrick (1983). In order to test this restriction, Hansen and Hodrick (1983) as well as many subsequent researchers assume that the conditional covariances between returns and the marginal rate of substitution in consumption move in proportion across assets over time. Under this assumption, the ratios of covariances in (24) are constant. Generally, the studies find that the over-identifying restrictions implied by returns moving in proportion are

---

[32]I define returns in this ways since the first-order condition is more general than for equity returns alone. See Lucas (1978, 1982).

[33]This step uses the definition of covariances, E(XY) = E(X)E(Y) + Cov(X,Y) for any X and Y.

not rejected for low frequencies such as quarterly returns, but are strongly rejected for high frequency data, such as weekly returns.[34]

Cumby (1988, 1990) and Lewis (1991) use consumption data to examine the auxiliary assumption that covariances move in proportion to eachother. Consistent with the pattern of rejection in the latent variable tests, Lewis (1991) finds that the ratios of covariances in (24) appear to move in proportion only over longer holding periods. However, the question remains whether this tendency not to reject over longer horizons is a matter of low power.

Bekaert and Hodrick (1992) indirectly consider this possibility by using the one step ahead information in a VAR of foreign exchange and equity returns to test the latent variable restrictions. They find that a single factor model as implied by (24) is rejected, although a two factor model appears to fit the data better.

The main contribution of this literature testing for latent variable relationships seems to be its characterization of the behavior of excess returns. This literature shows that some factors, or comovements, help explain returns. As with latent variable tests of the international CAPM, a single factor model could be the result of a general equilibrium pricing relationship, but it could also be due to any model that suggests a proportional relationship between returns. Therefore, the latent variable test appears too general to draw any implications for the validity of general equilibrium pricing models.

B.2b Hansen-Jaganathan Bounds

A useful way to compare the variability of predictable excess returns with the implications

---

[34]Hansen and Hodrick (1983) test these restrictions using monthly excess foreign returns across six currencies, rejecting this restriction with marginal significance levels near 5%. Hodrick and Srivastava (1984) expand the sample period and reject the model. Giovannini and Jorion (1987) examine weekly returns and use returns from the stock market, finding the restrictions to be rejected. Campbell and Clarida (1987) use three month returns across the Eurocurrency term structure as well as the foreign exchange market. Lewis (1990) surveys this literature and finds that the rejection of the latent variable restrictions is sensitive to the holding period alone.

of any particular model has been provided in the pioneering work of Hansen and Jaganathan (1991), originally applied to US T-Bill rates. Since the basic framework holds for *all* returns, it clearly has implications for international stock returns as well.

The Hansen-Jaganathan bounds use combinations of excess returns to provide a lower bound on the volatility of the intertemporal marginal rate of substitution in consumption, q_{t+1}. To see how this relationship is derived, consider again equation (22) using the Law of Iterated Expectations and subsuming the superscript *j*:

$$E(q_{t+1}\, er_{t+1}) = 0. \tag{25}$$

Suppose that the intertemporal marginal rate of substitution can be written as a linear projection on er_{t+1}.

$$q_{t+1} = \delta_o + \delta' er_{t+1} + e_{t+1}, \tag{26}$$

where e_{t+1} is the projection error. Then by OLS, the parameter vector δ can be written:

$$\delta = \Sigma^{-1}\, Cov(q_{t+1}, er_{t+1}) = \Sigma^{-1}\, [E(q_{t+1}\, er_{t+1}) - E(q_{t+1})\, E(er_{t+1})] = -\, \Sigma^{-1}\, E(q_{t+1})\, E(er_{t+1}) \tag{27}$$

where Σ is the variance of er_{t+1} (when er is a vector, Σ is the variance-covariance matrix) and where the second equality follows by equation (22). Substituting (27) into (26) above and noting that the variance of e_t is positive, we have:

$$\sigma^2(q_{t+1}) > [E(q_{t+1})]^2\, E(er_{t+1})'\, \Sigma^{-1}\, E(er_{t+1}) \tag{28}$$

or,

$$\sigma(q_{t+1})/[E(q_{t+1})] > [E(er_{t+1})'\, \Sigma^{-1}\, E(er_{t+1})]^{1/2}. \tag{29}$$

Bekaert and Hodrick (1992) estimate Hansen-Jaganathan bounds as in (29) using different measures of returns. For a combination of equity and foreign exchange returns in the US, Japan, UK, and Germany, they find that the bounds are in the vicinity of .6 to .7. However, Bekaert (1994) calculates the ratio of the $\sigma(q)/E(q)$ for an extension of the Lucas (1982) model to be .01 assuming a relative risk aversion parameter of 2. To obtain bounds near the Bekaert and Hodrick

(1992) estimates, this risk aversion coefficient must be over 140!

Why does risk aversion coefficient have to be so large to justify the high returns? Consider again the first order condition for equity returns given in equation (17). These returns depend upon the covariance between the return and the intertemporal marginal rate of substitution, q. For isoelastic utility, this marginal rate of substitution is just: $q_{t+1} = \rho(C_{t+1}/C_t)^{-\gamma}$. Since consumption has a low variance, the only way for the covariance between returns and q to be high is if γ is sufficiently high. This is just the equity premium puzzle applied to international returns.[35]

Overall, a major problem with reconciling investor home bias with international consumption movements is that the volatility of the implicit intertemporal marginal rate of substitution, or "pricing kernel", is not high enough to explain stock price movements. Nevertheless, this is a common inconsistency in the domestic asset pricing literature. It is possible to examine the implications of other sources of internationally non-traded risk as long as the necessary correlation between the pricing kernel and stock prices is taken as given. I follow this approach below.

C. Other States to Diversify

In the standard complete markets framework described above, I assumed that all individuals had the same utility function. This assumption led to the outcome that marginal utilities are equalized across countries.

Consumption growth rates can differ, however, if some components of utility are not internationally tradeable. Backus, Kehoe, and Kydland (1992) show this point when labor is immobile across countries. Tesar (1993) illustrates this possibility in the context of non-tradeable goods.

---

[35]See Kocherlakota (1996) for a discussion of the domestic equity premium puzzle. In their original discussion of the equity premium puzzle, Mehra and Prescott (1985) find that risk aversion greater than 10 can explain the puzzle. In the international context, the means and variances of returns tend to be higher so that higher values of risk aversion are required to reconcile returns.

Below, I first show this result by extending the same simple social planner's framework used above to show that non-tradeables break the model's implied link between consumption growth rates across countries. I then describe research that has related non-tradeable goods and labor to the investor home bias phenomenon. Lastly, I describe empirical research on the plausibility of this explanation.

C.1 Are Non-Traded Goods Responsible for the "Home Bias?"

The basic complete markets model considered above assumes that residents of all countries consume a single tradeable good. I now amend the social planner's problem in equation (12) to allow for non-tradeable goods, N^j, and non-tradeable leisure, L^j, in country *j*. The social planner now maximizes utility over J countries with representative agents having utility functions, $u(C^j(s^t))$, $N^j(s^t)$, $L^j(s^t))$, where j indexes the countries, j = 1, ..., J and s^t is the state of the economy at time *t*. C^j as before is a tradeable consumption good, but now is not the only argument in utility. Labor is immobile internationally and therefore functions as a non-traded good. Tradeables and non-tradeables are both non-durable.[36]

Given these assumptions, the social planner maximizes:

$$\text{Max} \quad \Sigma_{j=1}^{J} \lambda^j \Sigma_{t=1}^{\infty} \rho^t \Sigma_{st} \pi(s^t)\, u(C^j(s^t), N^j(s^t), L^j(s^t)) \qquad (30)$$

$$\{C^j(s^t)\}_{j=1}^{J}, \ \forall\, s^t$$

$$\text{s.t.} \quad \Sigma_{j=1}^{J} C^j(s^t) \leq \Sigma_{j=1}^{J} Y^{j,C}(s^t) \ \forall\, s^t$$

$$N^j(s^t)) \leq Y^{j,N}(s^t)$$

$$L^j(s^t) \leq Y^{j,L}(s^t)$$

where as before λ^j is the social planner's weight on country *j* utility, ρ is the discount rate, and $\pi(s^t)$ is the probability of state s^t. Furthermore, $Y^{j,C}(s^t)$, $Y^{j,N}(s^t)$, and $Y^{j,L}(s^t)$ are, respectively, country *j*'s

[36]In Lewis (1996a), I allow for durables as well.

output levels of tradeables, non-tradeables and leisure in state *s* at time *t*.

The first-order conditions with respect to tradeables are:

$$\rho^t \lambda^j u_C(C^j(s^t),N^j(s^t),L^j(s^t)) = \mu(s^t) \qquad (31)$$

where u_C is the marginal utility with respect to tradeables and $\mu(s^t)$ is the Lagrangian multiplier on the tradeables constraint in (30) over the probability of the state. In contrast to (13), this first-order condition depends upon realizations of non-tradeable goods and leisure, N^j and L^j.

Taking the ratio of first-order conditions with respect to tradeables at time *t* relative to those at *t-1* gives,

$$\frac{\rho\, u_C(C^j(s^t),N^j(s^t),L^j(s^t))}{u_C(C^j(s^{t-1}),N^j(s^{t-1}),L^j(s^{t-1}))} = \frac{\mu(s^t)}{\mu(s^{t-1})} \qquad (32)$$

Equation (32) says that the ratio of current to future marginal utility of tradeables is equal across countries, but that both the numerator and denominator depend upon realizations of non-tradeable goods and leisure. To simplify notation below, I adopt the notation that for any variable η, $\eta_t \equiv \eta(s^t)$, as before.

Taking the logarithm of equation (32) now implies:

$$\Delta\ln(u_C(C_t^j, N_t^j, L_t^j)) = \Delta\ln(u_C(C_t^i, N_t^i, L_t^i)) \qquad \forall\, i, j \qquad (33)$$

As before, the growth rates of the marginal utilities of tradeables are equalized. In this case, however, these marginal utilities depend upon realizations of non-tradeable goods and leisure that differ across countries. Therefore, the correlation of tradeables consumption need not be perfectly correlated across countries. This result appears to provide an opportunity to explain the consumption home bias puzzle. I will return to this issue after the next subsection that describes how it may explain the equity home bias puzzle as well.

C.2 Implications for Investor Home Bias

How does the possibility of hedging non-tradeable goods and/or leisure affect the optimal

portfolio allocation? Eldor, Pines and Schwartz (1988) show that differences in productivity shocks can produce home bias. Similarly, Stockman and Dellas (1989) point out that if investors consume non-traded goods in addition to traded goods, then their equity holdings will be skewed in favor of domestic stocks. They assume that non-tradeables and tradeables are separable in utility. However, they assume that only domestic residents can hold equity that pays out the domestic non-tradeable good. Therefore, investors diversify in the international tradeable equities, but hold all of the domestic non-tradeable equity. This model indeed implies investor home bias. In fact, it predicts that equities in non-tradeables will be held exclusively by the domestic residents, an observation inconsistent with casual empiricism.

The effects of non-separabilities in utility on home bias are also considered in Pesenti and van Wincoop (1994) and Tesar (1995). These papers assume that domestic residents are restricted from holding foreign non-traded goods equities, and derive conditions under which an investor would find it optimal to bias their wealth portfolio toward domestic traded goods equities. These studies share with Stockman and Dellas (1989) the assumption that domestic investors must hold all of domestic non-tradeables equities.

Baxter, Jermann, and King (1995) relax the assumption that domestic investors must hold domestic non-tradeables equities. They show that as long as investors are able to hold foreign non-traded goods equities, domestic investors will never choose to bias their portfolio holdings toward domestic traded goods equities. Rather, they will share equally in the world tradeable equity, but hold foreign non-tradeables equities to hedge their own non-tradeables shocks.

Baxter, Jermann, and King (1995) also show that the Stockman-Dellas result is sensitive to the assumption that utility is separable between traded and non-traded goods. Depending upon the degree of substitutability between tradeables and non-tradeables and the level of risk aversion, domestic residents may want to hold less than 100% of domestic non-traded good equities and may

even want to want to short it.

In sum, whether non-tradeables can explain home bias once the restriction on foreign ownership of non-tradeables equities is removed depends upon the degree of substitutability of tradeables and non-tradeables. All of the studies linking non-tradeables to home bias have assumed that the first-order condition given in (31) holds; i.e., marginal utilities of tradeables are equalized across countries. I next discuss the empirical plausibility of this assumption.

C.3 Empirical Evidence

The explanations of equity home bias described in section C.2 presume that non-tradeables also explain the consumption home bias. Therefore, in this section, I ask whether non-tradeables have the potential to explain the consumption puzzle, and therefore some hope for explaining the equity puzzle.

Backus, Kehoe, and Kydland (1992) introduce immobile labor into their two-country model. When they calibrate this model to data, they find that the model can generate a cross-country correlation of consumption that is less than, but close to, one. Therefore, they conclude that the model cannot generate sufficiently low consumption correlations to match the data.

Tesar (1993) and Stockman and Tesar (1995) show theoretically and empirically that the presence of non-traded goods can lower the implied correlation between consumption growth rates. They argue that non-tradeables break the link in the international correlation of consumption. Even if markets are complete, they reason, aggregate consumption confounds tradeables and non-tradeables, so researchers should not be surprised to find a low international correlation of aggregate consumption.

Stockman and Tesar (1995) calibrate their model with consumption and output data on tradeables and non-tradeables for the OECD countries. However, they find that the volatility of non-tradeables is not high enough to account for their model. They show that introducing

additional taste shocks across countries is necessary to account for the basic features of the model.

In Lewis (1996a), I find similar results to these studies but with a rather different methodology. Using a panel data set of 72 countries, I show that non-traded goods can explain about 22% of the variance in idiosyncratic component of consumption growth rates, leaving much of the idiosyncratic movements unexplained. To see how this relationship relates to the regression tests reported in Table 1, recall that the form of these regression tests are:

$$\Delta \ln(C_t^j) = \theta_o(t) + \beta \Delta Y_t^j + u_t^j \qquad (34)$$

where $\theta_0(t)$ measures the common growth rate of the Lagrangian in equation (13), Y_t^j is output of country j realized at time t, and u_t^j is a composite error term including measurement error and shocks to preferences. Table 1 reported risk-sharing tests of the hypothesis that $\beta = 0$, finding that the hypothesis was soundly rejected.

Equation (31) suggests why this simple framework does not work in the presence of non-tradeable leisure or goods. In this case, the marginal utility of tradeables consumption is equated across countries, but this marginal utility depends upon non-tradeables. Without controlling for non-tradeables, these variables are likely to be correlated with idiosyncratic output measured by Y_t^j, thereby biasing estimates of β.

Log-linearizing the first-order condition in equation (31) gives a new version of the test:[37]

$$\Delta \ln(C_t^j) = \theta_o(t) + \theta_1 \Delta \ln(N_t^j) + \theta_2 \Delta \ln(L_t^j) + \beta \Delta \ln(Y_t^{Cj}) + u_t^j \qquad (35)$$

θ_1 and θ_2 depend upon utility parameters and capture the degree of substitutability/complementarity between tradeables consumption and non-tradeables. Intuitively, when non-tradeables and tradeables are net complements, i.e., $\theta_i > 0$, consumers prefer more tradeables when non-tradeables increase. A risk-sharing test that corrects for non-tradeables is the hypothesis that tradeables consumption conditional on non-tradeables and leisure is uncorrelated with tradeables output, Y_t^{Cj}.

---

[37]For a derivation of this log-linearization, see Lewis (1996).

In other words, the non-tradeables corrected test is the hypothesis that $\beta = 0$ in equation (35).

Table 6 reports the results of tradeables regression tests from Lewis (1996a). As the table shows, the hypothesis that $\beta = 0$ is strongly rejected in all cases. The table also reports the degree of variability in tradeables that is explained by non-tradeables. Perhaps surprisingly, the answer is "not much." In none of the cases does the degree of variability in tradeables explained by non-tradeables exceed 1%. When including the possibility that durables contain some non-tradeables services components, the degree of variability explained increases somewhat, but is not greater than 10%. These results are consistent with those found by Stockman and Tesar (1995). The variability in non-tradeables does not seem to be sufficient to explain the lack of consumption risk-sharing.

The basic evidence from this research suggests that, while non-tradeables appear to be a plausible explanation of home bias, the first-order conditions are rejected empirically. Other explanations that depend upon the restriction that foreigners cannot hold shares of equity in foreign non-tradeables do not appear plausible. Therefore, non-tradeables models based upon complete markets do not appear to be capable of explaining home bias.

D. Gains from International Consumption Diversification

An important question for addressing consumption home bias is: what are the potential gains from diversifying consumption shocks across countries? If the gains are small, then relatively small transactions costs would be capable of explaining why investors don't optimally diversify.

In a seminal paper, Cole and Obstfeld (1991) show that goods market prices effectively help diversify consumption risk. In countries with relatively large productivity shocks, the price of the good falls relative to the price of scarcer goods. Thus, goods prices help diversify consumption risk.

In their paper, Cole and Obstfeld (1991) calculate the amount of permanent consumption that must be taken away from investors at the optimally diversified equilibrium to make them indifferent to being at autarchy. Perhaps surprisingly, they find that this number is small, about

0.04% of permanent consumption. Since the gains from risk-sharing are so small, they conclude that financial markets are relatively unimportant for diversifying risk.

A number of other papers have followed up on this analysis in a number of different ways. Tesar (1995) surveys this literature and finds, generally speaking that the gains are relatively small. Van Wincoop (1994) moves away from the assumption of perfect and complete markets. He assumes that certain kinds of risks cannot be diversified away.[38] He finds that the gains are an order of magnitude or more larger.

Nevertheless, the standard consumption literature tends to find smaller gains to diversification than the financial economics literature discussed in section I.D. Recall in that context, the gains from holding foreign stocks are estimated to sometimes exceed 100%.

What is the reason for these differences? In Lewis (1996b), I examine this question in a unified framework that considers the gains in both types of literature. I find that differences in the gains are not driven by the difference in treating stock returns as exogenous, as assumed in the finance literature, instead of endogenous, as assumed in the macroeconomics literature. Rather the differences arise primarily from the fact that consumption is much less variable than stock returns; i.e., the international equity premium puzzle noted earlier.

A consumption-based model that does not find low risk-sharing gains is Obstfeld (1994b). This model develops a growth framework in which domestic investors can increase the growth path of consumption by holding foreign assets. While this model is quite different than the others in the literature, it shows that gains can be large as long as growth is part of diversification.[39]

E. Restrictions and Frictions Affecting International Consumption Risk-Sharing

One of the underlying assumptions in the explanations for consumption home bias

---

[38]I will return to this point when discussing market frictions below.

[39]Another paper that makes this point is van Wincoop (1997).

considered so far is that international goods and financial markets are completely integrated. For the most part, these models assume that markets are free from any governmental restrictions or other capital market impediments. They also assume that investors are rationally informed about the potential gains from diversifying into foreign stock markets and, implicitly, that these gains are large enough to offset any transactions costs from acquiring foreign equities.[40] Any of these assumptions may be invalidated and, if so, may help explain the puzzle.

I examine this possibility in Lewis (1996a) by using a sample of 72 countries over 43 years and segmenting the countries into two groups depending upon whether they face certain capital market restrictions in a given year.[41] I then regress country-specific consumption growth on country-specific output growth as shown in Table 1, except that I split the regressions into the two groups. Strikingly, I find that countries with restrictions have a significantly higher coefficient on income, consistent with the view that these countries exhibit less risk-sharing. When I condition on non-tradeables, as shown in Table 5, I find that I can no longer reject risk-sharing. While more research should be done to determine whether these results derive from low power of the tests, it suggests that international capital restrictions may be important for understanding consumption home bias.

One way to move away from the assumption of complete and perfect markets is to assume that financial assets exist only on a limited number of securities. Indeed, a standard assumption in international macroeconomics is that financial trade across countries is limited to an internationally tradeable bond. Baxter and Crucini (1995) calibrate empirically a two-country general equilibrium model in which intertemporal trade is restricted to such a bond. When productivity shocks in the

---

[40]Obstfeld (1994a) provides a useful survey of the issues behind capital market movements as well as measures of capital immobility.

[41]This methodology is based upon consumption Euler equations introduced by Hall (1978). Hall (1989) surveys this literature.

two countries are transitory, they show that the implied consumption correlations are quite high, consistent with complete markets. However, when the productivity shocks have a unit root, the consumption correlations become too low to explain the data, even negative.

This finding is consistent with research in domestic financial markets such as Heaton and Lucas (1995) and Telmer (1993). The basic intuition for the finding is straightforward. Consider investors in two countries, labeled A and B. If the country A investor gets a temporarily high output shock relative to the country B investor, then A will want to lend to B. In equilibrium, consumption in country A and B will tend to equalize, *even though there is no international trade in equity*. Thus, if countries face temporary shocks, then restrictions in capital markets are unlikely to significantly affect the ability of investors to share in consumption risk as long as some market exists for financial trade.

What if production shocks are permanent? Consider the basic intution for investors in countries A and B again. When the country A investor receives a positive output shock, he now believes that the increase is permanent and no longer has an incentive to intertemporally smooth. In this scenario, consumption correlations can be quite low and even negative as found by Baxter and Crucini (1995).

Telmer and Yaaron (1996) examine the effects of incomplete capital markets in the presence of permanent shocks. They show in relatively general settings that consumption and asset pricing behavior can be quite different from complete markets when shocks are permanent. To explain consumption home bias, this research suggests that either productivity shocks must be permanent or else that restrictions must bind across international financial markets.

To address whether restrictions bind in bond markets, in Lewis (1997) I re-examine consumption behavior across countries facing international capital market restrictions. Instead of regressing realized country-specific consumption on realized country-specific output, as in Table 1,

I estimate the first order conditions given in equation (21). These can be written in the following form:

$$E_t\Delta\ln(C_t^j) = \theta_o(t) + \beta\, E_t\Delta Y_t^j + u_t^j \qquad (36)$$

or

$$\Delta\ln(C_t^j) = \theta_o(t) + \beta\, E_t\Delta Y_t^j + u_t^j + \epsilon_{t+1}^j$$

where $\epsilon_{t+1}^j = \Delta\ln(C_t^j) - E_t\Delta\ln(C_t^j)$, the forecast error in consumption growth. If countries have access to a bond to intertemporally smooth consumption, then expected consumption is independent of current information. On the other hand, if individuals are unable to intertemporally smooth, β will not necessarily equal zero. Furthermore, Campbell and Mankiw (1989, 1991) argue that β can be interpreted as the proportion of "rule-of-thumb" consumers who consume all of their income.

In Lewis (1997), I estimate this first order condition for restricted and unrestricted countries. If the restrictions do not matter, then I should find no difference. However, I find that β is significantly higher for countries with restrictions, suggesting a greater proportion of "rule-of-thumb" consumers in these countries according to Campbell and Mankiw (1989, 1991). These results suggest that international restrictions may be binding in more financial markets than just international equity markets.

F. Uncertainty in Estimation

In the equity home bias research, I noted earlier that an important new area of research addresses estimation risk. While the consumption literature is notoriously plagued by problems with measurement error, a comparison of consumption variability to equity variability shows that estimation uncertainty is much less of a problem.

Consider again Tables 1 and 2. As table 1 shows, the annualized variability of monthly stock returns is quite high, with a standard deviation near 52% for the U.S. On the other hand, the variability of annual consumption reported in Table 2 is much lower. Indeed, the standard error

on the coefficient of consumption for the U.S. is a precise .087, easily rejecting the hypothesis that the coefficient is zero. Generally speaking, empirical studies examining the existence of consumption home bias have no problem rejecting the hypothesis that actual consumption is significantly different than consumption implied by optimal risk-sharing, as the Table 2 results illustrate.

As we have seen, this same relative precision of consumption leads to substantially lower estimates of the gains from diversification than the much less precisely measured equity returns. This comparison leads to interesting paradox. The gains from equity diversification appear large, but the returns are very imprecisely estimated. On the other hand, the gains from diversification observed in consumption outcomes appear relatively small, but the consumption growth rates are precisely estimated.

G. Synthesis

Consumption home bias is the phenomenon that domestic consumption is more highly correlated with domestic output than would be suggested if domestic investors had optimally sold off claims on their output to foreigners. As the evidence shows quite clearly, this type of home bias is quite pronounced, and unlike its equity counterpart, is statistically significant.

Consumption home bias is theoretically related to equity home bias. Intuitively, countries that bias their equity holdings away from foreign assets will not diversify away all of their home output risk. As a result, the deviation of domestic consumption from world consumption will be positively correlated with the deviation of domestic output from world output.

Despite the plausibility of this connection, it is difficult to make this case empirically compelling. The volatility of the intertemporal marginal rate of substitution in consumption, or the "pricing kernel" as it is oftened called, is too low. This problem mirrors the equity premium puzzle in the domestic asset pricing literature.

Since this problem is well-known, one approach might be to take the required correlation between consumption and returns to explain the equity premium as given. Given the required correlation, what can explain the low degree of observed consumption risk-sharing?

One explanation that seems plausible at first blush is the presence of non-tradeables. Since risk-sharing in consumption is necessarily in the form of tradeables consumption, non-tradeables that are consumed exclusively in the home country would appear to break the link between consumption across countries. The problem with this explanation is that the variability of non-tradeables explains only a small fraction of the variability of tradeables. Therefore, consumption home bias needs an additional source of variability such as taste shocks to explain the puzzle.

Models relating non-tradeables to equity holdings take the first-order condition of risk-sharing in tradeables as given. However, this first-order condition is empirically rejected on both empirical and economic grounds. Moreover, some of these models impose the arbitrary assumption that non-tradeables equities are held only by domestic residents, an assumption without empirical support. In sum, explanations based upon non-tradeables alone do not seem likely to provide convincing evidence for consumption home bias.

Another possible explanation for consumption home bias is that the gains from risk-sharing are insufficient to merit the costs of diversifying. Early research suggested that these gains are quite small, making this explanation quite compelling. However, more recent research including such possiblities as increasing growth due to diversification suggests that the gains might indeed by rather large, even exceeding 100% of permanent consumption. With this wide range of estimates of the gains from risk-sharing, the jury is still out over whether the gains are small enough to explain the consumption home bias puzzle.

Finally, another set of explanations for consumption home bias is the presence of capital market restrictions that impede investor's ability to diversify. While evidence from domestic

financial markets suggest that restrictions on asset holdings do not affect equilibrium outcomes much, these models are largely driven by intuition from transitory shocks. More recent studies have found that different capital market restrictions can have strong effects on equilibrium consumption holdings if income shocks are permanent.

Empirical evidence indeed suggests that restrictions are important in affecting equlibrium consumption outcomes. Countries with restrictions appear less able to diversify across states of output as well as over time. Future research should examine the robustness of these results as well as investigate whether permanent productivity shocks across countries as empirically important.

REFERENCES

Adler, M., and B. Dumas, 1983, "International portfolio choice and corporate finance: A synthesis," *Journal of Finance*, 38, 925-984.

Backus, David, Patrick Kehoe, and Finn Kydland, 1992, "International real business cycles," *Journal of Political Economy* 100, 745-775.

Baxter, M. and M. Crucini, 1995, Business cycles and the asset structure of foreign trade, *International Economic Review*, 821-854.

Baxter, Marianne, and Urban Jermann, 1997, "The international diversification puzzle is worse than you think," *American Economic Review*

Baxter, Marianne, Urban Jermann, and Robert King, 1995, "Non-traded goods, non-traded factors, and non-diversification," University of Virginia working paper.

Bekaert, Geert, 1994, "Exchange rate volatility and deviations from unbiasedness in a cash-in-advance model," *Journal of International Economics*, 36, 29-52.

Bekaert, Geert and Robert J. Hodrick, 1992, "Characterizing predictable components in excess returns on equity and foreign exchange markets," *Journal of Finance*, 47, 467-510.

Bekaert, Geert and Michael S. Urias, 1996, "Diversification, integration, and emerging market closed-end funds," *Journal of Finance* 51, 835-869.

Black, F., 1974, "International capital market equilibrium with investment barriers," *Journal of Financial Economics*, 1, 337-352.

Bohn, Henning and Linda Tesar, 1996, "U.S. Equity Investment in Foreign Markets: Portfolio Rebalancing or Return Chasing?" *American Economic Review*, 86, 77-81.

Bonser-Neal, C., G. Brauer, R. Neal and S. Wheatley, 1990, "International investment restrictions and closed-end country fund prices," *Journal of Finance*, 45, 523-548.

Campbell, J.Y., and R.H. Clarida, 1987, "The term structure of Euromarket interest rates: An empirical investigation," *Journal of Monetary Economics*, 19, 25-44.

Campbell, J.Y. and Y. Hamao, 1992, "Predictable stock returns in the United States and Japan: A study of long-term capital market integration," *Journal of Finance*, 47, 43-70.

Campbell, J.Y. and G. Mankiw, 1989, Consumption, income, and interest rates: Reinterpreting the time series evidence," in Blanchard, O.J., and S. Fischer, eds., *NBER Macroeconomics Annual: 1989* (MIT Press: Cambridge, Mass.).

Campbell, J.Y. and G. Mankiw, 1991, The response of consumption to income: A cross-country investigation, *European Economic Review*, 35, 723-756.

Claessens, S. and M. Rhee, 1993, "The effects of equity barriers on foreign investment in developing countries," *National Bureau of Economic Research Working Paper*, No. 4579.

Cole, Hal, and Maurice Obstfeld, 1991, "Commodity trade and international risk sharing: How much do financial markets matter?" *Journal of Monetary Economics*, August, 28: 3-24.

Cooper, Ian A., and Evi Kaplanis, 1991, "What explains the home bias in portfolio investment?" *London Business School* working paper.

Cumby, Robert E., 1988, "Is it risk? Explaining deviations from uncovered interest parity," *Journal of Monetary Economics*, 22, 279-300.

Cumby, R.E., 1990, "Consumption risk and international equity returns: Some empirical evidence," *Journal of International Money and Finance*, 9, 181-192.

Dumas, B. and B. Solnik, 1993, "The world price of exchange rate risk," working paper, HEC School of Management.

Eldor, R., D. Pines, and A. Schwartz, 1988, "Home asset preferences and productivity shocks," *Journal of International Economics*, 25, 165-176.

Engel, C.M., 1993, "Tests of CAPM on an international portfolio of bonds and stocks, *National Bureau of Economic Research Working Paper*, No. 4598.

Engel, C.M. and A.P. Rodrigues, 1993, "Tests of mean-variance efficiency of international equity markets," *Oxford Economic Papers*, 45, 403-421.

Errunza, V. and E. Losq, 1985, "International asset pricing under mild segmentation: Theory and evidence," *Journal of Finance*, 40, 105-124.

Errunza, V. and E. Losq, 1989, "Capital flow controls, international asset pricing, and investor's welfare: A multi-country framework," *Journal of Finance*, 44, 1025-1037.

Eun, C.S. and S. Shim, 1989, "International transmission of stock market movements," *Journal of Financial and Quantitative Analysis*, 24, 241-256.

Ferson, W.E. and C.R. Harvey, 1993, "The risk and predictability of international equity returns," *Review of Financial Studies*, 6, 527-566.

French, K. and J. Poterba, 1991, "International diversification and international equity markets," *American Economic Review*, 81, 222-226.

Froot, K. and K. Rogoff, 1995, Perspectives on PPP and long-run real exchange rates, in G. Grossman and K. Rogoff, eds, *Handbook of international economics* (North Holland: Amsterdam).

Gibbons, M. and W.E. Ferson, 1985, "Testing asset pricing models with changing expectations and an unobserved market portfolio," *Journal of Financial Economics*, 14, 217-236.

Gorman, L.R., and B.N. Jorgensen, 1996, "Domestic versus International Portfolio Selections: A Statistical Examination of the Home Bias," working paper, Kellogg Graduate School of Management, Northwestern University (Evanston, IL).

Giovannini, A. and P. Jorion, 1987, "Interest rates and risk premia in the stock market and in the foreign exchange market," *Journal of International Money and Finance*, 6: 107-124.

Grauer, R.R., and N.H. Hakansson, 1987, "Gains from international diversification: 1968-85 returns on portfolios of stocks and bonds," *Journal of Finance* 42, 721-739.

Hall, R.E., 1978, "Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence," *Journal of Political Economy*, 86, 971-987.

Hall, R.E., 1989, "Consumption," in R.J. Barro ed., *Modern Business Cycle Theory*, Harvard University Press: Cambridge, MA.

Hansen, L.P. and R.J. Hodrick, 1983, "Risk averse speculation in the forward foreign exchange market: An econometric analysis of linear models," in J.A. Frenkel, ed., *Exchange Rates and International Macroeconomics* (University of Chicago Press: Chicago).

Hansen, L.P. and R. Jagannathan, 1991, "Implications of security market data for models of dynamic economies," *Journal of Political Economy*, 99, 225-262.

Hansen, L.P. and K.J. Singleton, 1983, "Stochastic consumption, risk aversion, and the temporal behavior of asset returns," *Journal of Political Economy*, 91, 249-265.

Hardouvelis, G.A., R. La Porta, and T.A. Wizman, 1993, "What moves the discount on country equity funds?" *National Bureau of Economic Research Working Paper*, No. 4571.

Harvey, C., 1991, "The world price of covariance risk," *Journal of Finance*, 46, 111-158.

Harvey, C., 1993, "Predictable risk and returns in emerging markets," working paper, Duke University.

Heaton, J. and D. Lucas, 1992, Evaluating the effects of incomplete markets on risk sharing and asset pricing, *Alfred P. Sloan School of Management working paper* No. 3491-92-EFA.

Heaton, J. and D. Lucas, 1995, The importance of investor heterogeneity and financial market imperfections for the behavior of asset prices, *Carnegie-Rochester Conference Series on Public Policy* 42, 1-32.

Heston, S.L. and K.G. Roewenhorst, forthcoming, "Industrial structure explains the benefits of international diversification?" *Journal of Financial Economics.*

Hodrick, R.J. and S. Srivastava, 1984, "An investigation of risk and return in forward foreign exchange," *Journal of International Money and Finance*, 3, 5-29.

Ingersoll, J.E., Jr., 1987, "Portfolio Separation Theorems," in *Theory of Financial Decision Making*, Rowman and Littlefield, Savage, MD.

Jacquillat, B. and B. Solnik, 1978, "Multinationals are poor tools for diversification," *Journal of Portfolio Management*, 4, 3-12.

Kocherlakota, N., 1996, "The Equity Premium: It's Still a Puzzle," *Journal of Economic Literature*, 34, 42-71.

King, M.A. and S. Wadhwani, 1990, "Transmission of volatility between stock markets," *Review of Financial Studies*, 3, 5-33.

Leme, P., 1984, "Integration of international capital markets," working paper, University of Chicago.

Levy, H. and M. Sarnat, 1970, "International diversification of investment portfolios," *American Economic Review*, 60, 668-675.

Lewis, K.K., 1990, "The behavior of Eurocurrency returns across different holding periods and monetary regimes," *Journal of Finance*, 45, 1211-1236.

Lewis, K.K., 1991, Should the holding period matter in tests of the intertemporal consumption-based CAPM? *Journal of Monetary Economics* 28, 365-389.

Lewis, K.K., 1996a, What can explain the apparent lack of international consumption risk-sharing? *Journal of Political Economy* 104, 267-297.

Lewis, K.K., 1996b, "Consumption, stock returns, and the gains from international risk-sharing," *National Bureau of Economic Research Working Paper*, No. 5410.

Lewis, K.K., 1997, "Are Countries with official international restrictions 'liquidity constrained'?" *European Economic Review*, forthcoming.

Lintner, J., 1965, "The valuation of risky assets and the selection of risky investment in stock portfolios and capital budgets," *Review of Economics and Statistics*, 47, 13-37.

Lucas, R.E., Jr., 1978, "Asset prices in an exchange economy," *Econometrica*, 46, 1429-1445.

Lucas, R.E., Jr., 1982, "Interest rates and currency prices in a two-country world," *Journal of Monetary Economics*, 10, 336-360.

Mehra, R. and E.C. Prescott, 1985, "The equity premium: A puzzle," *Journal of Monetary Economics*, 15, 145-162.

Obstfeld, M., 1994a, "International capital market mobility in the 1990s," in P.B. Kenen, ed., *Understanding Interdependence: The Macroeconomics of the Open Economy*, Princeton University Press, Princeton, NJ.

Obstfeld, M., 1994b, Risk-taking, global diversification, and growth, *American Economic Review* 84, 1310-1329.

Pesenti, P. and E. van Wincoop, 1994, "International portfolio diversification and non-traded goods," working paper, Princeton University.

Roll, R., 1977, "A critique of the asset pricing theory's tests; Part I: On past and potential testability of theory," *Journal of Financial Economics*, 4, 129-176.

Roll, R., 1992, "Industrial structure and the comparative behavior of international stock market indexes," *Journal of Finance*, 47, 3-41.

Scheinkman, J.A., 1984, "General equilibrium models of economic fluctuations: A survey of theory," working paper, University of Chicago.

Sharpe, W., 1964, "Capital asset prices: A theory of market equilibrium under conditions of risk," *Journal of Finance*, 19, 425-442.

Shiller, R.J., 1981, "Do stock prices move too much to be justified by subsequent changes in dividends?" *American Economic Review*, 71, 421-436.

Solnik, B., 1974a, "An equilibrium model of the international capital market," *Journal of Economic Theory*, 8, 500-524.

Solnik, B., 1974b, "The international pricing of risk: An empirical investigation of the world capital market structure," *Journal of Finance*, 29, 365-378.

Solnik, B., and A. de Freitas, 1988, "International factors of stock price behaviour," in S. Khoury and A. Ghosh, eds., *Recent Developments in International Finance and Banking*, Lexington Books, Lexington, MA.

Stehle, R., 1977, "An empirical test of the alternative hypotheses of national and international pricing of risky assets," *Journal of Finance*, 32, 493-502.

Stockman, A.C. and H. Dellas, 1989, "International portfolio nondiversification and exchange rate variability," *Journal of International Economics*, 1989, 26, 271-290.

Stockman, Alan C., and Linda L. Tesar, 1995, "Tastes and technology in a two-country model of the business cycle: Explaining international co-movements," *American Economic Review*, March, 85: 168-185.

Stulz, R.M., 1981a, "A model of international asset pricing," *Journal of Financial Economics*, 9, 383-406.

Stulz, R.M., 1981b, "On the effects of barriers to international investment," *Journal of Finance*, 36, 923-934.

Telmer, C.I., 1993, "Asset pricing puzzles and incomplete markets," *Journal of Finance*, 48, 1803-1832.

Tesar, L., 1993, "International risk sharing and non-traded goods," *Journal of International Economics*, 35, 69-89.

Telmer, C.I. and A. Yaaron, 1996, "Persistent idiosyncratic schocks and incomplete markets," *Carnegie Mellon University*, working paper.

Tesar, L., 1995, Evaluating the gains from international risk-sharing, *Carnegie Rochester Conferences on Public Policy* 42, 95-144.

Tesar, L.L. and I.M. Werner, 1992, "Home bias and the globalization of securities markets," *National Bureau of Economic Research Working Paper*, No. 4218.

Thomas, S.H. and M.R. Wickens, 1993, "An international CAPM for bonds and equities," *Journal of International Money and Finance*, 12, 390-412.

Van Wincoop, Eric, 1994 "Welfare gains from international risk sharing," *Journal of Monetary Economics*, 34, 175-200.

Van Wincoop, Eric, 1996, "Growth uncertainty and risksharing," *Federal Reserve Bank of New York*, working paper.

Figure 1

Risk Return Trade-Off:
Portfolios of U.S. and Foreign Mutual Funds

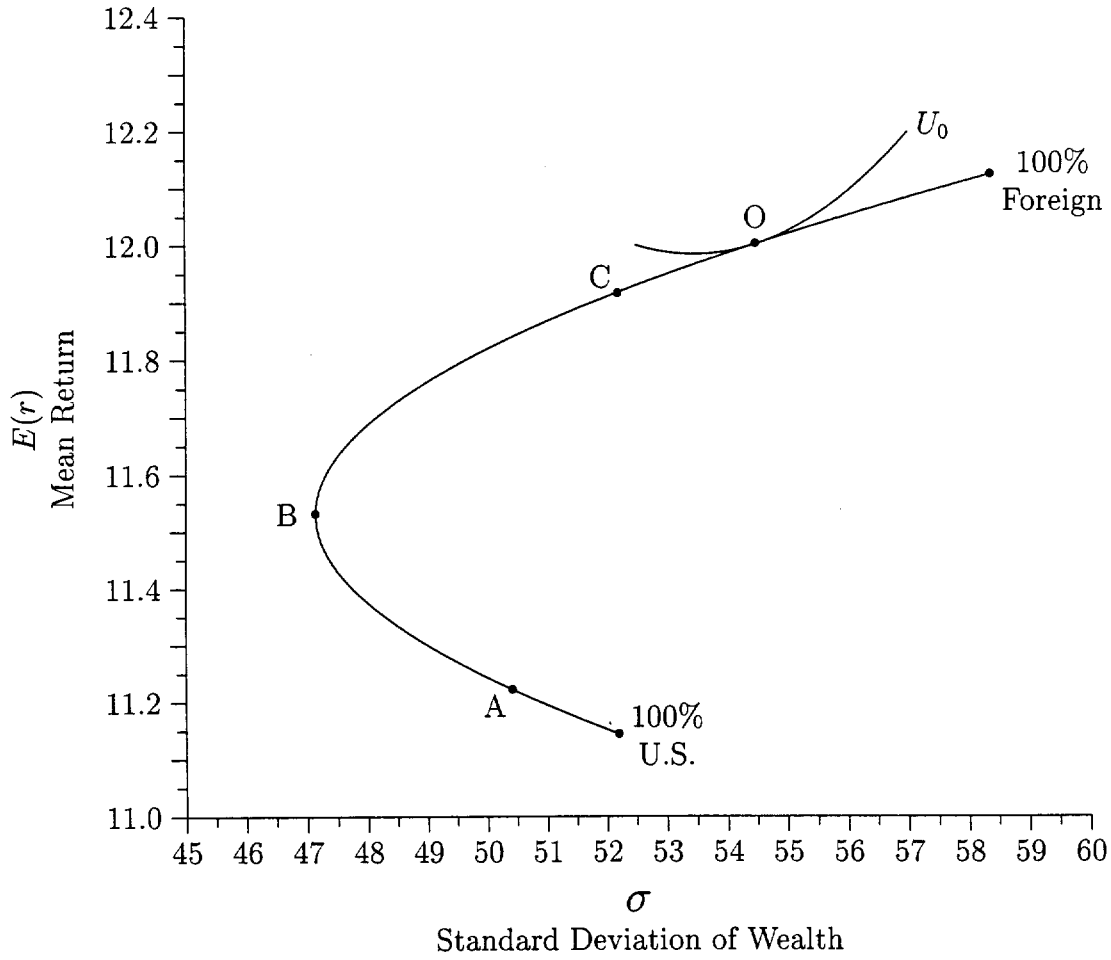

Figure 2

Pension Funds
Foreign securities as % of total assets

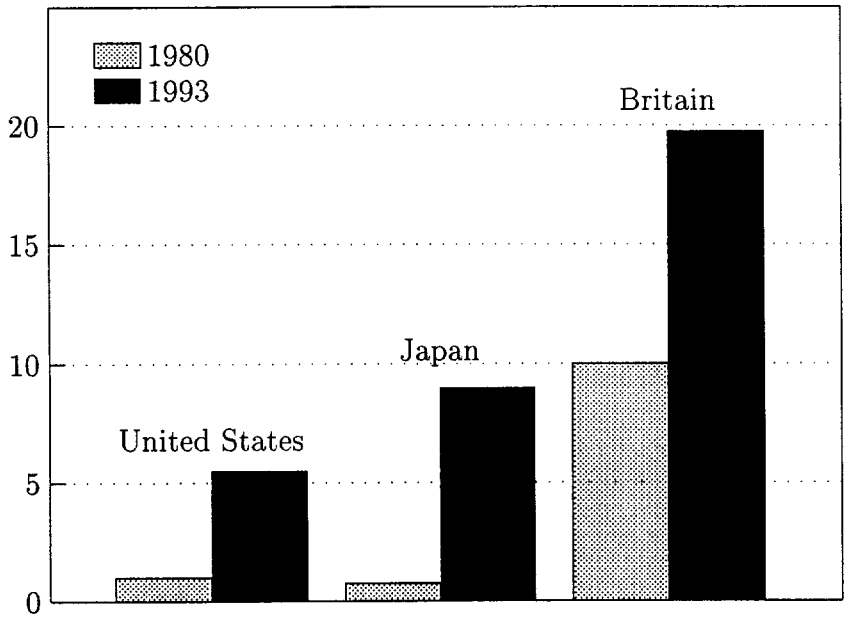

Table 1

Home Bias in Consumption Movements

A. Consumption and Output Growth Correlation Matrix for G-7

		Consumption						
		Canada	U.S.	Japan	France	Germany	Italy	UK
Output	Canada	1.000	0.700	0.050	0.121	−0.338	0.184	0.404
	U.S.	0.739	1.000	0.183	0.220	−0.092	0.120	0.584
	Japan	0.119	0.269	1.000	0.638	0.206	0.471	0.097
	France	0.359	0.345	0.673	1.000	0.054	0.391	0.092
	Germany	−0.199	0.0132	0.285	0.061	1.000	0.066	−0.139
	Italy	0.222	0.306	0.597	0.652	0.256	1.000	0.047
	UK	0.326	0.551	0.355	0.411	−0.005	0.340	1.000

B. Regressions of Country-Specific Consumption Growth on Country-Specific Output Growth

	Canada	U.S.	Japan	France	Germany	Italy	UK	PWT Pooled[a]
β	0.758	0.645	0.883	0.810	0.915	0.757	1.024	0.969
(Standard Error)	(0.083)	(0.087)	(0.711)	(0.139)	(0.038)	(0.121)	(0.113)	(0.028)

[a] ~~Corre~~cted for heteroskedasticity. Pooled for 72 countries rated $C-$ or better in Penn World Tables.

Table 2

Home Bias in International Equity Markets

A. Summary Statistics for Returns

	U.S. $E(r^h)$	Canada	France	Germany	Italy	Japan	UK	EAFE $E(r^f)$
1. Means[a]	11.14	9.59	11.63	11.32	5.81	14.03	12.62	12.12
2. Standard Deviation[b]	52.20	64.65	80.83	70.24	90.70	77.93	83.04	58.36
3. Correlation Matrix:								
U.S.	1.00	0.70	0.44	0.36	0.22	0.26	0.51	0.48
Canada	—	1.00	0.43	0.31	0.29	0.27	0.52	0.49
France	—	—	1.00	0.60	0.42	0.39	0.54	0.65
Germany	—	—	—	1.00	0.37	0.37	0.43	0.62
Italy	—	—	—	—	1.00	0.38	0.35	0.51
Japan	—	—	—	—	—	1.00	0.36	0.86
UK	—	—	—	—	—	—	1.00	0.71
EAFE	—	—	—	—	—	—	—	1.00

4. Variance-Covariance Matrix for U.S. and EAFE	$\text{Var}(r^h)$	$\text{Var}(r^f)$	$\text{Cov}(r^h, r^f)$
	2,725	3,406	1,415

B. Foreign Portfolio Shares in Percent of Wealth

	Actual	Implied								
γ	NA	0.1	0.5	1.0	1.5	2.0	2.5	3.0	6.5	10.0
χ_t^f	8.00	39.75	39.51	39.48	39.47	39.47	39.46	39.46	39.45	39.45

Notes: [a]Annualized Mean Dollar Monthly Returns.

[b]Annualized Standard Deviation of Monthly Returns = 12 × Standard Deviation of Monthly Return.

Table 3

Domestic Relative to Foreign Turnover of Stock Ownership

Country	Domestic Ratio	Foreign Equity Held by Domestic Resident	Domestic Equity Held by Foreign Resident
Canada	0.61	7.7	2.2
UK	0.77	NA	1.4
U.S.	1.07	2.5	1.6

Notes: From Tesar and Werner (1992).

Table 4

A. Institutional Investors' Holdings of Foreign Securities
(In percent of total assets)

	1980	1988	1990	1991	1992	1993
Pension funds						
Canada	4.1	5.3	5.8	8.5	10.2	10.3
Germany	—	3.8	4.5	4.5	4.3	4.5
Japan	0.5	6.3	7.2	8.4	8.4	9.0
United Kingdom	10.1	16.5	18.0	20.8	22.0	19.7
United States	0.7	2.7	4.2	4.1	4.6	5.7
Mutual funds						
Canada	19.9	19.5	17.5	16.2	16.7	17.1
Germany	—	—	56.3	53.5	47.6	45.2
Japan[1]	—	9.1	7.9	13.0	9.9	—
United Kingdom	—	—	37.1	39.2	37.9	36.0
United States	—	—	—	6.6	—	10.1

Sources: Bank of Canada, *Bank of Canada Review*, various issues; Bank of Japan, *Economic Statistics Monthly*, various issues; Bisignano (1994); Chuhan (1994); European Federation of Investment Funds and Companies; International Monetary Fund, *International Financial Statistics*; InterSec Research Corporation; United Kingdom, Central Statistical Office, *Financial Statistics*, various issues; United States, Board of Governors of the Federal Reserve System, *Flow of Funds Accounts*, various issues, and IMF staff estimates.

[1]Investment trusts.

(continued)

Table 5

Net Crossborder Equity Flows[1]
(in billions of U.S. dollars)

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Investor from									
North America	3.7	−2.2	4.0	21.0	12.0	48.3	46.7	89.1	55.0
United States	2.6	−2.7	2.0	19.0	10.3	43.3	42.3	84.8	49.0
Canada	1.1	0.5	2.1	2.0	1.8	4.9	4.4	4.3	6.0
Japan	8.2	16.9	3.0	17.9	6.3	3.6	−3.0	15.3	13.5
Europe	21.4	9.5	14.4	38.3	4.6	40.0	8.0	61.0	46.3
United Kingdom	8.9	3.8	9.7	24.2	−0.9	25.6	−3.1	19.4	14.2
Rest of the world	8.8	−7.7	11.4	9.4	−19.7	8.7	2.0	30.9	4.8
Equity from									
North America	19.8	20.3	−3.7	13.8	−15.9	9.6	−3.9	32.3	6.3
United States	19.1	16.5	−1.4	11.4	−14.5	11.0	−4.1	24.3	1.8
Canada	0.7	3.8	−2.3	2.4	−1.3	−1.4	0.3	7.9	4.5
Japan	−15.8	−42.8	6.8	7.0	−13.3	46.8	8.9	20.4	45.5
Europe	33.6	29.7	23.0	47.7	15.9	24.2	25.5	68.5	29.1
United Kingdom	7.8	19.5	9.7	11.2	5.4	5.8	10.1	19.6	11.1
Emerging markets	3.3	5.9	3.5	10.1	13.2	15.8	21.2	62.4	39.9
Hong Kong, China, and Singapore	2.7	4.8	1.9	1.9	2.4	3.9	5.9	17.1	9.0
Other Pacific Rim countries	0.7	1.3	0.6	1.4	1.5	0.9	5.0	23.0	7.0
Latin America	0.2	0.4	0.7	7.0	9.9	11.2	9.6	20.0	14.9
Other[2]	−0.3	−0.6	0.3	−0.3	−0.6	−0.1	0.7	2.2	9.0
Rest of the world	1.0	3.4	3.2	8.1	3.3	4.2	2.0	12.3	1.8
Total	42.0	16.4	32.9	86.6	3.2	100.6	53.7	196.3	119.6

Source: Baring Securities and *IMF Capital Markets Report*, 1996.

[1]The data for 1994 are estimates.

[2]Africa, Middle East, and Eastern Europe.

Table 6

Regressions of Tradeables on Non-Tradeable Goods and Leisure

$$\Delta c_t^i = \theta_0(t) + \theta_1 \Delta n_t^i + \theta_2 \Delta \ell_t^i + \theta_3 \Delta d_t^i + \beta \Delta y_t^i + \epsilon_t^i$$

Regressors	Coefficients				% Tradeables Explained by Non-Tradeables[a]
	θ_1	θ_2	θ_3	β	
1. Tradeables Output	—	—	—	0.533 (0.002)	—
2. Non-Tradeable Goods and Tradeables Output	0.027 (0.020)	—	—	0.505 (0.018)	0.3%
3. Leisure and Tradeables Output	—	0.250 (0.226)	—	0.533 (0.002)	$< 0.1\%$
4. Durables Purchases and Tradeables Output	—	—	0.131 (0.043)	0.412 (0.055)	6.73%
5. Non-Tradeable Goods, Leisure, Durable Purchases	0.033 (0.045)	0.500 (0.920)	0.133 (0.040)	0.373 (0.110)	9.48%

Notes: Heteroskedasticity-corrected standard errors in parentheses.

[a]Calculated as

$$\frac{\text{Var}(\Sigma_j \theta_j Z_{jt})}{\text{Var}(\Delta c_t - \theta_0(t))}$$

where Z_{jt} is the regressor j at time t.