Explaining Home Bias in Equities and Consumption

by

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ABSTRACT

Domestic investors hold a substantially larger proportion of their wealth portfolios in domestic assets than standard portfolio theory would suggest, a phenomenon called "equity home bias." In the absence of this bias, investors would optimally diversify domestic output risk using foreign equities. Therefore, 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, a phenomenon I call "consumption home bias." In this paper, I discuss these two biases and their potential relationship.

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Do individuals hold the optimal portfolio? Do they do a good job of hedging risks? The answer to these questions are clearly important for understanding the economy. If individuals indeed hedge risk optimally, then resources are allocated to their most efficient uses. If not, then many other questions arise. Why not? What is the explanation for these inefficiencies? And what do these explanations say about how the economy behaves?

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?*[1] Here the answer appears to be "no."

This answer has come from both financial and macroeconomic research. At least since the 1970s, financial economists have noted that the proportion of foreign assets held by domestic investors is too small relative to the predictions of standard portfolio theory (Haim Levy and Marshall Sarnat (1970), for example). More recently, macroeconomic models based upon complete markets that assume agents can trade Arrow-Debreu claims on international assets have implied that the *ex post* marginal rates of substitution in consumption should be equalized for residents in different countries. Under the additional assumption of isoelastic utility, these models imply that consumption growth rates should be equal across countries, an implication dramatically rejected by the data (Paolo Leme (1984), Jose Scheinkman (1984), and David Backus, Patrick Kehoe, and Finn Kydland (1992)). 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 with foreigners and their marginal rates of substitution will not be equalized internationally.[2]

The observation that individuals hold too little of their wealth in foreign assets has been called "home bias." As noted above, this phenomenon may also be related to the observation that consumption growth rates do not move together across countries as much as international risk-

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[1]Another subset of these questions concern hedging risks across smaller groups of individuals such as regions or even households. Given space constraints, I do not address these issues here.

[2]As I describe below, this link does not necessarily hold. For example, if individuals can borrow and lend internationally, *ex post* risk-sharing in consumption can be largely duplicated through *ex ante* consumption smoothing behavior even in the presence of no international trade in equities (John Heaton and Deborah Lucas (1995,1996), Chris Telmer (1993).)

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 these two rather different literatures jointly to provide a more complete perspective of the home bias phenomenon.

To understand the nature of "equity home bias" as noted in finance models, consider Figure 1. This figure plots the mean and standard deviations of annualized monthly returns from January 1970 to December 1996 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.[3] This index is often used as a non-US world stock market index, a convention that I follow below. Moving along the curve from 100% US stocks to 100% foreign stocks, 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. Thus, the relatively low risk aversion as assumed by this utility function implies an even higher proportion of foreign stocks than point C. Indeed, a portfolio of 100% share in the S&P 500 is dominated by all portfolios with foreign share of about 39% corresponding to the minimum variance point B. Nevertheless, estimates from the literature put the share of US holdings of foreign equities at about 8%, which would imply point

[3]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.

A.[4]. Clearly, this portfolio 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 suboptimal to 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 iso-elastic, 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 annual data from the Penn World Tables from 1950 to 1992.[5] 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, individuals in different countries should optimally diversify their domestic output risk by

[4]This estimate is from Henning Bohn and Linda Tesar (1996) and is based upon aggregate US equity flows cumulated over time. Kenneth French and James Poterba (1991) give similar estimates of foreign equity holdings. Milton Pappas (1997) describes a new survey by the U.S. Treasury Department that estimates U.S. holdings of foreign securities on March 31, 1994 to be $870.3 billion, about $353.6 billion higher than earlier U.S. Commerce Department estimates. However, the survey does not provide a measure of U.S. portfolio wealth to provide a new foreign portfolio share estimate.

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

purchasing claims on other countries' output. In this case, consumption growth rates should have a high correlation even when output growth rates do not. Clearly, the evidence in Table 1 shows the opposite pattern. Consumption growth rates have a lower correlation (shown in the upper triangular portion) than output (shown in the lower triangular portion.) This pattern is difficult to reconcile with risk-sharing.

Panel B of Table 1 shows an alternative way to view this phenomenon. Consumption growth rates, Δc_t^i for each country *i* at time *t*, are regressed on a common world time effect $\theta_o(t)$ and output growth rates, Δy_t^i for country *i* at time *t*:

$\Delta c_t^j = \theta_o(t) + b\ \Delta y_t^j + u_t^j$.

This regression therefore gives the relationship between country-specific (domestic minus world) consumption growth and country-specific (domestic minus world output) output growth. Under perfect risk-sharing, idiosyncratic consumption growth will be uncorrelated with the idiosyncratic output growth. Therefore, risk-sharing implies that $b = 0$.

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 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.[6] 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 quite different literatures: the first in financial economics, the second in macroeconomics. Below, I first examine finance-based explanations and then turn to those based in macroeconomics. Finally, I discuss whether current knowledge about home bias in equities can improve current understanding of home bias in consumption and vice versa.

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

This essay concerns many of the ideas in the current literature on home bias in equities and consumption. However, given the breadth of the two literatures and my own space constraints, this essay is neither comprehensive nor a bibliography of current research in the area. As such, I exclude many important and useful papers with apologies to their authors.[7]

I. Home Bias Observed in International Equity Markets

The home bias in international capital markets was first noted in the finance literature. In this literature, stock returns are treated as exogenous, an assumption I maintain in my discussion of the equity home bias. 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 a suboptimally small proportion of foreign stocks *and* bonds (Bruno Solnik (1974a)). 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 minimize the importance of home bias but nonetheless find the bias difficult to explain. Introducing bonds is likely to make the home bias puzzle even worse.

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 gains or losses on both local stock market and exchange rate changes.

Row 1 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 return for the "Europe, Australia and Far East" EAFE index or EAFE.

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[7]For some surveys related to parts of this essay, see Tesar (1995), Rene Stulz (1994), and Karen Lewis (1995). Karen Lewis (1998) contains more references but is still incomplete.

Row 2 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 is easy to understand. Variability in US returns depend only upon the stock market, while 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 US dollar exchange rate against the foreign currency.

Row 3 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 Table 2, A.

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 modified to include foreign securities.[8] 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:

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

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

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

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:[9]

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

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

Note that the portfolio variance, $\underline{\chi}_t' Var_t(\underline{r}_{t+1}) \underline{\chi}_t$, 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. 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.[10] 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 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 decreases 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

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[9]Clearly, 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 below, inflation risk is small relative to equity and currency risk, and cannot account for home bias. Therefore, I ignore this distinction here for the sake of simplicity, but emphasize the distinction where important below.

[10]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.

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 share is only 8%. Clearly, no degree of risk intolerance can justify such a low level of foreign portfolio allocation. Thus, these numbers suggest the presence of home bias.

B. Examining the Pricing Relationships

This CAPM framework presumes international capital markets are integrated so that domestic investors can hold foreign equities. One indirect approach to examining home bias is to study whether the pricing relationships consistent with no home bias are maintained. If so, it might be argued that home bias in holdings of stocks is relatively unimportant since equity trade appears to generate pricing relationships consistent with integrated markets. If not, international capital markets are often perceived to be "segmented" into domestic markets.

1. Equity Pricing Assuming Integration in Capital Markets and Goods Markets

Using this approach, how should equity returns be related across countries in the absence of home bias? The simple model above can be used to answer this question when capital markets and goods markets are internationally integrated.

When the optimal portfolio shares hold in equilibrium, the international CAPM 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:

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

Taking the individual solution for home equity returns from (3) gives:

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

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

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

$$= \beta^h \, E_t r^M_{t+1}$$

where $\beta^h = Cov_t(r^h_{t+1}, r^M_{t+1})/Var_t(r^M_{t+1})$. Thus, stocks are priced according to their "betas" with the

market portfolio, given here as the world portfolio.

This international CAPM 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 also goods markets must be equalized through purchasing power parity.

Studies of the pricing relationships have taken at least two (non-mutually exclusive) forms. First, some use a measure of the world market return, r^M, and ask whether the β's of domestic returns on the world market explain domestic returns. The evidence from this eclectic literature is mixed.[11] The precise form of the pricing relationship among returns are usually rejected by the data. On the other hand, domestic returns move significantly with foreign returns. This evidence suggests that domestic and international equity markets are not completely segmented.

A second form called the "latent variable test" avoids specifying a world market return by simply studying the co-movements of returns. To see this relationship, 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:

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

The model therefore predicts that returns should move together in proportion to their betas. This relationship is typically tested by assuming that $E_t r^b_{t+1}$ is a linear function of some information variables. The constraints implied by equation (7) are almost always rejected by the data.[12] On the other hand, latent variable models that allow for more than one "beta" often explain returns better.

Thus, the evidence for the international CAPM under integrated markets appears to be mixed at best. The most positive evidence comes from the ability for international returns to

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[11]For example see Campbell Harvey (1991). Early empirical studies of the unconditional version of equation (6) include Solnik (1974a) and Richard Stehle (1977).

[12]See for example Geert Bekaert and Robert Hodrick (1992) and Wayne Ferson and Campbell Harvey (1993). Lewis (1995) provides a more detailed discussion and references for latent variable tests.

explain domestic return movements. However, it could be argued that this behavior is explained by reasons having nothing necessarily to do with the international CAPM.[13]

On the other hand, there is an important restrictive assumption underlying this pricing relationship. The model assumes that real returns are perceived the same by all investors regardless of their country of residence. I describe the implications of relaxing this assumption next.

2. Equity Pricing 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 (Kenneth Froot and Kenneth Rogoff (1995)). Thus, it would seem important to allow goods prices to differ across countries.

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 single beta link across equity returns 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.

To illustrate the basic effects of deviations from purchasing power parity on the international CAPM, I modify 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:

$$\chi_t^f = \frac{(E_t r_{t+1}^f - E_t r_{t+1}^h)/\gamma}{\mathrm{Var}(r^f - r^h)} + \frac{(\sigma_h^2 - \sigma_{hf})}{\mathrm{Var}(r^f - r^h)} \qquad (8)$$

[13]For example, Mervyn King and Sushil 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.

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}.

There is a straightforward interpretation to this demand function given by Adler and Dumas (1983). 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 γ, and hence the greater the response of demand to higher expected returns. On the other hand, as γ increases, the importance of relative returns across countries declines. In the limiting case when γ 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 foreigner's portfolio optimization follows the same steps as the domestic resident, except that the foreigner views real returns in units of his 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.[14] 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 as noted earlier.

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

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[14]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, $r^i_t = r^{*i}_t + \pi_t - \pi^*_t - \Delta s_t$.

$$\chi_t^{*f} = \frac{(E_t r_{t+1}^{f} - E_t r_{t+1}^{h})/\gamma}{Var(r^f - r^h)} + \frac{(\sigma_h^2 - \sigma_{hf})}{Var(r^f - r^h)} - \frac{Cov(\varepsilon_{t+1}, r_{t+1}^{f} - r_{t+1}^{h})}{Var(r^f - r^h)} \quad (9)$$

The first two components represent the same portfolio demands as for the domestic investor. These components are, respectively, the speculative portfolio and a hedge portfolio components.

Foreigner demand for foreign equity also includes a third component, however. This component 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 home inflation π represents higher foreign inflation measured in home currency, $\pi^*_t + \Delta s_t$. Thus, if the covariance between ε and foreign excess returns is positive and, therefore, the covariance between ε and domestic excess returns is negative, then domestic equities provide a natural hedge to foreigners. Therefore, the covariance between ε and excess returns enters into the demand equation for foreign equities 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:

$$E_t r_{t+1}^{f} - E_t r_{t+1}^{h} = \gamma \omega_t^* Cov(\varepsilon_{t+1}, r_{t+1}^{f} - r_{t+1}^{h}) - \gamma (\sigma_h^2 - \sigma_{hf}). \quad (10)$$

Thus, international returns depend upon the foreign inflation hedge portfolio weighted by the foreign share in world wealth.

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 are driven by inflation risk "betas" that are specific to individual countries. To see how this modification affects the simple equilibrium relationship in (10), multiply and divide the right-hand side by the variance of foreign relative to home returns, $Var(r^f - r^h)$. Then, equation (10) can be rewritten:

$$E_t r_{t+1}^{\ f} - E_t r_{t+1}^{\ h} = \gamma\, Var(r^f - r^h)\, (\omega_t^{*}\, \beta^{\varepsilon,f-h} + \beta^{h,f-h}) \qquad (10')$$

where $\beta^{\varepsilon,f-h} \equiv Cov(\varepsilon, r^f - r^h)/Var(r^f - r^h)$, the beta of PPP deviations with the excess return, and where $\beta^{h,f-h} \equiv Cov(r^h, r^f - r^h)/Var(r^f - r^h)$. Returns now depend upon two betas. The first captures the component that hedges PPP deviations while the second includes the component that hedges nominal return comovements.

In this simplified two-country version, the inflation hedge implies only one additional beta. However, the original Adler and Dumas (1983) model shows more generally that world equity returns depend upon a matrix of exchange rate changes weighted by a vector of country shares in world wealth. Hence, returns depend upon multiple betas.

The typical finding that single beta models of international stock returns are rejected in favor of multiple factor models provides some indirect support for this model. However, the model also predicts that the multiple factors arise from the variance of exchange rate changes (driving the PPP deviations.) Estimates based upon unconditional means and variances have rejected the notion that country-specific inflation hedge portfolios can explain home bias (Ian Cooper and Evi Kaplanis (1994)). More recent estimates of the conditional version of this CAPM also reject the model, but find that exchange rate risk has significant explanatory power for equity returns (Bernard Dumas and Bruno Solnik (1995)).

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

Overall, the evidence for the international CAPM has been mixed. The data usually reject the model, yet returns often have significant explanatory power for other returns. Moreover, multiple factor models have more success than the single factor models in explaining returns,

particularly when the estimation accounts for exchange rate risk. What this 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. Without addressing why markets are segmented or integrated, the existing literature cannot provide an answer to the home bias question either.

Instead the literature typically imbeds the assumption of integrated markets into the tests. 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. Given the inability for the CAPM to provide an explanation to the home bias puzzle, I now consider more specific explanations.

C. Other Risks to Diversify

One set of explanations for the home bias puzzle maintains that domestic investors have alternative assets with underlying risks that provide the same benefits as holding foreign stocks. This line of reasoning has led to two types of answers to the home bias puzzle. First, domestic assets may provide the diversification potential without requiring domestic investors to look abroad for securities with the requisite attributes. Second, the lack of marketable trade in certain parts of wealth can affect the importance of diversification possibilities. I describe these two related arguments here.

C1. The International Diversification Potential of Domestic Stocks

An old story 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 argument seems plausible, it does not hold up empirically. The stocks of multinationals usually move quite closely with their respective national market indexes. Indeed, studies have shown that the betas of these stocks with respect to their own markets are usually relatively close to one. Therefore, the multinationals provide little better diversification than the domestic market.[15]

When viewed in light of the evidence described earlier, this result is perhaps not surprising. Many multinational firms are important components 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.

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

Implicit in the capital asset pricing model is the assumption that all wealth is liquid and tradeable. Thus, the CAPM is typically measured with respect to a market portfolio of stocks and perhaps bonds.

On the other hand, important components of wealth are not liquid and still other components are not tradeable at all. Therefore, the question is: do these non-tradeable assets provide a rationale for domestic residents to hold a disproportionately large share of their wealth in the domestic market?

Human capital is often considered the largest component of non-marketable wealth. However, omission of this asset from the analysis turns out to worsen the home bias puzzle rather

[15]Some evidence for the importance of national factors is provided by Bertrand Jacquillat and Bruno Solnik (1978) and Steven Heston and Geert Roewenhoerst (1994).

than help resolve it. Marianne Baxter and Urban Jermann (1997) show that domestic human capital returns are highly correlated with the domestic stock market returns but not 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.

Indeed, as long as non-marketable wealth is more highly correlated with the domestic market than with the foreign market, this explanation cannot help explain the home bias puzzle.

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 International Equity Diversification

An alternative explanation for the equity home bias puzzle is that the gains from diversifying are insufficient to warrant the costs involved in diversifying the portfolio. However, the gains from international diversification of stock portfolios appear to be large.[16]

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. 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

[16]For an early reference, see Levy and Sarnat (1970), or more recently, Robert Grauer and Nils Hakansson (1987).

upon his utility function.[17] Solving for this optimal allocation with different values of relative risk aversion implies gains ranging from 20% to near 100% of lifetime (permanent) consumption (Karen Lewis (1996b)). 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 argument that the gains are not worth the costs of foreign investing. This reasoning leads to the next potential explanation for equity home bias.

E. Restrictions and Frictions Affecting Foreign Investment

An alternative approach is to assess the costs, rather than the gains, of international diversification. If the costs of acquiring and/or holding foreign equities are sufficiently high, then investors may be induced to keep their savings at home. The costs of international diversification include international taxes, informational costs, and other barriers to trade equity.

To understand how taxes or costs can affect foreign holdings, consider the optimal allocation of foreign stocks as implied by equation (8). Suppose now that taxes or costs on foreign holdings can be represented by a constant 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 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:

$$\chi_t^f = \frac{(E_t r_{t+1}^{\ f} - \tau - E_t r_{t+1}^{\ h})/\gamma}{Var(r_h - r_f)} + \frac{(\sigma_h^2 - \sigma_{hf})}{Var(r_h - r_f)} \qquad (11)$$

As the costs or taxes τ increase, the domestic holdings of foreign stocks decrease. Theoretical

[17] 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, the so-called "tangency portfolio." Since I am focusing upon equities and not bonds, I do not directly address the tangency portfolio in this essay. However, I discuss below some empirical estimates of the extent of equity home bias which use the tangency portfolio.

studies have clarified the relationship between returns and taxes.[18] Some empirical evidence has suggested that markets are segmented due to taxes and other restrictions.[19]

Indeed, governmental capital controls have historically generated significant hurdles to international investment. Under the Bretton Woods system, these controls were often imposed to help maintain some short term autonomy of monetary policy. Following the break-down of this system, many countries maintained taxes and other restrictions on international investment into the 1980s and even the early 1990s. More recently, however, the international trend has been toward more deregulation both among the capital markets of developed countries as well as the developing countries' so-called "emerging markets."

If governmental restrictions had been an impediment to investment, then the dismantling of these restrictions ought to increase foreign investment. This foreign investment increase should be particularly strong among investors with relatively low costs of transacting in financial markets such as institutional investors. Indirect evidence for changes of foreign investment over time for these investors is given in Table 3 and Figure 2. From 1980 to 1990 and then to 1993, the foreign securities portion of pension funds increased for all countries considered. This increase is particularly striking since pension fund managers are often restricted in the size of their foreign portfolio allocation.

On the other hand, the data generally suggests that home bias is still prevalent, even among institutional investors. Evidence for a rise in foreign holdings by mutual funds is more mixed than for pension funds. With the exception of the US, the foreign allocation of mutual funds has either remained about the same or even declined in the case of Germany. Moreover, the foreign share of

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[18]These papers include Fischer Black (1974), Rene Stulz (1981a), and Vihang Errunza and Etienne Losq (1989).

[19]For instance, Vihang Errunza and Etienne Losq (1985) test a restricted version of the Stulz (1981a) model.

both mutual funds and pension funds are quite low in the US at 10% and 5.7%, respectively.

Another way to examine whether restrictions affect portfolio allocation is to examine securities prices from countries where these restrictions are prevalent, such as in emerging markets. This evidence suggests that the capital restrictions have been binding on foreign investors.
Empirical studies show that deviations between the value of equities on domestic markets relative to international markets decline once international capital market liberalization is introduced and vice versa (Catherine Bonser-Neal, et al (1990), Gikas Hardouvelis, Rafael La Porta, and Thierry Wizman (1994), and Stijn Claessens and Moon Whoan Rhee (1994)).

An alternative cost of foreign investment is the cost of acquiring information about foreign equity markets (Thomas Gehrig (1993)). Equity investment in foreign companies that are not cross-listed in domestic markets requires understanding foreign accounting practices and corporate relationships, not to mention the legal environment. Some indirect evidence points to the importance of these informational costs. For example, Jun-Koo Kang and Rene Stulz (1997) find that foreign investors primarily invest in stocks of Japanese companies that are better known to foreign investors, even when the expected returns are lower than returns on other Japanese stocks.

Taken together, the evidence suggests that government restrictions and information costs 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 argument is more difficult to make for the equities of 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 such as Germany and the UK yet these countries do not impose significant restrictions of capital account movements. Moreover, the costs of acquiring information on at least some firms in these countries do not appear large, particularly for institutional investors and for foreign stocks that are traded in the US, so-called ADRs (American Depositary Receipts.)

Additional evidence of this implausibility is provided in Linda Tesar and Ingrid Werner (1995). 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 4 reports their results. While the domestic 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.

Indeed, cross-border equity flows have been quite large over the past decade or so. Table 5 shows the large magnitudes of these flows to and from various parts of the world. For example, in 1994, US investors acquired 49 billion dollars worth of equity from abroad while foreigners bought only 1.8 billion dollars worth of equity from the US. These figures also show tremendous volatility over time. Anecdotal evidence following the 1995 Mexican and 1997 Asian financial crises also suggest significant international movement in capital. If the costs of foreign investment are high, the size and variability of these flows are difficult to justify.

Of course, costs of foreign equity holdings are in general difficult to assess since investors differ in terms of their relevant costs. Whatever the relevant costs, it seems likely that these costs have been declining over time. 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. Empirical Uncertainty in Establishing the Presence of Equity Home Bias

An alternative view of the equity home bias comes from incorporating empirical uncertainty into the analysis. Note that the gains from international diversification in finance are calculated from measures of the expected returns and their variances. These measures are typically derived from historical means and variances of returns. 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 from 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%.[20]

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 not statistically 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.

Some recent research examines just this issue. Geert Bekaert and Michael Urias (1996) use an estimation approach that examines whether the sources of uncertainty contained in foreign returns is captured or "spanned" by domestic returns. In particular, they examine the gains from the point of view of U.S. and U.K. domestic investors of holding closed-end mutual funds invested in foreign countries. They find that these country funds are spanned by the U.S. market and, hence, cannot reject the hypothesis that there are no gains to foreign investment for Americans. This same hypothesis is rejected for the U.K. Thus, the Bekaert-Urias results would seem to

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

suggest that home bias cannot be explained by statistical uncertainty for the residents of the U.K.

Larry Gorman and Bjorn 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 of the G-5 countries (U.S., U.K., Germany, France, and Japan). They examine a number of different scenarios finding somewhat mixed results for the presence of home bias.[21]

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. Similarly, Gorman and Jorgensen (1996) examine exclusively the Group-of-Five countries and do not allow for holdings in other markets.[22] Also, in marked contrast to the home bias literature, other finance research tends to find little or no effect from estimation risk on portfolio allocation decisions, even when these decisions include foreign stocks (Robert Stambaugh (1997), for example). These inconsistencies require further research.

Nevertheless, this literature is likely to be important in the future as it puts the home bias

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[21]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. 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.

[22]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 greater diversification potential may make home bias more likely for these countries.

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, rejections of the international CAPM do 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 argument that the potential gains are not worth the costs of diversification also appears 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.

A different 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 domestic investor should place a significant fraction of his wealth in foreign stocks, these calculations do not include the uncertainty of the estimates of means and variances. Recent research suggests that once this uncertainty is included, the hypothesis that portfolios with foreign investments are not better performers than domestic portfolios alone cannot be rejected. This line of research suggests that

the hypothesis that "equity home bias" does not exist cannot be rejected, although the robustness of this result remains to be seen.

In the meantime, there are at least three different issues that arise from this research to date. First, even if the returns are too volatile to imply statistically significant differences in mean returns as some researchers claim, 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. Thus, an important issue for future research is whether foreign investment can reduce the variability of a domestic portfolio and the precision with which one make this claim.[23]

Second, the standard investment analysis used to motivate 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.

By contrast, the large movements of capital in and out of emerging markets during the early 1990s suggests that many investors do not follow "buy and hold" strategies. Table 5 shows that over the 1990s, cross-border equity flows across countries and, particularly, into developing countries have been quite volatile. 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.

Thus, the second issue for future research is to understand who is undertaking the market-

[23]Note that the spanning test of Bekaert and Urias (1996) directly addresses whether closed-end country funds can reduce the variability of a domestic investor's portfolio, but the generality of their results to open-ended foreign investments is not yet known.

timing strategies. One possibility is that institutional investors are behind much of these large movements in capital. If this possibility is indeed true, then it implies that agency problems between individual investors and money managers may be an important piece of the equity home bias puzzle.

A third issue for future research is generated by these large capital flows as well. That is, while foreign equity *flows* by domestic residents are large, the home bias puzzle says that foreign equity *holdings* are small. This observation makes the home bias puzzle even more puzzling. It suggests that a full explanation of home bias must reconcile these two seemingly contradictory observations.

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

II. Home Bias Observed in International Consumption Movements

Following the initial observation of home bias in the finance literature based upon exogenous equity prices, the international macroeconomics literature began to examine investor home bias as well in the 1980s. In this newer literature, asset prices are typically treated as endogenous. In particular, the equity returns are determined by consumption allocation decisions across time and states of nature. Thus, the underlying focus of this macro literature has been upon consumption behavior. I therefore categorize this research as "consumption home bias" because it treats stock returns as indirect functions of consumption.

In this part of the essay, I examine this home bias literature grounded in macroeconomics. 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 important caveats. Finally, I describe some explanations and empirical evidence for this puzzle and 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. The first-order conditions of this social planner problem also give the first-order conditions that arise when markets are complete and domestic investors optimally choose foreign securities. Therefore, this first-order condition underlies many macroeconomics-based studies of the home bias puzzle.[24]

Consider then 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 is separable in tradeable consumption. I will return to the case where non-tradeables are non-separable in utility below.

Given these assumptions, the social planner maximizes:

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

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

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

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, $Y^j(s^t)$ is country *j*'s output level of tradeables in state *s* at time *t*. While the Y^j 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).

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[24]See for instance Marianne Baxter, Urban Jermann, and Robert King (1998), and Alan Stockman and Harris Dellas (1989).

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:

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

where Δc^j_t is the growth rate of consumption in country *j*. Thus, complete markets together with isoelastic utility implies that consumption growth rates should be equalized across countries.

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 some cases where consumption and output correlations are roughly the same. 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. Therefore, the co-movements in consumption implied by the absence of home bias when markets

are complete do not appear to hold in the data.

To understand the potential connection between consumption behavior and the equity home bias puzzle, I continue with the simple general equilibrium framework above, but focus upon individual investor decisions concerning equity. Under this assumption, optimal international equity market integration implies that consumption growth rates are equalized as noted above. Moreover, this framework generates pricing relationships among stock prices, providing a benchmark for empirical studies.

For this purpose, 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.

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,

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

with respect to consumption of the good, C^j, and the share of domestic equity gives the first-order condition:[25]

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

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

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

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.

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[25]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 $C^j_t + \theta_t\, z^j_t \le \theta_{t-1}\, Y^j_t + \theta_{t-1}\, z^j_t$ (Robert Lucas (1982)).

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.

Under the specific assumptions of the endowment economy, the price can be further solved in terms of the production state. In equilibrium, the quantity of shares must equal one and, in the absence of investment, consumption equals production: $C^j_t = Y^j_t$.[26] 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.

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 $\underline{z}^i_t$. In this case, as long as countries have the same iso-elastic utility function, then all countries will hold the same portfolio. 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 $\underline{Y}_t = \Sigma^J_{j=1}\ Y^j_t$, the same steps may be followed as for the closed economy case to yield the mutual fund price:

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

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:

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

Each country *j* will sell its endowment stream on world markets and receive $\underline{z}^j$. Country *j* will in

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

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: $C_t^j = \theta^j \underline{Y}_t$. Each country shares in world consumption according to its share of wealth as valued by the world stock market.

Clearly, this result leads to the same implication for international consumption co-movements as in the social planner's problem. For integrated stock markets under iso-elastic utility, residents in different countries share in the world consumption growth rate and therefore they have the same consumption growth rates as given by (16).

On an intuitive level, this discussion suggests that home bias in the portfolios of domestic investors would also mean that consumption growth rates are also not equalized. If domestic residents do not hold sufficient claims on foreign output, then domestic country-specific consumption movements would likely be positively correlated with country-specific output movements as well.

This simple intuition can be misleading, however. Home bias by domestic investors in equity markets does not necessarily generate home bias in consumption movements, a point I discuss in the final section.

B. Examining 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.1 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.[27] 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:

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

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*.[28] Since relation (21) holds for any asset with return *j*, it also holds for the risk-free rate, defined as R^{rf}.

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

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:[29]

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

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

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

Thus, all returns must move in proportion to eachother according to the ratios of their conditional covariances with the marginal rate of substitution in consumption.

Note that this proportionality of returns is precisely the same prediction as given by the international CAPM relationship in equation (7). Latent variable tests examine this same proportionality. Therefore, the latent variable tests discussed in Section I.B could also be

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[27]Lars Hansen and Robert Hodrick (1983) is the pioneering study in this literature. Lewis (1995) provides a survey.

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

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

interpreted as evidence in favor or against the first order condition (21).

As noted earlier, the evidence from this literature rejects the hypothesis that a single factor of proportionality drives returns, but instead supports the view that multiple factors determine these returns. The main contribution of this literature testing for latent variable relationships seems to be its characterization of the behavior of excess 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.2 Hansen-Jaganathan Bounds

The pioneering work of Lars Hansen and Ravi Jaganathan (1991) provides a useful way to compare the variability of predictable excess returns with the implications of any particular pricing relationship such as the investor's first order equation in (22). 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, rewrite equation (22) using the Law of Iterated Expectations and subsuming the superscript *j*:

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

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

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

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

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

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 (25). Substituting (27) into (26) above and noting that the variance of e_t is positive, we have:

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

or,

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

This inequality, known as the Hansen-Jaganathan bounds, says that the ratio of the standard deviation of the intertemporal marginal rate of substitution to its mean must exceed the scaled second moment of excess returns given by the right-hand side of equation (29).

Evidence on this relationship provides a startling contradiction to this inequality. Bekaert and Hodrick (1992) estimate Hansen-Jaganathan bounds 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 lower bounds on the right-hand side of (29) are in the vicinity of .6 to .7. However, Geert 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 values near the Bekaert and Hodrick (1992) estimates, this risk aversion coefficient must be over 140!

Why does the risk aversion coefficient have to be so large to justify the high returns? Consider again the first order condition for returns given in equation (23). 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.

Thus, a major problem with reconciling investor home bias with international consumption movements is that the volatility of the implicit intertemporal marginal rate of substitution is not high enough to explain stock price movements. This is a common inconsistency in the domestic asset pricing literature (Rajnish Mehra and Edward Prescott (1985).)

C. Other Risks to Diversify

The standard complete markets framework above presumed that the consumption good is tradeable across countries. This assumption led to the outcome that consumption growth rates are equalized across countries. Consumption growth rates can differ, however, if some components of utility are not internationally tradeable.[30]

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

To illustrate this point, I 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 is no longer 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.

Given these assumptions, the social planner carries out the following optimization problem:

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

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

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

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

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

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

[30]For example, see Backus, Kehoe, and Kydland (1992) when this component is leisure and Alan Stockman and Linda Tesar (1995) when this component is non-tradeable goods.

production levels of tradeables, non-tradeables and leisure (the residual of labor) in state *s* at time *t*. As before, these quantities may either be endowments or the results of a production process.

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. Intuitively, the quantities of non-tradeables and leisure affect the marginal utility of tradeables.

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,

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

so that the growth rates of the marginal utilities of tradeables are equalized. In this case, however, the marginal utilities depend upon realizations of non-tradeable goods and leisure that differ across countries.

This new first-order condition introduces two important amendments to the discussion of how consumption home bias appears in equity holdings and consumption co-movements, respectively. First, since investors in different countries face idiosyncratic non-tradeables risks,

these investors will optimally choose to hold different securities. If so, then the pattern of foreign asset allocation across countries will correspond to attempts to hedge these country-specific risks. Second, even when domestic investors are hedging risks optimally, the growth rate of tradeables consumption will not be the same across countries. This result therefore appears to provide an opportunity to explain the low correlation of consumption across countries. I will address these two implications in turn.

C.2 Implications for Foreign Investor Allocation

How does hedging non-tradeable goods and/or leisure affect the optimal portfolio allocation? This question is addressed in a number of papers.[31] One way in which this literature acheives home bias is by inducing domestic residents to hold all of the existing equity from domestic firms that produce non-tradeable goods. This result is often acheived in one of two ways. Either tradeables and non- tradeables are assumed to be separable in utility or else domestic residents are simply assumed to be restricted from holding equities in foreign non-tradeable goods-producing firms. International risk-sharing is accomplished by diversifying into equities of foreign tradeables-producing firms.

While the exclusive ownership of domestic non-tradeables equities can help generate home bias, it appears inconsistent with casual empiricism. Moreover, for non-separable utility, there is no clear reason why domestic investors cannot acquire equities in firms that produce non-tradeables. For example, the equities of restaurant companies and of financial services firms such as insurance companies and banks are often internationally traded.

When the assumption that domestic investors must hold domestic non-tradeables equities is relaxed, the presence of non-tradeable goods no longer provides an unambiguous explanation for home bias. Baxter, Jermann, and King (1998) show that, depending upon the degree of

[31]These papers include Stockman and Dellas (1989), Laura Bottazi, Paolo Pesenti and Eric van Wincoop (1996), and Baxter, Jermann and King (1998), among others.

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. At the same time, investors around the world hold the same portfolio shares of equities in tradeable goods, a prediction which is also implausible.

Overall, the presence of non-tradeables does not necessarily help explain home bias without imposing some restrictive assumptions on the form of utility or the tradeability of foreign non-tradeables. Without these restrictions, the desire to hedge non-tradeables risk may even imply that domestic investors should increase their holdings of foreign equities, thus deepening the puzzle. Indeed, if the firms that produce non-tradeable goods are less likely to be publicly listed than firms that produce tradeable goods, then the home bias puzzle can be exacerbated. Specifically, if non-tradeables output is more highly correlated with the domestic equity market than the foreign equity market, then domestic residents who wish to hedge the risk from non-tradeables risk would tend to short the domestic stock to take larger positions in the foreign stock. This argument simply extends the logic from Baxter and Jermann (1997) about human capital to the stocks of non-tradeable goods.

Moreover, as noted above, casual empiricism does not appear to support the pattern of foreign asset allocation predicted by amending the standard model with non-tradeables. One reason may be that actual stock prices do not accurately match the risks associated with the availability of particular types of goods; an inconsistency between stock prices and consumption movements that was noted above. However, as long as domestic investors in each country optimally hedge their non-tradeables risk, the first-order conditions imply that marginal utilities of tradeables are equalized across countries.

C.3 Empirical Evidence on the Equality of Marginal Utility of Tradeables

But what is the evidence on this first-order condition? The basic regression approach used to examine the first-order conditions without non-tradeables in Table 1 can be modified for this

purpose. Recall that the form of these regression tests are:

$$\Delta c_t^j = \theta_o(t) + b\,\Delta y_t^j + u_t^j \qquad (34)$$

where $\theta_0(t)$ measures the common growth rate (of the Lagrangian in equation (13)), y_t^j is the logarithm of the 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 b = 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, therefore biasing estimates of b.

Log-linearizing the first-order condition in equation (31) gives a new version of the test described in more detail in Karen Lewis (1996a).

$$\Delta c_t^j = \theta_o(t) + \theta_1\,\Delta n_t^j + \theta_2\,\Delta l_t^j + b\,\Delta y_t^{C,j} + u_t^j \qquad (35)$$

where lower-case letters are the logarithms of their upper-case counterparts. θ_1 and θ_2 depend upon utility parameters and capture the degree of substitutability/complementarity between tradeables consumption and non-tradeables. 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, $Y_t^{C,j}$. In other words, the non-tradeables corrected test is the hypothesis that b = 0 in equation (35).

Table 6 reports the results of tradeables regression tests from Lewis (1996a). As the table shows, the hypothesis that b = 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 services contain some

components that is non-tradeable internationally, the degree of variability explained increases somewhat, but is not greater than 10%. 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. The Gains from International Consumption Diversification

As noted before, an important question for addressing home bias is: what are the potential gains from international diversification? Recall that in terms of diversifying stock returns, the gains from holding foreign stocks are estimated to sometimes exceed 100% of permanent consumption.

In the context of consumption home bias, this question could be restated, what are the gains from diversifying consumption shocks across countries? The standard consumption literature tends to find that the gains are typically less than one or two percent of permanent consumption (Tesar (1995).)[32] What is the reason for these dramatic differences in estimated welfare gains from risk-sharing in equities and consumption? Since the gains come from the benefits of reducing the variability of equity returns and consumption, it seems likely that the differences in gains derive from differences in the underlying volatility of these variables.[33] This intuition turns out to be

[32]An important exception that finds high gains is Obstfeld (1994b) who allows for an internationally risk-free bond and a larger group of countries.

[33]Since volatility is at the heart of differences between some low estimates of consumption risk-sharing gains and high estimates of stock-diversification gains, I focus upon this issue almost exclusively. In doing so, I grossly generalize and simplify the gains-from-consumption-risk-sharing literature that has differed markedly in terms of other features such as the presence of non-tradeables, market incompleteness, and treatment of consumption trends. For more references and

correct.

To understand how differences of variability translate into calculations of welfare gains, it is useful to consider a standard approach to calculating welfare gains (Robert Lucas (1987), Hal Cole and Maurice Obstfeld (1991)). The gain is calculated by asking how much permanent consumption must be given to an investor who is in autarky to make him as well off as he would be if he were optimally diversified. In other words, if C^A is permanent consumption at autarky and C^* is permanent consumption based upon the optimally diversified portfolio, then the gain, g, is given by:

$$U(C^A(1 + g)) = U(C^*) \qquad (36)$$

The calculation of this measure will obviously depend upon: (a) the utility function and (b) the measures of permanent consumption in autarky, C^A, and at the optimum, C^*.

How much utility investors gain by reducing risk is given by the curvature of the utility function. Using the constant-relative-risk-aversion (CRRA) form as above: $U(C) = (C^{(1-\gamma)})/(1-\gamma)$. Thus, the gains from diversification will depend in part upon risk aversion.[34]

The next item needed to calculate the gains is the set of measures of the autarky consumption path, C^A, and the optimal consumption path, C^*. One method is to examine the lower bound case where risk-sharing eliminates all consumption variability (Lucas (1987)). Another method is provided by the international equity model in Section II.A. Recall that in autarchy, domestic residents hold the domestic equity and, hence, consume the dividend stream of domestic

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discussion, see Lewis (1995,1998).

[34]I use the CRRA utility function for expositional purposes only. Indeed, when consumption grows over time, this utility function can lead to misleading interpretations of the risk aversion coefficient since it is also the inverse of the elasticity of intertemporal substitution in consumption. As clarified by Maurice Obstfeld (1994a), the problem arises because the utility gains from less variable consumption increase with risk aversion, but the gains from a steeper certainty equivalent consumption path (due to the lower variablity) also increase with the elasticity of intertemporal substitution and therefore decrease with γ. Hence, higher γ can both increase and decrease the welfare gains from risk sharing.

output. On the other hand, the optimally diversified portfolio is a mutual fund of foreign outputs, so that in equilibrium domestic investors consume a fraction of world output. Thus, C^A is the present value of domestic consumption, while C^* is the present value of the domestic country's appropriately priced share of world consumption.

Welfare calculations are therefore based upon the combination of risk-aversion given by the utility function and the set of autarky and optimal consumption paths given by domestic consumption and world consumption. Clearly, then, calculations of the welfare gains depend critically on the assumed form for the consumption processes, including both the persistence of its innovations and its variability. I discuss these two issues in turn.

First, the persistence of innovations crucially affects the overall degree of consumption variability. For example, the consumption literature that finds exceptionally small gains to risk-sharing often treats consumption risk as deviations from a deterministic trend. In other words, the consumption process may be written as:

$$c_t^j = \mu t + k\, c_{t-1}^j + e_t^j, \qquad k < 1. \qquad (37)$$

where as before c_t^j is the logarithm of consumption at time *t* for country *j*, μ is the growth rate, *t* is calendar time, k is an autoregressive coefficient, and e_t is an innovation to the consumption process. When $k < 1$, disturbances to consumption are transitory. Thus, the greatest amount of variability that can be eliminated is the variance around the deterministic world growth rate, μ.

On the other hand, this variance is substantially larger when the disturbances to consumption are permanent; i.e., when $k = 1$. In this case, the variance of the innovation cumulates over time so that the gains are potentially much greater (Obstfeld (1994a).) Rewriting (37), the consumption process becomes:

$$\Delta c_t^j = \mu + e_t^j, \qquad (37')$$

where now e_t^j is a permanent disturbance. Over time, the innovation cumulates into a stochastic trend. Thus, in contrast to the transitory shock case when $k < 1$, a reduction in the variability of

consumption affects the whole trend in consumption.[35]

In the two-period finance context characterized by the CAPM, the distinction between transitory and permanent innovations are obscured. Nevertheless, innovations to stock prices are treated as permanent through the calculation of returns and have permanent effects upon end-of-period wealth. Thus, it would seem that treating innovations to consumption as transitory as in (37) as opposed to permanent as in (37') may potentially explain the higher gains to equity diversification than consumption risk-sharing.

Some calculations of welfare gains from risk-sharing based upon permanent country-specific innovations suggest that this distinction does not provide a full explanation, however. Obstfeld (1994a) calculates the difference in gains for the U.S. economy based upon the transitory shocks in (37) and the permanent shocks in (37'). Surprisingly, when the risk aversion parameter γ is 5,

he finds that the gains to diversification from treating shocks as permanent is only 0.47% of annual consumption, compared to the gains of 0.18% based upon a deterministic time trend. Even when γ is increased to 10, a level some would argue is unrealistically high, permanent shocks imply a gain of only 0.52% while transitory shocks give a gain of 0.35%. Even with permanent shocks, the consumption variability is too low to generate significant gains, Obstfeld observes. This basic finding is echoed in multi-country studies of international risk-sharing that allow for permanent country-specific shocks (Lewis (1996b)).

This evidence suggests that while allowing for permanent shocks in the underlying risky

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[35]Technically, for the trend to a domestic investor's consumption path to be affected, the country-specific permanent shock to autarky consumption, C^A, must be independent from the permanent shock to the optimal consumption process, C^*. In other words, C^A and C^* cannot follow the same stochastic trend (i.e., they cannot be cointegrated.) Thus, a permanent shock to e_t^j is necessary but not sufficient for risk-sharing to affect the stochastic trend of domestic consumption. For simplicity, in the text, I use the terminology "permanent shock" to mean a permanent country-specific shock that is independent of the optimal consumption path.

variable may not be sufficient to explain the differences between gains based upon consumption and equities, considering the difference in variances directly may be the key. The high variability of stock returns generates volatile wealth portfolios which in turn imply significant gains for reducing the variability of these portfolios. On the other hand, the relative variability of consumption is quite low. For example, while the standard deviation of U.S. consumption growth reported by Obstfeld (1994a) is only 2.7%, the standard deviation of the U.S. market reported in Table 2 is 52.2%. The evidence suggests that this disparity is the primary source for the difference in gains between consumption and equities.

A further complication in the literature is that some studies have found very large consumption gains when the notion of risk-sharing is expanded. For example, Obstfeld (1994b) allows for international trade in a risk-free bond which permits the economy to grow at a different deterministic trend. In this context, the gains from "risk-sharing" are closer to those for equities.

The wide range of numbers for the welfare gains thus make impossible a precise statement about these gains without taking a strong stand on the investment opportunity set, described next.

E. Restrictions and Frictions Affecting International Consumption Risk-Sharing

One of the underlying assumptions in the explanations for consumption home bias 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. Any of these assumptions may be invalid and, if so, may help explain the puzzle.

Recent evidence finds that countries with international capital market restrictions also have a greater tendency to consume country-specific innovations of their output relative to the rest of the world (Lewis (1996a).) This evidence suggests that residents of these countries do not have access

to complete markets.

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. A recent literature in asset pricing has examined the effects of various types of trading frictions, including the inability to trade assets other than a risk-free bond (Heaton and Lucas (1995, 1996) and Telmer (1993)). When shocks to consumption are transitory, this literature has found that complete markets risk-sharing is largely duplicated under incomplete markets as long as investors have an asset with which to intertemporally smooth consumption.

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 international market exists for intertemporal 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. This intuition explains why studies that allow for permanent shocks to output are able to generate greater departures from the complete markets outcome.[36] It is noteworthy that this distinction between temporary and permanent shocks to consumption was also potentially important for

[36]Among others, see Kjetil Storesletten, Chris Telmer, and Amir Yaron (1997) in the asset pricing literature, and Marianne Baxter and Mario Crucini (1995) in the international macroeconomics literature.

determining the magnitude of welfare gains.

Overall, this literature implies some necessary (but not sufficient) conditions for international capital market restrictions to explain significant deviations from complete markets. Either output must have permanent productivity shocks across countries or else the restrictions must bind across all international financial markets and durable goods markets as in an autarkic economy.

F. Empirical Uncertainty in Establishing the Presence of Consumption Home Bias

In the equity home bias research, I noted earlier that an important new area of research addresses whether the presence of home bias can be established given the enormous amount of estimation variance in stock return means. Table 1 shows that the annualized variability of monthly stock returns is quite high, with a standard deviation near 52% for the U.S. By analogy, this same question could be applied to consumption home bias. That is, since consumption growth rates are variable, can we even be sure that a consumption home bias puzzle exists?

The significantly lower variability of consumption makes verifying home bias in consumption much easier than doing so for equities. The hypothesis of no consumption home bias was clearly rejected in Table 1. For instance, 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.[37] 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.

[37]On the other hand, consumption is generally viewed as containing more measurement error than equity prices with resulting difficulties in establishing consumption home bias (Lewis (1996a)).

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, investors who bias their equity holdings away from foreign assets will not optimally diversify their home output risk. As a result, the deviation of domestic consumption from world consumption is likely to 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 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 as given the required correlation between consumption and returns to explain the equity premium. 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 non-tradeables are consumed exclusively in the home country, they would appear to break the required link of common consumption growth 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. These models lead to counterfactual predictions about the domestic investor's holdings of tradeables relative to non-tradeables equities. More importantly, the first-order condition on which these predictions are based is empirically rejected. 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 may impede an 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 international equlibrium consumption movements. 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 are empirically important. Of so, then the gains from international consumption diversification are likely to be larger and the consumption home bias puzzle worsened.

III. Are Home Bias in Equities and Home Bias in Consumption Linked?

In this essay, I have discussed home bias in equities and in consumption. Home bias in equities says that domestic investors' holdings of foreign assets are too small relative to portfolio shares that would optimally hedge risk and possibly even increase returns. Home bias in consumption says that output risks are not optimally shared across countries so that domestic consumption is correlated with country-specific shocks to domestic output. Casual intuition would suggest that these two puzzles are linked. Portfolios that are biased toward domestic equities would seem to generate consumption that is biased toward domestic output.

This intuition can be misleading, however. In fact, home bias in equities is neither sufficient nor necessary for home bias in consumption.

To see why home bias in equities is not sufficient, consider a counterexample where there is only international borrowing and lending, but no trade in equities. In this world, equity home bias would be extreme: no holdings of foreign equities by either country. However, if output shocks across countries are transitory, then consumption growth rates will be highly correlated, as in the case of no consumption home bias. As discussed above, this outcome results from the desire by residents in each country to smooth consumption over time. Indeed, as long as some internationally traded asset exists for intertemporal smoothing, then the desire to consumption smooth will tend to mitigate consumption home bias (Heaton and Lucas (1995,1996), Telmer (1993)). Thus, equity home bias is not sufficient to generate consumption home bias.

To see why equity home bias is not necessary, consider a different counterexample where domestic residents are optimally invested in the foreign equities based upon the CAPM applied to all publicly listed firms. However, some of domestic output is not securitized; that is, state-contingent claims on some part of domestic output are not traded (and the space of output realizations is not spanned by traded claims.) For example, claims to human capital and, in some countries, claims on the services sector are typically not traded on financial markets. Then,

domestic consumption will be correlated with the country-specific shocks to domestic output. Consumption home bias will exist even though there is no measured equity home bias. Thus, equity home bias is not necessary to generate consumption home bias.

As these two counter-examples illustrate, a strong link between equity home bias and consumption home bias relies upon strong assumptions about the structure of the economy. The most direct link exists when markets are complete, when equity is traded on all output in the economy, and when countries can be viewed as populated by representative agents. These assumptions and some of their implications have led to contradictory empirical implications in the closed economy literature. The contradictions are just as apparent in this international context and some of these have been noted throughout this essay.

Fundamentally, consumption behavior has a difficult time explaining equity pricing behavior. The consumption process cannot explain either the mean of equity returns, nor its high variance. As long as these contradictions remain, the link between equity home bias and consumption home bias will remain weak. Understanding about this potential link is likely to progress only as a general unified understanding of consumption and equity prices progresses.

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Table 1

Home Bias in Consumption Movements

Data are pooled for 72 countries rated $C-$ or better in Penn World Tables for 1950 to 1992.

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

		Consumption Correlations						
		Canada	U.S.	Japan	France	Germany	Italy	UK
Output Correlations	Canada	—	0.700	0.050	0.121	−0.338	0.184	0.404
	U.S.	0.739	—	0.183	0.220	−0.092	0.120	0.584
	Japan	0.119	0.269	—	0.638	0.206	0.471	0.097
	France	0.359	0.345	0.673	—	0.054	0.391	0.092
	Germany	−0.199	0.013	0.285	0.061	—	0.066	−0.139
	Italy	0.222	0.306	0.597	0.652	0.256	—	0.047
	UK	0.326	0.551	0.355	0.411	−0.005	0.340	—

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

	Canada	U.S.	Japan	France	Germany	Italy	UK	PWT Pooled[a]
b	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]Corrected for heteroskedasticity using method described in Lewis (1997).

Table 2

Home Bias in International Equity Markets

Data in Panel A are monthly dollar indexes including reinvested dividends from Morgan Stanley. Panel B shares are calculated from the summary statistics in Panel A together with a relative risk aversion parameter (γ) using equation (4) in the text.

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

[a] Annualized Mean Dollar Monthly Returns.

[b] Annualized Standard Deviation of Monthly Returns.

Table 3

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

Source: International Monetary Fund, *Capital Markets*, 1995.

[1]Investment trusts.

Table 4

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

Source: Tesar and Werner (1995).

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: *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
(Heteroskedasticity-corrected standard errors in parentheses)

$$\Delta \ln(C_t^j) = \theta_0(t) + \theta_1 \, \Delta \ln(N_t^j) + \theta_2 \, \Delta \ln(L_t^j) + b \, \Delta \ln(Y_t^{c,j}) + u_t^j$$

Regressors	Coefficients				% Tradeables Explained by Non-Tradeables[a]
	θ_1	θ_2	θ_3	b	
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%

Source: Lewis (1996a).

[a]Calculated as

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

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