NBER WORKING PAPER SERIES

ARE FINANCIAL ASSETS PRICED LOCALLY OR GLOBALLY?

G. Andrew Karolyi
René M. Stulz

Working Paper 8994
http://www.nber.org/papers/w8994

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
June 2002

Prepared for the Handbook of the Economics of Finance, George Constantinides, Milton Harris, and René M. Stulz, eds., North-Holland. We are grateful to Dong Lee and Boyce Watkins for research assistance, and to Michael Adler, Kee-Hong Bae, Warren Bailey, Soehnke Bartram, Laura Bottazzi, Magnus Dahlquist, Craig Doidge, Cheol Eun, Vihang Errunza, Jeff Frankel, Thomas Gehrig, John Griffin, Cam Harvey, Mervyn King, Paul O'Connell, Sergio Schmukler, Ravi Schukla, Enrique Sentana, Bruno Solnik, Christof Stahel, Lars Svensson, Linda Tesar, Frank Warnock, and Simon Wheatley for comments. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

Are Financial Assets Priced Locally or Globally?
G. Andrew Karolyi and René M. Stulz
NBER Working Paper No. 8994
June 2002
JEL No. G11, G12, G15

ABSTRACT

We review the international finance literature to assess the extent to which international factors affect financial asset demands and prices. International asset pricing models with mean-variance investors predict that an asset's risk premium depends on its covariance with the world market portfolio and, possibly, with exchange rate changes. The existing empirical evidence shows that a country's risk premium depends on its covariance with the world market portfolio and that there is some evidence that exchange rate risk affects expected returns. However, the theoretical asset pricing literature relying on mean-variance optimizing investors fails in explaining the portfolio holdings of investors, equity flows, and the time-varying properties of correlations across countries. The home bias has the effect of increasing local influences on asset prices, while equity flows and cross-country correlations increase global influences on asset prices.

G. Andrew Karolyi
Fisher College of Business
Ohio State University
2100 Neil Avenue
Columbus, OH 43210-1144

René M. Stulz
Fisher College of Business
Ohio State University
2100 Neil Avenue
Columbus, OH 43210-1144
and NBER
stulz_1@cob.osu.edu

1. Introduction

Over the last forty years, financial markets throughout the world have steadily become more open to foreign investors. Yet, most academic research on portfolio choice and asset pricing focuses only on local factors when investigating the determinants of portfolio choice and of expected returns on risky assets. For instance, a vast literature looks at the relation between the U.S. risk premium and the volatility of the U.S. stock market even though in global markets the U.S. risk premium ought to depend at least on the relation between U.S. stocks, a global market portfolio, and possibly exchange rates. In this paper, we examine the lessons from the theoretical and empirical finance literature on the extent to which global factors -- i.e., foreign stock markets and exchange rates -- affect asset demands and prices, and on when these factors can be ignored or have to be taken seriously.

We start this paper by examining how portfolios would be chosen and asset prices determined in a world where financial markets are assumed to be internationally perfect. In such a world, an asset has the same price regardless of where it is traded and no finance is local. Markets where assets have the same price regardless of where they are traded are said to be integrated, while markets where the price of an asset depends on where it is traded are said to be segmented. In examining the empirical evidence on asset pricing models that assume financial markets to be internationally integrated, a case can be made for studying the cross-section of expected returns without regard for international influences, at least for large markets like the U.S. But, the case for ignoring international determinants of national stock market risk premiums and how they evolve over time has no basis.

Models with internationally perfect financial markets have severe limitations in explaining portfolio holdings and how portfolio holdings change over time. The home bias puzzle, which refers to the phenomenon that investors overweight the securities of their country in their portfolio, is inconsistent with models where investors have the same information across countries and where financial markets are assumed to be perfect. Recent research provides a wealth of empirical results on how foreign investors choose their asset holdings and on their performance. The picture that emerges from this literature is that there are systematic patterns in ownership of foreign stocks that are hard to reconcile with models assuming perfect financial markets. The only way to rationalize these patterns would be to argue that the gains from international diversification are too small to make holding foreign assets worthwhile. Though there is evidence suggesting that the gains from international diversification have become weaker over time, only investors with extremely strong priors against the hypothesis that assets are priced in internationally integrated markets are likely to conclude that international diversification is not worth it. The home bias decreases the relevance of international determinants of domestic stock prices.

The 1990s showed that cross-country equity flows are highly volatile and raised important questions about whether and how flows affect stock prices. In 1998, net equity flows to Latin America amounted to $1.7 billion in contrast to $27.2 billion in 1993. Yet, at the same time, net capital flows to Latin America in 1998 were more than twice their amount in 1993. In other words, both the amounts of net equity flows and net equity flows in proportion to total capital flows are highly variable. Further, from 1994 to 1995, net equity flows to Latin America fell by roughly 40% while net equity flows to East Asia increased by a bit more than 40%.[1]

The growing importance of capital flows in the 1990s has led to concerns about contagion. Since national stock markets are correlated because of interdependence among countries, one would naturally expect a shock in one country to affect other countries. Some have called this transmission of shocks contagion, even though it has little to do with the traditional definition of contagion in epidemiology according to which a healthy individual is made sick by a disease transmitted in some way from a stricken individual. Contagion that makes a healthy country sick has been a source of concern in the 1990s, leading many to believe that such irrational or non-

[1] See Edison and Warnock (2001), table 1.

fundamental contagion can destabilize economies. Neither the high volatility of equity flows nor contagion is consistent with models where investors act rationally, are similarly informed, and trade in financial perfect markets. Some models suggest that factors that have been advanced to explain the home bias can also help explain the volatility of equity flows and perhaps some forms of contagion. However, the volatility of equity flows and contagion increase the importance of international determinants of stock prices – at least for the countries affected by such phenomena.

The paper proceeds as follows. Section 2 reviews the various international asset pricing models that assume internationally integrated financial markets, shows the conditions under which assets can be priced locally with these models, and surveys the empirical evidence on these models. Section 3 discusses the home bias. Section 4 addresses the issues of the volatility of equity flows and contagion. Section 5 concludes.

2. The Perfect Financial Markets Model

How would individuals choose portfolios and how would asset prices be set in a world with perfect financial markets? In an international setting, the most important implication of perfect financial markets is that all investors face the same investment opportunity set because there are no barriers to international investment. However, in a world of perfect financial markets, the assumptions one makes about how goods prices in different currencies are related have important implications for how individuals choose portfolios and how asset prices are determined. If consumption opportunity sets are the same across countries, it does not matter where an investor is located. An investor can achieve the same expected lifetime utility given his wealth anywhere in the world. If consumption opportunity sets differ across countries and investors are not mobile, then an investor's expected lifetime utility depends on where she is located. In that case, an investor may hold a different portfolio depending on her country of residence. We consider successively the case where investors have the same consumption opportunity sets across countries and the case where they do not. We then present a general approach that encompasses the special cases we discuss in the first two parts of this section. We conclude the section with a discussion of the empirical evidence on the predictions of the perfect markets model for security returns.

2. A. Identical Consumption Opportunity Sets Across Countries

Consider a world where goods and financial markets are perfect, so that we have no transportation costs, no tariffs, no taxes, no transaction costs, and no restrictions to short sales. Grauer, Litzenberger, and Stehle (1976) modeled such a world using a state-preference framework. We assume further that there is only one consumption good.[2] In such a world, every investor has the same consumption and investment opportunity sets regardless of where she resides. Further, the law of one price holds for the consumption good, so that if e(t) is the price of foreign currency at date t, P(t) is the price of the good in the domestic country, and P*(t) is the price in the foreign currency, it must be that P(t) = e(t)P*(t). In such a world, an investor can use the consumption good as the numéraire, so that all prices and returns are expressed in units of the consumption good.

We now consider a one-period economy in which real returns are multivariate normal and there is one asset that has a risk-free return in real terms, earning r. Investors care only about the distribution of their real terminal wealth. The properties of the multivariate normal distribution (see Fama, 1976, Chapters 4 and 8) imply that:

$$\mathrm{E}(\mathrm{r}_{\mathrm{i}}) - \mathrm{r} = \alpha_{\mathrm{i}} + \beta_{\mathrm{i}}^{\mathrm{d}}\left[\mathrm{E}(\mathrm{r}_{\mathrm{d}}) - \mathrm{r}\right], \qquad (1)$$

[2] The consumption good can be a basket of goods where the spending proportions on each good are constant.

where E(.) denotes an expectation, r_i is the real return on asset i, r_d is the real return on the domestic market portfolio, β_i^d is the domestic beta of asset i defined as $\frac{\mathrm{Cov}(r_i, r_d)}{\mathrm{Var}(r_d)}$ where Cov(.,.) denotes a covariance and Var(.) denotes a variance, and α_i is a constant. If domestic investors can only hold domestic assets and if foreign investors cannot hold domestic assets, then we know that α_i must be equal to zero for all assets because then the capital asset pricing model (CAPM) must hold in the domestic country. However, in a world where domestic investors have access to foreign assets, the CAPM must hold in real terms using the world market portfolio. Consequently:

$$E(r_i) - r = \beta_i^w \left[E(r_w) - r\right], \tag{2}$$

where r_w is the real return on the world market portfolio, β_i^w is the world beta of asset i defined as $\frac{\mathrm{Cov}(r_i, r_w)}{\mathrm{Var}(r_w)}$. We call equation (2) the "world CAPM" to contrast it with the traditional implementation of the CAPM that uses the domestic market portfolio, which we call the domestic CAPM.

We now build on Stulz (1995) to analyze the mistake in using the domestic CAPM when the world CAPM is appropriate. Equations (1) and (2) imply that α_i must satisfy:

$$\alpha_i = \left[\beta_i^w - \beta_d^w \beta_i^d\right] \left[E(r_w) - r\right]. \tag{3}$$

Equation (3) shows that systematic mistakes are possible when one uses the domestic CAPM and when domestic investors have access to world markets. At the same time, though, equation (3) puts a bound on the economic importance of these mistakes. Since the domestic market portfolio has a beta of one, the weighted average of the alphas in equation (3) must be equal to zero. To understand the nature of the mistakes, we have to understand how the world beta of asset i, β_i^w, differs from the product of the world beta of the domestic market, β_d^w, and of the domestic beta of asset i, β_i^d. Using the multivariate normal distribution, we can write the return of asset i as:

$$r_i - r = \alpha_i + \beta_i^d [r_d - r] + \varepsilon_i^d. \tag{4}$$

Similarly, the return of the domestic market portfolio can be written as:

$$r_d - r = \beta_d^w [r_w - r] + \varepsilon_d^w. \tag{5}$$

Substituting equation (5) into equation (4), we have:

$$r_i - r = \alpha_i + \beta_i^d \left[\beta_d^w [r_w - r] + \varepsilon_d^w \right] + \varepsilon_i^d. \tag{6}$$

The world market beta of asset i is therefore:

$$\beta_i^w = \beta_i^d \beta_d^w + \frac{\mathrm{Cov}(\varepsilon_i^d, r_w)}{\mathrm{Var}(r_w)}. \tag{7}$$

Substituting (7) into (3), we get the result of Stehle (1977) that the pricing mistake from using the domestic CAPM when the global CAPM is appropriate is:

$$\alpha_i = \frac{\mathrm{Cov}(\varepsilon_i^d, r_w)}{\mathrm{Var}(r_w)} \left[E(r_w) - r \right]. \tag{8}$$

Equation (8) shows that the domestic CAPM understates the return of assets whose market model residual is positively correlated with the world market portfolio. However, the domestic CAPM correctly prices those assets whose market model residual is uncorrelated with the world market portfolio. If high domestic beta stocks have risk diversifiable internationally but not domestically, using the domestic CAPM inappropriately would lead one to conclude that the security market line is too flat. One would expect multinational corporations to have returns correlated with foreign markets in such a way that the domestic market portfolio return does not capture all their systematic risk.

Our analysis so far shows that, even when the assumptions required for the CAPM to hold are made, the domestic CAPM does not hold in global markets. One inevitably makes pricing mistakes using the domestic CAPM as long as $\mathrm{Cov}(\varepsilon_i^d, r_w)$ is not zero for every security. There exists an upper bound on the absolute value of the pricing mistakes. Let R_{ij}^2 be the R-square of a regression of the return of asset i on asset j. With this notation, the bound can be written as:

$$|\alpha_i| \le \sqrt{(1-R_{id}^2)(1-R_{wd}^2)\frac{Var(r_i)}{Var(r_w)}} \left[E(r_w) \; - \; r \right]. \tag{9}$$

Consider an asset that has a variance that is four times the variance of the world market portfolio. If the variance of security i is four times the variance of the world market, the R-square of a regression of the security on the domestic market portfolio is 0.3, the R-square of a regression of the world market on the domestic market is 0.2, and the world market risk premium is 6%, the bound is 9%. Consider now an asset with the same volatility but in the U.S., where a regression of the world market portfolio on the domestic market portfolio would have an R-square of at least 0.8. In this case, the bound would be 4.49%. If we are willing to make assumptions about the correlation between the domestic market model residual of an asset and the return of the world market portfolio that is not explained by the domestic market portfolio, we can compute the limits of the pricing mistakes. Consider, for example, a correlation of 0.2. In this case, the asset in a country whose market portfolio is poorly explained by the world market portfolio has a pricing mistake no greater than 1.8%, while the U.S. asset has a pricing mistake of 0.88%.

It follows from this analysis that using a domestic CAPM is more of a problem in countries whose market has a lower beta relative to the world market portfolio. Since the U.S. is a country where the R-square of a regression of the world market portfolio on the domestic market portfolio is high, the mistakes made by using the domestic market portfolio for U.S. risky assets are smaller than for risky assets of other countries where the R-square of similar regressions is much smaller. Further, the mistakes are likely to be less important for larger firms simply because the domestic market portfolio explains more of the return of these firms.

We now turn to the issue of the determinants of the market risk premium. We keep the same assumptions, but now we have an investor who chooses her portfolio to maximize her expected utility of terminal real wealth, E[U(W)], with U(W) strictly increasing and concave in W. Consider first an investor who can only hold U.S. assets, so that the investor holds the U.S. market portfolio. Using a first-order Taylor-series expansion, the first-order conditions of the investor's portfolio choice problem imply that:

$$E(r_d) - r = T^R \mathrm{Var}(r_d), \tag{10}$$

where T^R is the investor's coefficient of relative risk tolerance. Equation (10) implies that the risk premium on the domestic market portfolio increases with the variance of the return of the domestic market. This equation has been the basis for a large literature starting from Merton (1980). However, equation (2) provides a different formula for the risk premium on the domestic market portfolio:

$$E(r_d) - r = \beta_d^w \left[E(r_w) - r\right]. \tag{11}$$

With equation (11), the risk premium on the domestic market portfolio depends on its world beta. Since stock markets typically have a positive correlation with the world market portfolio, an increase in the variance of the domestic market portfolio will increase its risk premium. However, if one were to look at the cross-section of expected returns across national stock markets, there is no reason for markets with higher variances to have higher risk premiums since a higher variance for a country's market portfolio does not imply that the country's market has a higher correlation with the world market portfolio. In fact, one would expect the opposite, in that emerging markets tend to have high variances but low correlations with the world market portfolio (see Harvey, 1995). So far, we considered a one-period model. If one is willing to assume that equation (11) holds each period, the volatility of the domestic market portfolio could increase at the same time that the risk premium on the domestic market portfolio could fall. This could happen because the correlation of the domestic market portfolio with the world market portfolio falls or the risk premium on the world market portfolio falls.

2.B. Different Consumption Opportunity Sets Across Countries

In the previous section, we considered a model where all investors have the same consumption opportunity set. In such a model, the residence of an investor who maximizes the expected utility of terminal wealth and whose terminal wealth consists only of the value of securities held is irrelevant. In the presence of inflation, purchasing power parity must hold under such conditions. With purchasing power parity, a percentage depreciation of the domestic currency is offset by an equivalent percentage increase in domestic prices. There is a large literature in international economics that documents that purchasing power parity does not hold – at least for countries with moderate and low inflation.[3] The assumption that consumption opportunity sets are the same across countries is stronger than the assumption of purchasing power parity. It requires that the relative price of any two consumption goods be the same in each country at all times. Even with purchasing power parity holding, it would be possible that a particular good is not available in one country but is available in another country. The law of one price would not apply for that good even though it has to apply for every good when all investors have the same consumption opportunity set. The empirical evidence shows that there are significant departures from the law of one price across as well as within countries, but keeping distance constant, the departures are more volatile across countries than within countries.[4]

A simple way to model a world with departures from the law of one price is to assume that there is a different consumption good in each country.[5] This approach was first used by Solnik (1974) to derive an asset pricing model where foreign exchange rate risk is priced. Such an assumption implies that trade takes place in intermediate goods. Solnik (1974) assumes that there is no inflation, so that the price of the consumption good in a country is fixed and the price of a foreign currency is simply the price of the foreign good in terms of the domestic good. With such

---

[3] Froot and Rogoff (1995) state that "price level movements do not begin to offset exchange rate swings on a monthly or even annual basis." (p. 1648). In a comprehensive study using 64 real exchange rates, O'Connell (1998) concludes that "no evidence against the random walk null can be found."

[4] See Froot and Rogoff (1995) and Sarno and Taylor (2001) for reviews of the evidence. Engel and Rogers (1996) examine deviations from the law of one price across cities in the U.S. and Canada. They find that the volatility of deviations increases as distance between two cities increases but there is also a substantial border effect on this volatility.

an approach, investors in each country use their consumption good as the numéraire. If one considers the portfolio choice of a domestic investor in this model, there is only one difference from the model discussed in the previous section but it is of critical importance. In the previous section, the consumption good had the same price everywhere using the same numéraire. This meant that all investors would evaluate the riskiness of an asset in the same way. Now, this is no longer true. Consider an asset that is riskless in terms of the domestic good. This asset is riskless for a domestic investor, but it is not so for a foreign investor.

Let r be the return per unit of time of the domestic risk-free asset in domestic currency and r* be the return of the foreign currency risk-free asset in foreign currency. For a domestic investor, the instantaneous domestic currency return on the foreign currency riskless asset depends on the exchange rate dynamics. We assume that the exchange rate follows a geometric Brownian motion, so that:

$$\frac{de}{e} = \mu_e dt + \sigma_e dz_e, \tag{12}$$

where μ_e is the instantaneous expected rate of change of the exchange rate, σ_e is the instantaneous volatility of the rate of change of the exchange rate, and dz_e is the increment over dt of a Brownian motion with zero drift and unit volatility. With this assumption about the foreign exchange dynamics, the instantaneous domestic currency return on the foreign risk-free asset is r*dt + (de/e), while the foreign currency return on the foreign risk-free asset is r*dt. In contrast, the foreign currency return on the domestic risk-free asset is rdt – (de/e) + σ_e^2 dt. The volatility

---

[5] Alternatively, there could be many consumption goods but all investors would consume the goods in the same constant proportions so that the basket of goods they consume is constant. Such an extension would lead to the same results as Solnik's model provided that the price of a country's basket of goods is constant in the currency of that country.

term comes from Jensen's inequality: the price of the domestic currency for foreign investors is a convex function of the domestic currency price of the foreign currency.

Whenever a domestic investor holds a foreign asset, her return in domestic currency depends on the exchange rate, so that she bears exchange rate risk. Let I_{fj} be the price in domestic currency of foreign asset j and let I^*_{fj} be the price of the same asset in foreign currency. The instantaneous return in domestic currency on foreign asset j is:

$$\frac{dI_{fj}}{I_{fj}} = \frac{dI^*_{fj}}{I^*_{fj}} + \sigma^*_{fj,e}dt + \frac{de}{e} \quad , \tag{13}$$

$\sigma^*_{fj,e}$ is the instantaneous covariance of the foreign currency return of foreign asset j with the rate of change of the exchange rate. A domestic investor can make the domestic currency return on her holdings of foreign assets uncorrelated with the rate of change of the exchange rate, so that she does not have to bear foreign exchange rate risk if she does not wish to do so. Let I^*_{ff} be the value in foreign currency of a domestic investor's investment in foreign risky assets. If the investor shorts n units of the foreign risk-free asset per unit of investment in the foreign risky assets and puts the proceeds of the short sale in the domestic risk-free asset, the domestic currency return on the investor's holdings of foreign currency risky assets over dt is:

$$\frac{dI_{df}}{I_{df}} = \frac{dI^*_{ff}}{I^*_{ff}} + \frac{de}{e} + \sigma^*_{ff,e}dt - n\left(r^*dt + \frac{de}{e} - rdt\right). \tag{14}$$

If the investor chooses n to be equal to $1 + \frac{\sigma^*_{ff,e}}{\sigma^2_e}$, the domestic currency return of the investor's investment in the foreign currency risky assets is uncorrelated with the exchange rate.

In the risk management literature, n is the hedge ratio – i.e., the ratio of the size of the hedge relative to the size of the position being hedged. In Solnik's model, the returns of risky assets in their own currency are assumed to be uncorrelated with the rate of change of the exchange rate, so that the optimal hedge ratio is one. Sercu (1980) relaxes this assumption of Solnik's model. We call the extended model the Solnik/Sercu model in the following discussion. With multiple countries, each risky asset is exposed to the risk of multiple currencies, so that an asset has an optimal hedge ratio with respect to each foreign currency.

Since the investor can hedge her foreign stocks against exchange rate risk, the two decisions of how much foreign exchange rate risk to bear and of how much foreign equity to hold are separable. Empirically, $\frac{\sigma^{*}_{\mathrm{ff,e}}}{\sigma^{2}_{\mathrm{e}}}$ is close to 0, so that an investor hedges the foreign exchange risk of a foreign currency investment by shorting the currency in which the risky assets are denominated for an amount approximately equal to her holdings of these risky assets. If our investor chose to take on no foreign exchange rate risk, she would therefore sell short an amount of the foreign risk-free asset roughly equal to her holdings of foreign risky assets. Foreign investors would have to hold an amount of the foreign risk-free asset equal to the amount of that asset shorted by domestic investors. If the domestic investor holds some foreign exchange risk, she does not hedge all her holdings of foreign stocks and, consequently, foreign investors hold a smaller amount of the foreign risk-free bond.

Perold and Schulman (1988) argued in an influential article that hedging is a free lunch since it reduces volatility at no cost in expected return because on average there is no compensation for bearing foreign exchange rate risk. Their argument is controversial on empirical grounds because generally high interest rate currencies earn a risk premium (see Froot and Thaler, 1990, for a review of the evidence). If correct, however, their argument would imply that the exchange rate exposure of stocks would not affect their expected returns, so that one could ignore exchange rates when considering the cross-section of expected returns for common stocks.

To consider the validity of the Perold and Schulman argument on theoretical grounds, note that it implies that foreign investors short the domestic currency for an amount equal to their holdings of domestic currency risky assets. Domestic investors must be the counterparties of these short sales, so that if foreign investors hedge all their domestic exchange rate risk, domestic investors must hold an amount of the domestic risk-free asset equal to the short position in domestic risky assets of foreign investors. In this case, foreign investors take no foreign exchange risk. This makes sense if foreign investors receive no reward for being long the domestic currency, which requires that the expected excess return of the domestic currency risk-free asset over the foreign risk-free asset is zero.

The excess return of the domestic currency risk-free asset over the foreign risk-free asset is $rdt + \sigma_e^2 dt - de/e - r^*dt$. Foreign investors will not take a long position in the domestic risk-free asset if the expected excess return of the domestic currency risk-free asset over the foreign risk-free asset for that investor is zero. That is, the following condition must hold: $rdt + \sigma_e^2 dt - \mu_e dt - r^*dt = 0$. For the Perold and Schulman argument to be theoretically valid, it must be that when this condition is satisfied, domestic investors do not take exchange rate risk either. However, the excess return on the foreign risk-free asset over the domestic risk-free asset for a domestic investor is $r^*dt + de/e - rdt$, so that the expected excess return for a domestic investor on a long position in the foreign risk-free asset is $r^*dt + \mu_e dt - rdt$. If the expected excess return of holding the domestic risk-free asset is zero for foreign investors, then the expected excess return of holding the foreign risk-free asset is positive and equal to $\sigma_e^2 dt$ for a domestic investor. Consequently, it is not possible for both domestic and foreign investors to contemplate an expected excess return of zero when investing in the other country's risk-free asset.[6] In a symmetric world, one would think neither domestic nor foreign investors would be rewarded for bearing exchange rate risk since rewarding one group of investors would seem to penalize the other group of investors. Jensen's inequality makes this reasoning incorrect. If foreign investors receive no reward for being long the foreign currency risk-free asset, then domestic investors are rewarded for being long the foreign currency risk-free asset. In equilibrium, in a symmetric world where consumption opportunity sets differ across countries, there will therefore exist some reward for taking currency risk, so that exposures to foreign exchange rates will be priced in assets.

To present a key insight of Solnik's model, let's use his assumption that the domestic risky assets have domestic currency returns uncorrelated with the exchange rate and that the foreign risky assets have foreign currency returns uncorrelated with the exchange rate. In this case, the domestic investor can hedge her holdings of the foreign risky assets against exchange rate risk by borrowing an amount in foreign currency equal to her holdings of foreign currency risky assets. Similarly, foreign investors hedge their currency risk by borrowing in domestic currency an amount equal to their holdings of domestic currency risky assets. If there is no reward for taking foreign currency risk, domestic investors will short the foreign currency risk-free asset for an amount exactly equal to their investment in foreign currency risky assets and will bear no foreign exchange rate risk. As the reward for taking foreign exchange rate risk increases, domestic

---

[6] This result holds more generally and is known as Siegel's Paradox (Siegel (1972)). This Paradox states that it is not possible for the forward exchange rate to be an unbiased predictor of the spot exchange rate from the perspective of investors in the domestic as well as in the foreign country. If the forward exchange rate is F and the spot exchange rate at maturity of the contract is e, the forward exchange rate is an unbiased predictor from the perspective of the domestic country if $F = E(e)$. However, from the perspective of investors in the foreign country, the forward exchange rate is an unbiased predictor if $(1/F) = E(1/e)$. Because of Jensen's inequality, $E(e)$ is not equal to $1/E(1/e)$ as long as e is random. Black (1990) argues that investors bear exchange rate risk in equilibrium because of Siegel's paradox. Solnik (1993) clarifies the implication of Siegel's paradox for the pricing of exchange rate risk.

investors decrease the extent to which they hedge the foreign exchange risk associated with their holdings of assets risky in foreign currency.

We assume that there are N risky assets for each investor. Let the N-th risky asset be the foreign currency risk-free asset for a domestic investor and the domestic currency risk-free asset for a foreign investor. Define w_N^{di} as the fraction of her wealth the i-th domestic investor puts in the N-th domestic risky asset, which is the foreign currency risk-free asset for her, and w_N^{fj} be the fraction of her wealth the j-th foreign investor puts in the N-th foreign risky asset, which is the domestic currency risk-free asset for her. Solving for these asset demands, we have:

$$w_N^{di} = T_i^d \left(\frac{r^* + \mu_e - r}{\sigma_e^2} \right) - w_f^{di}, \tag{15}$$

$$w_N^{fj} = T_j^f \left(\frac{r - \mu_e + \sigma_e^2 - r^*}{\sigma_e^2} \right) - w_d^{fj}, \tag{16}$$

where T_i^d and T_j^f are, respectively, the relative risk tolerances of the domestic investor and of the foreign investor, and w_f^{di} and w_d^{fi} are, respectively, the fraction of the wealth of the i-th domestic investor invested in foreign risky assets and of the wealth of the i-th foreign investor invested in domestic risky assets. Let T^d be the wealth-weighted average of the risk-tolerances of the domestic investors and T^f the corresponding quantity for foreign investors. Further, let W^d be the aggregate wealth of domestic investors, W^f the aggregate wealth of foreign investors, and W^w equals the sum of W^d and W^f.

We can use equations (15) and (16) to obtain the equilibrium risk premium on an investment in a foreign risk-free bond financed through risk-free borrowing in the domestic currency. Assuming that there is no net supply of the risk-free asset, the domestic holdings of the domestic risk-free asset must correspond to the short position of foreign investors in the same asset.

Another way to put this is that a dollar invested in the domestic risk-free asset by domestic investors is a dollar that foreign investors borrow from domestic investors. Equilibrium in the market for the domestic risk-free asset therefore requires that:

$$\frac{W^d - w_d^w W^w + T^f W^f}{T^d W^d + T^f W^f} = \frac{r^* + \mu_e - r}{\sigma_e^2}\ , \tag{17}$$

where w_d^w is the weight of domestic currency risky assets in the world market portfolio. The numerator on the right-hand side of this equation is the domestic currency expected excess return on an investment in the foreign risk-free bond. Alternatively, it is the expected gain from a long forward position to buy the foreign currency. This is the forward risk premium for a domestic investor.

An important implication of equation (17) is that the forward risk premium can be different from zero when (1) the foreign exchange rate is uncorrelated with equities in their own currency and (2) there is no net supply of riskless bonds in either domestic or foreign currency.[7] In such a world, there would be no risk premium for foreign exchange in the world CAPM in real terms. The domestic currency return on foreign stocks would depend on the exchange rate, but the real return of foreign stocks would not. Consequently, the beta of foreign exchange with respect to the world market portfolio would be zero. In contrast, foreign exchange rate risk would be priced in Solnik's model so that the markets for the foreign currency and domestic currency risk-free assets are in equilibrium. Using the domestic CAPM leads to pricing mistakes in this model not only

[7] One might argue that assuming no riskless bonds outstanding is unrealistic since there are government bonds outstanding. However, government bonds are obligations of domestic residents, so that in a world where the Ricardian equivalence result holds, one can view domestic residents as supplying these bonds (see Barro, 1974).

because the market portfolio should include foreign assets, but also because it omits the foreign currency risk factor when the assumptions that lead to Solnik's model hold.

To understand the determinants of the risk premium on foreign exchange, consider an increase in domestic wealth, W^d. As a result of this increase, the demand for foreign stocks by domestic investors increases. Absent increased borrowing in foreign currency, the foreign currency exposure of domestic investors increases. To reduce this foreign currency exposure, domestic investors want to borrow more abroad to hedge holdings of foreign stocks. Keeping all expected returns the same, there is now excess demand for borrowing in foreign currency. To reduce that excess demand, the reward for bearing foreign currency risk has to increase for domestic investors, so that they borrow less to hedge their foreign stock holdings. An increase in the value of domestic stocks means that the weight of domestic stocks in the portfolios of foreign investors increases and hence these investors want to borrow more in domestic currency to reduce their foreign currency exposure. To reduce the excess demand for borrowing in domestic currency by foreign investors, the expected excess return of the domestic risk-free asset in foreign currency has to increase, which is equivalent to a decrease of the expected excess return of the foreign risk-free asset in domestic currency.

This pricing of foreign exchange risk is the central feature of Solnik's model. It is important to note, however, that his model takes exchange rate dynamics as exogenous. In an equilibrium model, the exchange rate and its dynamics would be functions of more primitive quantities. In such a model, there would be no exchange rate risk premium – the risk premium paid for taking on foreign exchange rate risk would be the risk premium for taking on exposure to the primitive variables that affect the exchange rate. However, it would still be correct that taking on foreign exchange rate risk could be rewarded even when there is no correlation between the return on foreign exchange and the return on the market portfolio.[8]

2.C. A General Approach

Merton (1973) provides a general representation of the demand function for risky assets when the investment opportunity set changes over time. His approach was subsequently extended to the case where commodity prices change randomly over time. Let S be a vector of state variables that describe the investment and consumption opportunity sets. We now assume that there are K countries, with n^j assets in country j, and N risky assets in domestic currency. V is the instantaneous variance-covariance matrix of returns of the assets risky in domestic currency, V_S is the instantaneous covariance matrix between asset returns and the changes in the state variables, and μ is the vector of instantaneous expected excess returns using the domestic currency as the numéraire. Investors are assumed to maximize their expected lifetime utility of consumption of goods. Let J(W,S,t) be the indirect utility function of lifetime consumption as a function of wealth, the state variables, and time. With this notation, the asset demands for the i-th investor of country k must satisfy:

$$w^{ki} = \frac{-J_w^{ki}}{J_{ww}^{ki} W^{ki}} V^{-1}\mu + V^{-1} V_S \frac{-J_{wS}^{ki}}{J_{ww}^{ki} W^{ki}}, \tag{18}$$

where J_w^{ki} is the partial derivative of J(W,S,t) with respect to wealth. J_{ww}^{ki} and J_{wS}^{ki} are, respectively, the partial derivatives of J_w^{ki} with respect to wealth and the vector of state variables.

---

[8] International asset pricing models that make the exchange rate endogenous include Lucas (1982), Svensson (1985), and Stulz (1987) for monetary economies. Uppal (1993) extends the model of Dumas (1992), where it is costly to transport the only consumed good between two countries. In his model, the exchange rate is the relative price of the foreign good in terms of the domestic good.

Equation (18) has a straightforward interpretation. All investors' holdings of risky assets can be decomposed into holdings of the so-called tangency portfolio, $V^{-1}\mu$, and S so-called hedge portfolios, where the weights of these portfolios sum to one through riskless borrowing and lending. The hedge portfolios hedge the investor against the impact of unexpected changes in state variables on her marginal utility of wealth.

The asset demands of equation (18) accommodate any assumptions about consumption opportunity sets. Note that all investors can solve their portfolio choice problem using domestic currency as their numéraire. We can use equation (18) to understand the asset demands of the model discussed in Section 2.A. With that model, all investors consume the same good, the price of the good differs across countries, the law of one price applies to the good, and the investment opportunity set is constant. The real wealth of the investor depends only on the price of the good in the numéraire currency. If the price dynamics of the good in that currency are exogenously specified and the price of the good is a sufficient statistic for the consumption opportunity set, then the price of the good in the numéraire currency is the only state variable. If there is a risk-free asset in real terms, then a nominal risk-free bond is a perfect hedge against unanticipated changes in the price of the good. Hence, equation (18) can be used to characterize asset demands when there is a risk-free asset in real terms as well as when such an asset does not exist. This equation shows how inconsequential exchange rates are in the model of Section 2.A. A foreign currency risk-free asset is treated no differently than any other risky asset in the asset demand equations. In other words, there is nothing special about exchange rates in that model.

If the assumptions of Solnik/Sercu model are used to characterize asset demands using equation (18), then the only state variables are exchange rates. Each investor consumes only one commodity, but that commodity depends on the country of residence of the investor. The indirect utility function of an investor depends only on her wealth and on the exchange rate of her country. This means that the indirect utility function of investors will vary across countries because they care about different prices. The role of the exchange rate is not trivial in that model because the price of each currency relative to the numéraire currency is a sufficient statistic for the consumption opportunity set of investors from the country of that currency.

Using the domestic currency as the numéraire, there is a perfect hedge against fluctuations of the exchange rate of country i, namely the risk-free bond of country i. Since that hedge is part of the risky securities, each column of V_S is also a row of V in the Solnik/Sercu model, so that $V^{-1}V_S$ is an identity matrix. An investor from the j-th country would therefore add to her holdings of the tangency portfolio an investment of $\frac{-J_{wS_j}}{J_{WW}W}$ in the risk-free bond of her country. Interestingly, in this model, all investors hold the same tangency portfolio and in addition take on a position in the risk-free bond of their country to hedge against changes in the price of the commodity they consume. Since stocks are not used to hedge, every investor in the world holds two different stocks in the same proportion. Consider an investor from country j. In addition to her holdings of the risk-free bond of her country through the tangency portfolio, she holds $\frac{-J_{wS_j}}{J_{WW}W}$ in the risk-free asset of her country. We could construct the asset demands in any currency that we want. If we use currency k for the asset demands for the i-th investor in country k, then no state variable enters the investor's indirect utility function of wealth. This investor will put $T^{ki}W^{ki}$ in the tangency portfolio and $(1 - T^{ki})W^{ki}$ in the risk-free asset of country k.

Consider then stock j that has a weight of w_j^w in the world market portfolio. Since there is no hedging demand for stocks in the Solnik/Sercu model, it must be that:

$$w_j^w W^W = w_j^T \sum_i^K T^i W^i = w_j^T \lambda W^W , \tag{19}$$

where w_j^T is the weight of asset j in the tangency portfolio, T^i is the wealth weighted average of risk tolerances in country i, W^i is the country i wealth, λ is the wealth weighted average of risk-tolerances across countries, and W^W is world wealth. It follows from this that the weight of a stock in the tangency portfolio is 1/λ times its weight in the world market portfolio. We can now get to the weight of country q's risk-free bond in the tangency portfolio. The risk-free bond has zero capitalization but has a hedging demand from investors of country q. Let the weight in the tangency portfolio of the risk-free bond from country q be w_q^T. Consequently:

$$(1-T^q)W^q + w_q^T \sum_i^K T^i W^i = 0 \ . \tag{20}$$

We can solve for w_q^T to find out the exposure to currency q in the tangency portfolio. Black (1990) created a considerable amount of controversy by using the currency exposure in the tangency portfolio to point out that, in a symmetric world, there is a universal hedge ratio. To understand the issues raised by Black (1990), it is better to follow Solnik (1993) and consider the amount of the risk-free bond sold in the tangency portfolio as a fraction of the share of the risky assets of country q in the tangency portfolio, which we write as w^{Tq}. This expression, which has the interpretation of a hedge ratio, is:

$$h_q = \frac{-w_q^T}{w^{Tq}} = \frac{(1-T^q)W^q}{M^q}, \tag{21}$$

where M^q is the market capitalization of country q. Suppose that we are in a symmetric world with relative risk tolerance less than one. In such a world, there cannot be net foreign investment, so that $W^q = M^q$, and everybody has the same risk tolerance. Hence, the hedge ratio is the same for stocks of every country – it is exactly 1 – T, where T is the common risk tolerance. Black (1990) called this the universal hedge ratio.

In general, the world is not as simple as we presumed in the analysis just concluded, so that hedge ratios differ for stocks of different countries. For instance, differences in risk tolerance across countries or net foreign investment render the universal hedge ratio formula useless. More importantly, the result relies on the assumption that investors hold the log portfolio and the riskless asset when they compute their asset demands in their own currency. In general, this is not the case because investors want to hedge a variety of risks. For example, a major limitation of the Solnik/Sercu model is that it assumes away inflation. Introducing inflation makes it possible to distinguish between nominal exchange rate changes and real exchange rate changes. If there is inflation, investors will attempt to hedge against the effects of inflation. Adler and Dumas (1983) develop a model where the price level in each country evolves randomly and where deviations from purchasing power parity are possible. In their work, they make clear the role of the utility function of investors, of price level changes, and of deviations from purchasing power parity in international portfolio choice and international asset pricing.

More generally, the instantaneous distribution of the rate of change of the exchange rate can change over time, consumption baskets may differ across investors, the investment opportunity set can change over time, investors may have non-investment income, and so on. In such a world, Stulz (1981a), building on Breeden (1979), shows that instantaneous expected excess returns must satisfy:

$$\mu_{\mathrm{i}} - \mathrm{r} - \sigma_{\mathrm{I_i},\mathrm{P}} = \frac{\beta_{\mathrm{I_i},\mathrm{c}}}{\beta_{\mathrm{M,c}}}\left[\mu_{\mathrm{M}} - \sigma_{\mathrm{M,P}}\right], \tag{22}$$

where μ_{i} is the instantaneous domestic expected currency return on a position in asset i financed by borrowing in the risk-free asset of the country of asset i, r is the instantaneous domestic nominal rate of interest, $\sigma_{\mathrm{I_i},\mathrm{P}}$ is the instantaneous covariance between the return on the position in asset i and the domestic rate of inflation, $\beta_{I_i,c}$ is the instantaneous consumption beta of the return of the position in asset i, where c is real consumption in the domestic country, $\beta_{M,c}$ is the instantaneous consumption beta of portfolio M, μ_M is the instantaneous expected excess return of portfolio M, and $\sigma_{M,P}$ is the instantaneous covariance between the excess return of portfolio M and the rate of inflation. This equation holds regardless of the composition of the reference portfolio M, so that it holds if that portfolio is the world market portfolio. The CAPM is a special case of this equation that obtains when the market portfolio has a return perfectly correlated with consumption.

It is immediately clear from equation (22) that the domestic CAPM cannot hold if investors hold internationally diversified portfolios because consumption will not be perfectly correlated with the domestic market portfolio. Yet, if domestic assets are not correlated with the residual of a regression of consumption on the domestic market portfolio, the relative pricing of domestic risky assets will still be correct when using the domestic market portfolio. More generally, however, even foreign assets can be priced domestically when using the consumption beta model. As emphasized in Stulz (1981a), with the consumption capital asset pricing model, one does not have to make a priori assumptions about foreign exchange rate dynamics to price assets since the same version of the model is consistent with any type of foreign exchange rate dynamics. Further, one does not have to make assumptions about the importance of global factors on asset pricing since the consumption capital asset pricing model implemented with domestic consumption holds regardless of the importance of these factors. The model can be used to price foreign exchange risk and implies that the risk premium on foreign currency increases with the consumption beta of the exchange rate. Finally, the earlier models of Grauer, Litzenberger, and Stehle, of Solnik, and of Sercu, as well as the Adler and Dumas model, obtain as special cases of equation (22).

2.D. Empirical Evidence on Asset Pricing Using Perfect Market Models

How well do these international asset pricing models perform? The empirical literature can be classified into those studies that provide tests of the world CAPM single-factor model (Section 2.A), those that examine multi-factor asset pricing models, such as the international arbitrage pricing model or the Solnik/Sercu international asset pricing model (IAPM) with currency hedging portfolios (Section 2.B), and finally, the general intertemporal or consumption-based asset pricing models (Section 2.C). We assess each of these separate classes of studies in this section, but it is worthwhile to note several common themes. First, empirical tests for each class of models adopted unconditional approaches early on. Over time, the focus shifted to conditional tests that assume the model holds period by period and thus allow the joint distribution of asset returns to change dynamically over time. Second, studies in each class differentiate themselves according to the test assets that are under examination by the authors. For example, while equities are often the focus and, usually, in the form of national indexes, there are some studies with individual stocks and portfolios constructed using various stock characteristics, such as growth, value, size, and industry group. Further, some of the international models are tested with fixed income securities, currency futures, and forward contracts. Finally, tests employ a return horizon that is dictated by data availability and low frequency quarterly and monthly returns are most commonly featured. However, a number of more recent tests consider higher frequency daily or weekly returns. Overall, the evidence shows that country risk premiums change dynamically and predictably over time with their covariance with the world market portfolio return, a result that is supportive of international asset pricing. However, it is much less clear how the cross-section of expected returns across global securities is affected by global factors when one goes from a purely-domestic asset pricing model to an international asset pricing model.

The early empirical studies of international asset pricing models provide unconditional tests of the world CAPM with monthly returns on national stock indexes. Stehle (1977) evaluates the world CAPM for the U.S. and eight other national indexes to investigate whether U.S. assets are priced internationally. He tests whether the risks that are diversifiable internationally but that are not diversifiable domestically are priced. He finds support for this hypothesis, but in his sample the zero-beta portfolio return is too high and the international security market line slope is too flat to be consistent with the model. Overall, this rather weak inference in favor of international pricing stems from the low power of his tests. After all, there is strong collinearity between the U.S. index and the world index with more than 40 percent weight of the world market portfolio placed on the former. This challenge motivates Jorion and Schwartz (1986) to focus on the North American case, using monthly returns on about 750 individual stocks in Canada. They take advantage of a control sample of Canadian stocks that were also listed on U.S. exchanges and use an orthogonalization of the world market portfolio (NYSE Composite index) relative to the domestic market portfolio (Toronto Stock Exchange 300). They find that, while national factors are priced, risk exposures to the U.S. market are not priced for Canadian stocks, even for those cross-listed in the U.S. Mittoo (1992) finds evidence, using the CAPM and the arbitrage pricing model, that Canadian stocks were priced as in a segmented market from 1977 to 1981, but as in an integrated market from 1982 through 1986. Results supportive of international pricing are found in Korajczyk and Viallet (1989) who provide evidence using over 6,000 individual stocks from the U.S., Japan, and the U.K. with 15 years of monthly data. They show that the world CAPM outperforms the domestic CAPM in that average model mispricing errors are smaller. However, in their various tests, they also find that the world CAPM model still retains large pricing errors for small stocks, that these average pricing errors are significant for the world CAPM for each market in at least one specification, and that the world CAPM dominates only in the more recent (1979-83) subperiod.

A number of recent studies investigate the world CAPM model in a conditional setting with time-varying expected returns, variances, and covariances. This is an important feature that can have important implications for the empirical performance of asset pricing models. The first efforts in this regard by Mark (1988), Giovannini and Jorion (1989), and McCurdy and Morgan

(1992) investigate the risk premium in currency forward contracts. They all find that the conditional covariances implied by the world CAPM indeed have some success in forecasting the conditional risk premia over time. Unfortunately, the risk premia are quite large in certain subperiods and the overidentifying restrictions implied by the world CAPM are rejected easily. Giovannini and Jorion, in particular, use weekly returns constructed from government bonds denominated in six currencies and a simple multivariate GARCH specification. They find that there are negligible differences in the huge statistical rejections for either the static (unconditional) world CAPM or those specifications with more general covariance dynamics. However, their tests and others like theirs make the additional assumption that government bonds are net wealth. Rejecting the world CAPM in such tests can be due to this critical auxiliary assumption. Harvey (1991) employs a conditional framework using monthly returns on a number of Morgan Stanley Capital International (MSCI) stock indexes allowing the expected excess index returns, their betas, and even the world market price of risk to vary over time. Estimated with GMM and local and world instrumental variables, the conditional world CAPM model is useful for predicting expected excess returns. Although the overidentifying restrictions of the model cannot be rejected for the G-7 countries, model pricing errors associated with several countries, and especially Japan, suggest either these markets are not integrated with world markets or the model fails to capture some important priced risks.

Chan, Karolyi, and Stulz (1992) test implications of the world CAPM using daily data for the 1980s with a multivariate GARCH structure for time-varying conditional expected excess returns and covariances. They cannot reject the world CAPM restriction in a model with a domestic (U.S.) and foreign (MSCI EAFE index) portfolio, but they find that a simple two-beta model where each portfolio is a source of risk outperforms the world CAPM. One of the limitations of their approach is the low cross-sectional power of the tests. As a result, De Santis and Gerard (1997) extend this multivariate GARCH approach to eight national MSCI indexes with a more parsimonious but less general dynamic GARCH structure. Their tests cannot reject that the price of risk is equal across markets or that the model pricing errors equal zero. Moreover, they cannot reject that country-specific risks are zero. The results are somewhat sensitive to bear market conditions and high interest rate economic environments. The relevance of economic cycles for conditional risk and expected returns is featured in the specification tests of Zhang (2001) that are applied to size and book-to-market portfolios of stocks from the U.S., the U.K., and Japan. She shows that the world CAPM (equation (1)) is not rejected with these business cycle conditioning instrumental variables. Strikingly, she does not find that exchange rate risk is priced.

The inability of the world CAPM to explain the cross-section of global security expected returns may stem from the potential importance of sources of priced risk other than the world market portfolio in international asset pricing models. A number of studies establish the conditions under which a multi-beta model, such as the APT or intertemporal CAPM, can hold internationally (see, for instance, Solnik, 1983) assuming a perfect markets model with identical consumption and investment opportunity sets across countries (Section 2.A above). Cho, Eun, and Senbet (1986) are the first to provide tests of the international APT. They employ factor analysis with monthly returns for 349 stocks from 11 countries and find that three or four factors are reliably identified. However, the cross-sectional tests (equality of intercepts across pairings of country groups of stocks) lead them to reject international market integration and the APT. Curiously, the results are not sensitive to the currency denomination of the returns and the model does reliably hold for certain pairings of country groupings. Gultekin, Gultekin, and Penati (1989) and Korajczyk and Viallet (1989) show that the performance of the international APT depends on the sample period because markets were less open in the 1970s or the early 1980s than they are later on. For example, Korajczyk and Viallet find that the international APT outperforms the world CAPM in terms of average pricing errors (though strangely both models are dominated by the domestic APT) but the international APT performs best with capital control dummies during the 1969-74 period. Finally, building on the early success of the three-factor model of Fama and French (1993) in capturing market, size, and book-to-market effects in the U.S., Fama and French

(1998) propose a similar multi-beta model for the cross-section of global stock returns of the MSCI universe of 7,500 stocks from thirteen countries between 1975 and 1995. They show that, while the world CAPM fails, a world two-factor model (world market beta and value-growth beta) can explain the cross-section of expected returns, including most of the annual 7.68 percent average global value premium for size and book-to-market portfolios during this period. Griffin (2001) finds that the success of the world value-growth factor for some countries stems from the domestic components of that factor.

The world CAPM would perform poorly if differences in consumption baskets across countries play an important role in the cross-section of expected returns. In this case, the consumption asset pricing model or the Solnik/Sercu model would perform better. Despite the conceptual superiority of the consumption-beta model, only a few papers have attempted to implement tests of that model, and even fewer have done so for international stock returns because of the problems of measuring consumption flows. Nevertheless, Wheatley (1988) and Cumby (1990) provide evidence that the Stulz (1981a) consumption beta model (equation 22) works reasonably for monthly MSCI national index returns during the 1970s and 1980s. Wheatley tests the model's restrictions on unconditional mean returns, and shows that the model performs well for all but certain markets (France, Hong Kong, and Italy) and for all but the early 1980s. Cumby employs vector autoregressions to test the model's restrictions on conditional mean returns, and finds the model works well during the 1980s, although not during the late 1970s.

Conditional tests of international APT or multi-beta asset pricing models have been the focus of most recent studies and have consistently shown a lot of promise. Campbell and Hamao (1992), Bekaert and Hodrick (1992), Ferson and Harvey (1993, 1994, 1995, 1997), and Harvey (1995) allow cross-sectional variation using extra-market factors related to macroeconomic and fundamental stock characteristics and show consistently that expected returns of individual countries are forecastable. Each of these studies examine national index returns for developed markets and, in the case of Harvey (1995), emerging markets, but their focus is typically on the role of local versus global conditioning information and exposures to pre-specified factors for expected returns and not the ability of the various multi-beta models to explain the cross-section of expected returns. In fact, Ferson and Harvey (1994) and Harvey (1995) show that both the international CAPM and the multi-beta models they study fail to explain the cross-section of expected returns for 21 national equity markets and new emerging equity markets in Europe, Latin America, Asia, Mideast, and Africa. Rouwenhorst (1999) offers further evidence of the importance of local factors, such as momentum, turnover, size, and value, using data from emerging markets. Griffin (2001) shows that size and book to market are local factors as well. Finally, Ilmanen (1995) presents conditional tests for long-maturity government bonds in six countries using a small set of global instruments and a latent factor model, like Bekaert and Hodrick (1992). He demonstrates significant predictable variation in excess bond returns, but he identifies one global risk factor that captures the cross-section of expected returns that is strongly correlated with a world excess bond return factor.

When exchange rates are perfectly correlated with relative prices of goods as in the model of Section 2.B and the only hedging portfolios investors hold are foreign-currency denominated bonds, expected asset returns depend on the covariances of assets with the return of the world market portfolio and with currency returns. Nevertheless, remarkably few of the empirical tests have paid attention to the role of foreign exchange risk. An early paper by Jorion (1991) showed that a trade-weighted exchange rate risk measure is priced in the 1980s for test assets comprised of portfolios of about 900 U.S. multinational firms constructed by the proportion of overseas sales. Later, Dumas and Solnik (1995) and DeSantis and Gerard (1998) find empirical support for conditional versions of multi-factor asset pricing models that include a world market portfolio and a series of foreign exchange return factors. Dumas and Solnik combine a "pricing kernel" formulation with a generalized instrumental variables approach for four developed markets and find that exchange rate risk is priced and cannot reject the international asset pricing model. De Santis and Gerard (1998) conduct similar tests using the multivariate GARCH representation of their 1997 paper, but also document that the currency risk premium captures almost 64 percent of the total premium during the 1980s for each market, except the U.S. Dahlquist and Sällström (2001) investigate the ability of asset pricing models to price 19 national portfolios, national industry portfolios sorted into 25 characteristic-sorted portfolios (such as value, growth, and size), and 39 global industry portfolios. They find that using national portfolios they cannot reject any of the models. However, when they investigate the characteristic-sorted portfolios, they find that the CAPM without foreign exchange risk factors performs poorly. However, even that model faces difficulties because characteristics are priced when added to the pricing equation and it does poorly when they try to price the global industry portfolios. Given the considerable success of industrial production as a conditioning variable in Zhang's (2001) work, it would be interesting to see how this variable performs in the tests implemented by Dahlquist and Sällström.

Though the empirical evidence on the world CAPM suggests that, for the U.S., it may not be necessary to use the world market portfolio to investigate the cross-section of expected returns, some of the empirical evidence on the pricing of exchange rate risk indicates that one may have to take into account the exposure of stocks to foreign exchange risk. Paradoxically, the evidence on foreign exchange rate exposures of stocks is weak as discussed in Griffin and Stulz (2001), making it puzzling that exchange rates would matter so much in the cross-section of returns in some studies.

3. Home Bias

The models discussed in Sections 2.A. and 2.B. have strong implications for the equity portfolios of investors. With these models, all investors hold any two stocks in the same proportion. The generalized model discussed in Section 2.C. predicts that all investors invest in the portfolio an investor with logarithmic utility would hold plus hedge portfolios. Except for hedge portfolios, therefore, all investors also hold any two stocks in the same proportion. If hedge portfolios do not include stocks, then all three models imply that investors hold any two stocks in the same proportion. Unless hedge portfolios contain stocks, it must therefore be the case that all investors hold the world market portfolio of stocks. As shown in Ahearne, Griever, and Warnock (2001), at the end of 1997 U.S. stocks comprised 48.3% of the world market portfolio. At that time, foreign stocks represented only 10.1% of the stock portfolios of U.S. investors. The holdings of foreign stocks predicted by the world CAPM and the Solnik/Sercu model were, therefore, about five times the actual holdings of foreign stocks of U.S. investors. This dramatic underweighting of foreign stocks in portfolios is called the home bias.[9] The home bias is pervasive across countries. French and Poterba (1991) and Tesar and Werner (1994) show that at the beginning of the 1990s, the fraction of stock market wealth invested domestically was in excess of 90% for the U.S. and Japan, and in excess of 80% for the U.K. and Germany.

Figure 1 uses flow of funds data to show how the home bias has evolved over time for U.S. investors from 1973 through the first quarter of 2001. This figure shows holdings of foreign stocks for American investors as a fraction of their stock market wealth and the share of U.S. stocks in the world market portfolio. Though the home bias has decreased for these investors, most of the decrease occurred over a few years from 1985 through 1994. Before 1985, holdings of foreign stocks represented a trivial fraction of the stock market wealth of American investors. From 1945 to 1973, holdings of foreign stocks as a fraction of stock market wealth never exceed 1%. Though holdings of foreign stocks increased sharply from 1985 through 1994 to roughly 10% of the stock market wealth of American investors, this fraction has stayed remarkably constant since then. It was 9.91% in 1994 and 10.53% at the end of the first quarter of 2001. Though the portfolio weight of foreign assets stayed relatively stable since 1994, the dollar value of foreign holdings more than doubled.

---

[9] Lewis (1999) provides a recent extensive review of the home bias literature.

For a number of years after World War II, most countries had strong barriers to foreign investment. Because most currencies were not convertible, investing abroad required access to scarce foreign currencies. Many countries also had prohibitions to foreign investment by their own citizens and often limits or outright prohibition to ownership of domestic stocks by foreign investors. Even when countries did not have outright restrictions on foreign investment, equity investment by foreign investors could be disadvantaged because of tax considerations, because of the necessity to acquire foreign exchange, and because of the costs of hedging exchange rate risk. In the presence of barriers to international investment, one expects investors to hold more domestic stocks than predicted by the world CAPM or the Solnik/Sercu model because barriers to international investment lessen the benefits of international diversification.

Black (1974) derives a model of international portfolio choice and asset pricing where barriers to international investment take the form of a proportional tax that is rebated for short sales. Barriers of this type might correspond to some types of taxes but, generally, obstacles to investment are such that they reduce the return both for short and long positions. Stulz (1981b) models such barriers as the equivalent of a tax paid on the absolute value of holdings of foreign stocks and shows that they imply that some foreign stocks are not held by domestic residents. This tax can represent explicit direct costs of holding foreign stocks as well as proxy for other indirect costs, such as information costs. Other barriers to international investment take the form of outright ownership restrictions. Eun and Janakiramanan (1986) and Errunza and Losq (1985) provide models that examine the portfolio and asset pricing implications of such barriers.

A number of papers investigate empirically the implications of partial segmentation, where partial segmentation is defined to mean that there are some equity flows that take place either in or out of a country, but these flows are limited because of explicit constraints on or because of barriers to international investment. Many of the papers discussed in Section 2.D. use the hypothesis of segmented markets as their alternative hypothesis. In particular, it is common in the literature to contrast global pricing of assets to local pricing of country portfolios. When using developed markets for the 1980s and 1990s, authors generally find that they can reject local pricing of country portfolios. However, for a number of countries, some of the barriers to international investment are known explicitly, so that a model that reflects these barriers can be tested. Errunza and Losq (1985) derive explicit predictions for the expected returns of securities that cannot be held freely by foreign investors and test these predictions on a short sample period, obtaining results that are consistent with their predictions. Hietala (1989) tests a model where he incorporates the ownership restrictions that applied to Finnish companies over his sample period and finds supportive evidence that the magnitude of the premium of unrestricted shares relative to restricted shares can be explained by his model. Bailey and Jagtiani (1994) investigate the determinants of the premium of shares available to foreign investors in Thailand and show how that premium varies over time.

With explicit or implicit barriers to international investment, securities available to foreign investors may not be equally attractive to all foreign investors since the barriers may differ across investors depending, for instance, on their tax status. In this case, the demand curves for domestic securities from foreign investors may be downward-sloping, creating incentives for firms to restrict their supply of shares available to foreign investors to increase the price of these shares. Stulz and Wasserfallen (1995) expand models with barriers to international investment to take into account the downward-sloping demand curves for domestic securities from foreign investors. They find supportive evidence for Switzerland. Domowitz, Glen, and Madhavan (1997) investigate the pricing of restricted and unrestricted shares in Mexico and find support for the hypothesis that the demand curve for Mexican shares from foreign investors is downward sloping.

Over the last thirty years, however, barriers to international investment have fallen dramatically. Emerging markets took longer to remove explicit barriers to international investment. However, even for emerging markets that have few such explicit barriers, sovereign risk remains often as a significant barrier to international investment. Further, in these markets, there have been instances where barriers have been restored – the most visible case being Malaysia in 1998. Bekaert and Harvey (1995) estimate a multivariate GARCH model where the degree of integration of an emerging market changes over time and then extract the extent to which the market is segmented from the data. With their approach, the risk premium on a market depends on its volatility if the market is completely segmented and depends on its world market beta if it is completely integrated. They allow a market's expected return to depend both on its volatility and on its world beta. The degree of segmentation of a market decreases when the market's world beta becomes a more important determinant of the market's expected return. They find that the degree of segmentation varies over time – sometimes decreasing and sometimes increasing.

Bekaert and Harvey (2000) and Henry (2000) provide evidence on the impact of removing barriers to international investment for emerging markets.[10] When a country's risk premium is determined locally, the mean-variance model implies that the risk premium increases with the volatility of that country's market. In contrast, when a country's risk premium is determined globally, the risk premium depends on the covariance of the return of that country's market portfolio with the return of the world market portfolio. Because emerging markets typically have high volatility but low betas, one would expect their equity to appreciate substantially when they move from local to global pricing. Henry (2000) shows that it is so. Investigating a number of countries, he finds that on average the equity of these countries appreciates by more than 25% over the eight months that precede the opening of their markets and the month of the opening. Further, Chari and Henry (2001) provide evidence supportive of the hypothesis that the expected return of individual stocks is determined by their local beta before their markets open up to foreign investors and by their global beta afterwards. At the same time, however, it is clear that

[10] Stulz and Wasserfallen (1995) provide an event study of the removal of barriers to international investment for a Swiss stock. They show that when Nestlé made shares that could be held only by Swiss residents freely available, the price of these shares increased sharply as predicted.

the impact of opening a country's markets to foreign investors has a relatively small impact on the risk premium of that market. While Henry investigates stock index returns around stock market openings, Bekaert and Harvey (2000) investigate changes in dividend yields. They provide a battery of econometric tests showing that, even though the risk premium falls, a reasonable estimate of this decrease in the risk premium is only at most between 100 basis points and 200 basis points.

The small decrease in the risk premium following the opening of a market to foreign investors is puzzling. Since the beta of emerging markets is so low and their volatility is so high, one would expect a much more dramatic impact. The home bias may help explain this low impact of stock market liberalization on the risk premium of emerging markets. The dramatic change from local to global pricing takes place only if, after liberalization, foreign investors begin to hold stocks of the liberalizing country in proportion to their weight in the world market portfolio. We know that they do not. If they did, the holdings of domestic stocks by domestic investors in emerging markets would be trivial since the share of an emerging market in the world market portfolio is typically less than 1%. Obviously, foreign holdings of emerging market stocks are not as extensive.

There are at least four reasons why one has to be skeptical about explanations of the home bias that rely on explicit direct barriers to international investment. First, these barriers have fallen over time. In fact, Errunza, Hogan, and Hung (1999) show that investors can obtain most of the benefits from international diversification by investing in securities traded in the U.S. such as American Depository Receipts (ADRs) and country funds. Despite the growth in these securities, as shown in Figure 1, the home bias for U.S. investors is unchanged over the last seven years. Second, the gross equity flows are very large compared to the net equity flows.[11] For instance, in 1999, equity transactions between U.S. investors and foreign investors totaled \$4.6 trillion.

Further, during the first three quarters of 2000, U.S. investors bought foreign shares for $1.376 trillion and sold foreign shares for $1.364 trillion, buying a net amount of foreign shares of slightly more than $12 billion. Such dramatic gross purchases and gross sales seem hard to reconcile with the existence of important differential transaction costs for the purchase and sale of foreign shares compared to domestic shares. Third, Glassman and Riddick (2001) calibrate a mean-variance model of portfolio choice with transaction costs in order to explain the deviations from the world market portfolio for U.S. investors when considering foreign holdings in Canada, France, Germany, Japan, and the U.K. They show that explicit direct barriers to international investment would have to be of an extraordinary magnitude -- more than 1% per month for an investor with a coefficient of relative risk aversion of 3 -- for a reasonable explanation of home bias. Fourth, Ahearne, Griever, and Warnock (2001) show ownership restrictions and transaction costs are second-order effects in explaining the cross-country holdings of foreign stocks for U.S. investors. Liberalization does not mean that foreign investors will immediately acquire a large stake in the liberalizing country. Absent foreign equity investment, the risk-sharing benefits of liberalization will not be obtained (see Stulz (1999)).

If explicit direct barriers to international investment and ownership restrictions fail to explain the home bias for U.S. investors, what can? The models discussed in Section 2.C. predict that investors will hold portfolios to hedge against unanticipated changes in state variables on which their expected lifetime utility depend. As long as the impact of some state variables depends on the country of residence of the investor and on the fact that to hedge these state variables requires common stocks, one would expect investors to hold stock portfolios that depend on their country of residence. The literature has focused on consumption good prices and human capital as the

---

[11] Tesar and Werner (1995) were first to notice that non-resident investors trade very actively compared to resident investors.

main state variable that could lead to differences in portfolios across countries. In Krugman (1981) and Stulz (1983), investors hold bonds rather than stocks to hedge against relative goods prices because the price of foreign bonds in domestic currency is correlated with the relative price of foreign goods so that their models cannot explain the home bias. Uppal (1993) provides a general equilibrium model that builds on Dumas (1992). The Dumas model is a two-country model where there is only one consumption good, but the location of the inventory of that good matters because changes in the stock of the good in one country can only take place as a flow and it is costly to move goods from one country to the other. In the Dumas model, the exchange rate is interpreted as the price of the good in the foreign country in terms of the price of the good in the domestic country. The setup of the model makes it possible to generate interesting dynamics for the real exchange rate. In particular, it is possible for the real exchange rate to differ from one and no trade in the good to take place. However, there are upper and lower limits to the extent to which the real exchange rate can depart from one because trade takes place when the real exchange rate deviates too much from one. Uppal's model investigates portfolio choice in such a setting. He finds that investors with a coefficient of relative risk aversion that exceeds unity end up overweighting foreign stocks.

Cooper and Kaplanis (1994) examine whether hedging against inflation risk can explain the home bias and conclude that it cannot. In a simple mean-variance model where human capital is a non-traded asset, Mayers (1973) shows that investors hold stocks to hedge that non-traded asset. If the return to human capital of an investor is negatively correlated with the return of the stocks from that investor's country, then that investor would increase her position in domestic stocks relative to what would be predicted in a model without non-traded assets. Fama and Schwert (1977) were first to examine this issue for the U.S. and found little correlation. However, Baxter and Jermann (1997) argue that the correlation between human capital and the stock market of the country of an investor is positive, so that their analysis leads them to conclude that domestic investors should hold fewer domestic stocks than predicted by the mean-variance model. In contrast, Bottazzi, Pesenti, and Van Wincoop (1996) present estimates showing a negative correlation, so that they can conclude that hedging of human capital can explain up to 40% of the home bias. However, Glassman and Riddick (2001) show that for human capital to explain the home bias, the return to human capital has to have positive correlation with stock market returns, this positive correlation has to be larger with most foreign markets than it is with the U.S., and the volatility of the return to human capital has to be large compared to the volatility of the U.S. stock market.

Though explicit direct barriers to international investment and ownership restrictions cannot explain the home bias, there are also indirect barriers to international investment. It has been often argued that investors know less about foreign stocks than they know about domestic stocks. The hypothesis that foreign investors are less well informed about domestic stocks forms the starting point for several theoretical models. In particular, Gehrig (1993) derives the optimal portfolio when foreign investors know less and shows that this assumption leads to an overweighting of domestic assets. Kang and Stulz (1997) provide some evidence about holdings of foreign assets that is consistent with an information advantage for domestic investors. They show that foreign investors in Japan hold more stocks of large companies than they do of small companies. In other words, the home bias is stronger for small stocks than for large stocks. One would expect that the information disadvantage of foreign investors would be smaller for large stocks. Dahlquist and Robertson (2001) investigate the holdings of Swedish stocks by non-resident investors. Their results are consistent with Kang and Stulz (1997). They point out that non-resident investors are mostly institutional investors and that the holdings of stocks by non-resident investors exhibit biases that are also typical of resident institutional investors.

Foreign investors could be disadvantaged because of distance, because of differences in language and culture, and because of time zone differences. There is evidence that distance matters. In two papers, Coval and Moskowitz (1999, 2001) show that the weight of a U.S. stock in U.S. mutual funds is negatively related to the distance between the location of the fund and the location of the headquarters of the firm and that mutual fund managers do better with their holdings of stocks of firms located more closely to where the mutual fund is located. Grinblatt and Keloharju (2001) show that, in Finland, language matters in an investor's portfolio allocation. Finnish investors whose native language is Swedish are more likely to own stocks of companies in Finland that have annual reports in Swedish and whose CEOs speak Swedish than those investors whose native language is Finnish. Choe, Kho, and Stulz (2001) find evidence that foreign investors buy at higher prices than resident investors in Korea and sell at lower prices. Shukla and van Inwegen (1995) show that U.K. money managers underperform American money managers when picking U.S. stocks. Hau (2001) finds that proprietary trades on the German stock market do better when they are geographically closer to Frankfurt. There is however some evidence that conflicts with the view that foreign investors are less well informed about domestic stocks. Grinblatt and Keloharju (2000), Seasholes (2000), and Karolyi (2002) provide evidence that foreign institutional investors outperform residents. Grinblatt and Keloharju use Finnish data to show that over their sample period foreign investors are better at picking Finnish stocks than domestic investors. Seasholes shows that in Taiwan foreign institutional investors buy stocks before positive earnings announcements and sell stocks before negative earnings announcements. Both papers argue that foreign institutional investors do better because they are more skilled at acquiring and interpreting information. Karolyi (2002) shows that foreign investors in Japanese equities outperformed Japanese individuals and institutions, including banks, trust and life insurance companies, and corporations themselves during the Asian financial crisis period.

In a mean-variance model where investors choose among all stocks, the information disadvantage of foreign investors matters in their portfolio allocation if they perceive that foreign stocks are riskier. Glassman and Riddick (2001) show that investors would have to scale up perceived market portfolio standard deviations typically by a factor from 2 to 5 depending on risk aversion to produce a home bias similar to the one observed for U.S. investors. Such scaling makes little sense. Yet, the confidence intervals around portfolio weights obtained from mean-variance optimization are large enough that they include the case of zero weight on foreign assets (Britten-Jones (1999)), so that investors with different priors might reach dramatically different conclusions about the benefits of international diversification. However, Pastor (2000) and Li (2001) provide evidence that Bayesian investors would have to have rather extreme beliefs in favor of domestic asset pricing to stay away from foreign stocks. It may well be, though, that investors overestimate the risk of foreign stocks and underestimate their expected returns because of behavioral factors. Shiller, Kon-ya, and Tsutsui (1996) provide survey evidence that domestic investors typically expect domestic stocks to earn more than foreign investors do.

Merton (1987) develops a model where investors hold stocks that they know. Such a model would be equivalent to one where investors think that the risk of stocks they do not know is extremely high. With that model, one would also see investors overweight domestic stocks. Strikingly, Ahearne, Griever, and Warnock (2001) find that the most important variable in explaining the underweighting of stocks of various countries by American investors is the fraction of a country's market capitalization that corresponds to firms with ADR programs: The greater this fraction for a country, the greater the weight of that country in the portfolio of U.S. investors. The impact of ADR programs might be due to the fact that having a foreign stock traded in the U.S. represents a certification effect and reduces information asymmetries because of the adoption of U.S. GAAP. Ahearne, Griever, and Warnock find that the impact of ADRs comes from listings that require firms to use U.S. GAAP and to provide SEC disclosures as opposed to OTC listings. At the same time, however, an ADR program makes firms known, especially when it involves listing on an exchange, which would be supportive of Merton's model. The empirical evidence on ADR programs (surveyed by Karolyi, 1998) shows that there is a positive abnormal return when a firm announces or lists an ADR program (Foerster and Karolyi, 1999, and Miller, 1999), that ADR programs experience a pre-listing stock price run-up and post-listing stock price decline (Foerster and Karolyi 1999, 2000), and that global factors affect the pricing of ADR firms more than firms from the countries of ADR firms that do not list in the U.S. (Mittoo, 1992, and Karolyi, 1998). This evidence is consistent with the hypothesis that a U.S. listing reduces some barriers to international investment.

The home bias has generated a great deal of research. However, most explanations for the home bias have trouble explaining the fact that the allocation to foreign stocks of U.S. investors remained stable from 1994 through 2000. During that period of time, the size of ADR programs increased dramatically and it became dramatically easier for U.S. investors to get exposure to foreign stocks with little impact on portfolio allocations. It is plausible that the success of the U.S. stock market led U.S. investors to keep their allocation to that market high, so that momentum trading explains why the home bias has not decreased. However, this explanation for why the home bias of U.S. investors has not decreased makes it even more puzzling why the home bias of foreign investors is so large. Pinkowitz, Stulz, and Williamson (2001) explain this home bias by the fact that, in most countries, firms have controlling investors who do not trade their shares. Perfect financial markets models with investors who are mean-variance optimizers cannot explain any of this.

4. Flows, Spillovers, and Contagion

Cross-border capital flows have grown dramatically in the past three decades, especially to developing economies. For example, in 1975, gross cross-border transactions in bonds and equities for the U.S. were equivalent to 4% of GDP. As shown in Figure 2, these transactions exceeded GDP for the first time in 1991 and by 2000 they had grown to 245% of GDP. Moreover, net portfolio flows have become an economically significant component of total capital flows. Figure 3 shows that total net capital flows to emerging markets were positive each year but were accelerating to a high of $180 billion in 1996 and subsequently declining to a low of $45 billion in 2000. Flows are also remarkably volatile: the East Asian crisis countries went from net private capital flows of $62.4 billion in 1996 to net private capital flows of -$46.2 billion in 1998.

The dramatic change in net private capital flows that takes place in crisis periods, as evidenced by the statistics for East Asia as well as the other statistics given in the introduction, have led many policymakers to question whether the financial liberalization process has gone too far and whether controls on capital flows should be reintroduced. The recent upheavals in Asia and Russia have led to the reimposition of some barriers to international investment in some countries. Prominent economists have argued that, while trade liberalization should be encouraged, this is not true of financial liberalization. For instance, Stiglitz (1998) called for greater regulation of capital flows, arguing that "…developing countries are more vulnerable to vacillations in international flows than ever before." Krugman (1998) argued as follows: "What turned a bad financial situation into a catastrophe was the way a loss of confidence turned into self-reinforcing panic. In 1996 capital was flowing into emerging Asia at the rate of about $100 billion a year; by the second half of 1997 it was flowing out at about the same rate. Inevitably, with that kind of reversal Asia's asset markets plunged, its economies went into recession, and it only got worse from there." Bhagwati (1998) states that: "This is a seductive idea: freeing up trade is good, why not also let capital move freely across borders? But the claims of enormous benefits from free capital mobility are not persuasive. (...) It is time to shift the burden of proof from those who oppose to those who favor liberated capital."

Policymakers, economists, and other observers have been concerned that countries are adversely affected by volatile flows and by contagion. These channels through which global forces affect countries cannot be understood with the perfect financial markets model discussed in Section 2. There is little role for equity flows in models where all investors hold stocks in the same proportions. In this section, we review two growing branches of the international finance literature that examine the channels through which global forces affect asset prices and that the economists quoted in the previous paragraph are concerned about. The first set of studies examines the joint dynamics of capital flows and asset returns. This research investigates whether flows reflect changes in expected returns as globalization and liberalization forces would predict or whether they may just as likely impact returns themselves. The second set of studies examines an important by-product of free capital flow: how global stock market returns move together. With free flows, markets are more closely connected. Investors who think that one market will have higher expected returns can move their investments to that market and this connection implies that markets move together more than they would if they were segmented. With growing liberalization and integration of markets, one would expect that international co-movements of stock returns have also grown, but a number of studies have rejected this notion. Moreover, while international stock returns comovements fluctuate over time, these fluctuations seem difficult to explain with economic fundamentals in those markets, leading some to suggest that they reflect irrational market contagion, especially around crisis periods (Mussa and Richards, 1999). Evidence that is supportive of this view is provided by Kaminsky and Schmukler (1999) who show that it is often impossible to find public information justifying large stock-price movements and that large negative (but not positive) stock-price movements are followed by reversals.

One important caveat has to be noted here that applies to our discussion in this section. There is a critical difference between equity flows and debt flows. Equity outflows can only take place if foreign investors sell stocks. Selling stocks in a hurry is expensive because of the price impact effect. Hence, the volatility of equity flows is naturally reduced by the price impact expense incurred by investors when they try to make rapid large changes in their stock holdings. In contrast, the properties of short-term debt make short-term debt flows more volatile. Consider a firm that has short-term creditors. If a short-term creditor can call his loan at par or can choose not to renew his loan, he gets the par amount of his loan and makes no loss – he suffers no price impact. However, when the firm has limited liquidity, not all short-term creditors can get their money back – the first ones to ask for it will get it, but not the last ones. Consequently, short-term creditors have an incentive to ask for their money back and not renew loans at the first sign of risk of default. The literature we review here is focused on equity flows than on short-term debt flows. It does not therefore study the causes and consequences of non-renewal of short-term debt.

To the extent that short-term funding is used to invest in illiquid projects, non-renewal of short-term debt can lead to a classic liquidity crisis. Radelet and Sachs (1998) emphasize this mechanism in the context of the East Asian crisis. They state that "international loan markets are prone to self-fulfilling crises in which individual creditors may act rationally and yet market outcomes produce sharp, costly, and fundamentally panicked reversals in capital flows" (Radelet and Sachs (1998), p. 5). King (1999) points out that "Virtually the whole of the $125 billion reversal of flows to the five Asian countries was accounted for by swings in short-term debt finance.(…) Liquidity runs, although not the sole cause of problems, did play a major part in recent financial crises." The literature we review is focused on equity flows rather than debt flows and therefore pays little attention to the issue of a liquidity crisis.

4. A. Flows and Returns

Can changes in equity valuations be traced directly to capital flows? If so, does the impact of capital inflows and outflows on valuations reflect information that foreign investors have that is not yet incorporated into prices, or are changes in valuations just the destabilizing by-product of excessively volatile flows as foreign investors come and go on a whim? That foreign investors are systematically better informed than domestic investors about events that affect the country as a whole is unlikely and, in fact, the asymmetry of information in favor of domestic investors is one of the leading explanations of the home bias phenomenon in Section 3. Studies by Tesar and Werner (1994, 1995) were the first to uncover positive, contemporaneous correlations between U.S. portfolio flows in developed and emerging foreign markets and market index returns. They employed quarterly data from the U.S. Treasury Bulletin between 1982 and 1994. Brennan and Cao (1997) develop and test a theoretical model that relates international investment flows to differences in information endowments between foreign and domestic investors. In their model, foreign investors are less well informed than domestic investors. As a result, public information is more valuable to foreign investors and has a greater impact on their forecasts of asset payoffs than on the forecasts of local investors. Foreign purchases of equity are volatile because foreign investors have more diffuse priors, so that news affects expected payoffs more for them than it does for local investors. They corroborate the Tesar and Werner findings of contemporaneous correlations in returns and flows using the same U.S. Treasury Bulletin data, but broaden the sample from Canada, Japan, U.S., and U.K to sixteen emerging markets.

The coarseness of low-frequency, quarterly data can mask the true dynamics of the relation between flows and returns. Indeed, Bohn and Tesar (1996) extend the analysis to monthly data for a large number of countries and, with the higher frequency data, were the first to uncover evidence of a delayed response of U.S. net portfolio flows to returns. That is, they found that foreign investors are positive feedback traders, buying following positive returns and selling following negative returns. Froot, O'Connell, and Seasholes (2001) corroborate this positive feedback trading using proprietary data from State Street Bank and Trust as custodian for institutional investors in 44 countries. Their advantage is the availability of daily reporting of these trades which allows them to delineate clearly components of the total quarterly covariance relationship into those due to flows leading returns, flows lagging returns, and flows contemporaneously correlated with returns. The results of this decomposition using their covariance ratio statistic (CVR) clearly shows that flows lagging returns account for 80% of the total, while contemporaneous and flows leading returns capture 4% and 16%, respectively.

Froot, O'Connell, and Seasholes also estimate a bivariate VAR and impulse responses that allows them to take into account the dynamics of flows to show that flows are highly persistent, especially for emerging markets. They then show that a one basis point increase in flows leads to a 40 basis point increase in equity prices over the first 30 days or so, but after controlling for the persistence of flows, they find a 100 basis point shock to returns leads to only a 0.05 basis point additional inflow over the next two or three months. Though significant, this effect is small. Using an extended structural VAR model, Froot, O'Connell, and Seasholes find that a one basis point shock to flows has a contemporaneous effect of increasing prices by 0.6 basis points. Most of the price impact of a shock to flows seems to come subsequently to the increase in flows. This could be evidence that flows contain information about future returns. This result is quite different from the literature on mutual fund flows and returns in the U.S. (Warther (1995) who uses monthly data and Edelen and Warner (2001) who use daily data) both find a permanent increase in prices following net inflows, but this increase is the result of the contemporaneous effect rather than of a lag effect. Clark and Berko (1996) document permanent price changes associated with foreign flows using Mexican data for the period from 1989 to 1993 when there was a significant acceleration in foreign ownership of Mexican equities. Froot and Ramdorai (2001) offer some new evidence indicating that the relation between flows and returns may be due to flows forecasting returns rather than the price pressure effect of flows. They examine the impact of cross-border portfolio flows using the prices of closed-end country funds to control for country fundamentals.

One possibility is that structural breaks, due to shifts in fundamental economic factors or crisis events, complicate empirical analysis. Choe, Kho, and Stulz (1999) examine portfolio equity flows to Korea during the Asian crisis period of 1997 at the stock level and again confirm the positive feedback effect among foreign investors. Surprisingly, this positive feedback effect weakens during the three months of their sample corresponding to the Korean phase of the Asian crisis.[12] If the positive-feedback effect dissipates, they argue that the trading practices of foreign investors are even less likely to be destabilizing. In fact, since their data was available on an intraday, transaction-by-transaction basis for individual stocks, they test whether large block purchases and sales by foreign investors have a permanent impact on prices like those of institutional investors on the NYSE (Chan and Lakonishok, 1993, 1995, 1997; Keim and

Madhavan, 1997). They find that these trades are incorporated into prices within 10 minutes with no subsequent lasting impact on prices, which is not consistent with the lag effect documented by Froot, O'Connell, and Seasholes. Unlike Choe et al. for Korea, Karolyi (2001) documents a significant structural break in flows and returns in Japan during the Asian crisis, but, surprisingly, he finds that positive feedback trading intensifies. Kaminsky, Lyons, and Schmukler (2000) investigate the trading of U.S. emerging markets mutual funds and, at a lower frequency, find that there is strong momentum trading on the part of these funds. Distinguishing between contemporaneous and lagged momentum trading, they find that contemporaneous momentum trading increases during crises, more so because of the investors in these funds than because of the managers, but that lagged momentum trading weakens during crisis periods. They also demonstrate that funds engage in what they call "contagion trading," namely that they sell in one country when returns in another country are poor. Such a trading practice might reflect the need to rebalance portfolios during crises, might be due to the fact that it is harder to sell in crises countries because of lower liquidity, or might simply reflect an element of panic. Bekaert, Harvey, and Lumsdaine (2002a, 2002b) explicitly model the importance of liberalization events and crises on the joint dynamics of flows and returns for a number of emerging markets using an econometric technique devised by Bai, Lumsdaine, and Stock (1998), though with monthly data. They find sharply different results if their VAR model is estimated over the entire 20-year sample and if the nonstationarity in the flows and returns relationship is ignored. Edison and Warnock

---

[12] Kim and Wei (2002) also investigate positive feedback trading of investors. They use monthly data and find strong positive feedback trading behavior during the crisis months. They attribute the differences between their results and those of Choe, Kho, and Stulz to the fact that their dataset has holdings of investors and to the fact that their sample period is longer. They extend the crisis period to June 1998. Because their crisis period is so long, they cannot say anything about the importance of feedback trading in the unfolding of the crisis. It is perfectly possible that all their feedback trading is in 1998.

(2001), using a somewhat different approach, find that flows to emerging markets depend little on the fundamentals of these markets but are related to U.S. interest rates. Their result contradicts the result in Bekaert, Harvey, and Lumsdaine. A possible explanation for the difference in results is that, whereas Bekaert, Harvey, and Lumsdaine normalize flows by the market capitalization, Edison and Warnock do not.

4.B. Correlations, Spillovers, and Contagion

There is growing evidence that risk premia are determined globally, as we showed in Section 2.D. This effect naturally induces comovements in stock prices around the world. In a conditional setting, time-variation in those comovements reflects economic fundamentals that would not naturally occur if markets were segmented. There are a number of studies that have documented patterns in comovements of global asset returns. Their findings are difficult to rationalize with models of international asset pricing that assume perfect financial markets.

Much of the analysis of stock price comovements focuses on one measure: correlations. Typically, studies have shown that correlations with foreign indexes, particularly for emerging markets, are low. At the same time, these correlations change over time, which makes it difficult to determine if correlations are greater now than they used to be when capital flows were more restricted. Institutional factors have always clouded the picture further; for example, how national indexes are constructed in terms of scope, coverage, and industrial composition of the companies they include has always plagued studies of cross-country correlations (Roll, 1992; Heston and Rouwenhorst, 1994; Griffin and Karolyi; 1998). Longin and Solnik (1995) tested the equality of covariance and correlation matrices of returns for seven developed markets across different 5-year periods between 1960 and 1990. They rejected the hypothesis of equality in 10 of 16 comparisons and find that correlations increase over time. To do this, they estimated a multivariate GARCH model, similar in structure to that in Chan, Karolyi, and Stulz (1992) and De Santis and Gerard (1997), to evaluate and confirm the significance of a trend factor in conditional correlations across these markets. There are other studies that challenge the trend toward higher correlations. De Santis (1993) focused on emerging markets and found that the correlation structure is essentially the same for the 1976-84 and 1984-1992 subperiods, which is surprising given the rapid pace of liberalizations in those markets. Bekaert and Harvey (1995) employ a multivariate GARCH model with a Hamilton (1989) regime-switching feature to test for time-variation in market integration. They develop an integration index that is a conditional regime probability statistic that captures the same conditional correlations as Longin and Solnik, but nested within an asset pricing structure. Their model is applied to 21 developed and 12 emerging markets and they examine on a country-by-country basis the time series of conditional regime probabilities. Overall, they find that there is little trend in these conditional probabilities. Finally, Bekaert and Harvey (2000) estimate a model that allows correlations between emerging markets and the world market to change over time. They then estimate these correlations before and after liberalizations. Out of seventeen emerging markets, they found the correlation to be higher for only nine markets, hardly overwhelming evidence in favor of higher correlations over time. Bekaert, Harvey, and Lumsdaine (2002a) suggest that results on the impact of liberalization are often hampered by an incorrect identification of the actual liberalization event, which they estimate endogenously.

While there is no clear evidence that correlations are increasing with greater liberalization, there is evidence that correlations are changing over time. Unfortunately, it is difficult to associate changes in correlations with economic fundamentals. Ilmanen (1995) shows that there is a strong common factor in interest rate movements across developed countries. He suggests that this increase in correlations with this common factor reflects the weakening of national monetary authorities to pursue different inflation or interest rate policies. But, it is not clear why this would be revealed in nominal bond yields rather than expected real yields. For equities, Longin and Solnik (1995) estimate their multivariate GARCH model allowing not only a trend factor in conditional correlations but also market returns, dividend yields, and interest rates.

Overall, these market and economic factors were not reliably significant. King, Sentana, and Wadhwani (1994) find only weak evidence of association between correlations in monthly national index returns and economic factors. These weak results with monthly returns motivate Karolyi and Stulz (1997) to examine higher frequency, intraday returns across the U.S. and Japan for indexes, portfolios of individual stocks and ADRs, and even Nikkei index futures contracts. They find that correlations are time-varying, but again are not significantly related to macroeconomic news, interest rate and exchange rate shocks, dividend yields, and even trading volume. The only instrument with reliable predictive power for conditional correlations is the magnitude and direction of market movements themselves, especially for negative returns. De Santis and Gerard (1997) find a similar volatility and asymmetry effect in conditional correlations for bear markets across ten developed markets for monthly returns. Longin and Solnik (2001) employ extreme value statistics to model this same pattern of "threshhold" or "extreme" correlations more formally.

A possible explanation for the weak evidence of association between correlations and fundamentals is that the correlations are inadequately measured. For example, there have been a number of studies of statistically significant leading and lagging relationships among national index returns and the volatility of their returns. Eun and Shim (1989) is one of the early studies to examine the joint dynamics of returns across national markets. They employ a VAR model with variance decomposition and impulse response analysis to show that the U.S. market often led other market returns by one or two days and that the variation in U.S. market returns could capture a significant fraction of the total variation in other developed market returns. The aftermath of the international October 1987 market crisis prompted studies by King and Wadhwani (1990), Hamao, Masulis, and Ng (1990) and Lin, Engle, and Ito (1994) to model the joint dynamics of high-frequency, intraday return volatilities using multivariate GARCH models. They find that unexpectedly high volatility in the U.S., when the U.S. market is open, leads to high volatility in Japan. The "volatility spillover" results provide similar inferences to Eun and

Shim, but they indicate that the structure of conditional correlations is more complex than observed with daily, weekly, or monthly returns and when ignoring the volatility process. For example, for the U.S., U.K. and Japan, Hamao et al. show that relationship is more symmetric: unexpected volatility shocks in the U.S. lead to higher volatility in Japan the next day and unexpected shocks to volatility in Japan leads to higher volatility in the U.K. but not in the U.S. There have been dozens of studies that seek to relate economic fundamentals to volatility spillovers, but, like with returns themselves, with limited success (asymmetry of positive and negative returns, Bae and Karolyi, 1994; regional versus international factors, Ng, 2000; macroeconomic news announcements, Connolly and Wang, 2001).

The problem with the evidence on comovements in returns and volatility spillovers is that it is consistent with two hypotheses that are difficult to separate empirically, but yet have very different implications for the efficiency of financial markets. One hypothesis is that the markets have common, unobservable global components and the changes in correlations and spillovers reflect innovations in these common components. Under this view, spillovers show that markets incorporate information efficiently. The second hypothesis is that correlations and spillovers are the work of uninformed investors who systematically overreact to news in one market, corresponding to shifts in sentiments. That is, they become more risk averse following bad news and less risk averse following good news irrespective of fundamentals in their own markets. The weak results with regard to fundamentals and the finding that comovements increase systematically during bear markets, and especially during the 1994 Mexican and 1997 Asian crises, prompted a number of researchers to focus on the latter hypothesis, commonly referred to as "contagion." The traditional view of contagion has to do with banking panics. The idea is that a bank fails and depositors start withdrawing funds from other banks that are healthy, thereby weakening these banks (Diamond and Dybvig, 1983). King and Wadhwani (1990) is among the first studies to apply the same concept to international stock returns: a shock in one market leads investors to withdraw funds from other markets because of irrational fears and thus leads to unusually high comovements of asset prices, particularly on the downside.[13] The concept, its definition and measurement issues have been addressed in a number of important recent papers, a subset of which are surveyed by Claessens, Dornbusch, and Park (2002) and featured in the book by Claessens and Forbes (2002).

The literature often defines contagion to be an increase in correlations among asset returns in different markets in periods of crisis. Calvo and Reinhart (1996), Frankel and Schmukler (1998), and Bailey, Chan, and Chung (2000) have suggested that the aftermath of the peso crisis in Mexico in 1994 was evidence of contagion, especially to other Latin American markets, often referred to as a "tequila effect." Calvo and Reinhart find evidence that correlations of weekly returns on equities and Brady bonds for Asian and Latin American emerging markets was higher after the Mexican crisis than before. Frankel and Schmukler (1998) provide evidence that emerging market disturbances spread via the international investor community in New York. Bailey, Chan, and Chung offer more powerful tests with transaction data at 30-minute intervals between December 1994 and April 1995 on Asian and Latin American ADRs on the NYSE and country funds. They show that on the critical days of the depreciation of the peso, exchange rate shocks had a significant and rapid (within 60 minutes) adverse effect on non-Mexican Latin American ADRs and country funds, but no measurable impact on Asian ADRs or country funds. A marked increase in correlations among different markets may, however, not be sufficient proof of contagion. Forbes and Rigobon (1998, 2002) show that in the presence of heteroscedasticity (increases in volatility around crises), an increase in correlation could simply be a continuation of strong transmission mechanisms that exist in more stable periods. They also show that increases in correlations of asset prices may result when changes in fundamentals, risk perceptions, or preferences (endogenous or omitted variables) are correlated without any additional contagion

[13] Claessens, Dornbusch, and Park (2002) define contagion as "the spread of market disturbances – mostly on the downside – from one (emerging market) country to the other, a process observed through co-movements in exchange rates, stock prices, sovereign spreads and capital flows." (p. 4)

being present. In fact, they show less than 10 percent of the pairwise correlations among 28 developed and emerging markets during the 1987 October crash, the 1994 Mexican peso crisis, and 1997 Asian crisis increased after accounting for problems of heteroscedasticity, endogenous and omitted variables.

Another way to control for the fundamentals is to study conditional probabilities rather than raw correlations. Eichengreen, Rose, and Wyplosz (1996), Sachs, Tornell, and Velasco (1996) and Bae, Karolyi, and Stulz (2002) examine whether the likelihood of an extreme outcome (in terms of exchange rates, interest rates, or stock returns) in one country increases when there are extreme outcomes in another or several countries. These authors employ limited dependent variable models (multinomial probit and logit) to control for economic and financial channels through which linkages would occur in stable periods. These models do not rely on correlations as linear measures of association, but there is much discretion in defining an extreme outcome and what constitutes contagion.

5. Conclusion

In this paper, we have attempted to assess what we learn from the literature on the influence of global factors on portfolio choices and asset pricing. Intentionally, we have mostly focused on equities. The literature has provided clear evidence that national market risk premiums are determined internationally, but less clear evidence that international factors affect the cross-section of expected returns. Among international factors that affect asset returns, it may well be that omitting exchanges rates is more of a problem than omitting the return of foreign assets uncorrelated with the domestic market portfolio for the U.S. Models that rely on perfect financial markets do not explain important stylized facts in international finance, such as the home bias and the volatility of capital flows. Though introducing barriers to international investment, especially differences in information between local and foreign investors, helps in understanding these facts better, our understanding of these facts is quite incomplete. Yet, existing explanations for the home bias cannot explain why this bias has not decreased in the U.S. since 1995. It may well be that investors buy foreign stocks when domestic stocks have done poorly or domestic interest rates are low, so that they did not increase their share of foreign stocks during the U.S. bull market, but such behavior seems a long way from what one would expect in a world of perfect financial markets populated with mean-variance optimizers. Perhaps a good indication of how much we still have to learn is that, while the policymakers and the press have taken it as a fact that there is contagion and that it is a first-order phenomenon, existing research raises more questions about contagion than it resolves and some authors fail to find it altogether.

References

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

Ahearne, A. G., W. L. Griever, and F. E. Warnock, 2001, Information costs and home bias: An analysis of U.S. holdings of foreign equities, Federal Reserve Board, International Finance Division, Working Paper 691 (Updated), Washington, D.C.

Bae, K., and G. A. Karolyi, 1994, Good news, bad news and international spillovers of stock return volatility between Japan and the U.S., Pacific-Basin Finance Journal 2, 405-438.

Bae, K., G. A. Karolyi, and R. M. Stulz, 2002, A new approach to measuring financial contagion, Review of Financial Studies, forthcoming.

Bai, J., R. Lumsdaine, and J. H. Stock, 1998, Testing for and dating common breaks in multivariate time series, Review of Economic Studies 65, 395-432.

Bailey, W., and J. Jagtiani, 1994, Foreign ownership restrictions and stock prices in the Thai capital market, Journal of Financial Economics 36, 57-87.

Bailey, W., K. Chan, and Y. P. Chung, 2000, Depositary receipts, country funds, and the peso crash: The intraday evidence, Journal of Finance 55, 2693-2717.

Barro, R. J, 1974, Are government bonds net wealth?, Journal of Political Economy 82, 1095-1118.

Baxter, M., and U. J. Jermann, 1997, The international diversification puzzle is worse than you think, American Economic Review 87, 170-180.

Bekaert, G., and C. Harvey, 1995, Time-varying world market integration, Journal of Finance 50, 403-444.

Bekaert, G., and C. Harvey, 2000, Foreign speculators and emerging equity markets, Journal of Finance 55, 565-613.

Bekaert, G., C. Harvey, and R. Lumsdaine, 2002a, Dating the integration of world capital markets, Journal of Financial Economics, forthcoming.

Bekaert, G., C. Harvey, and R. Lumsdaine, 2002b, The dynamics of emerging market equity flows, Journal of International Money and Finance, forthcoming.

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

Bhagwati, J., 1998, The capital myth, Foreign Affairs 77 (3), 7-12.

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

Black, F., 1990, Equilibrium exchange rate hedging, Journal of Finance 45, 899- 908.

Bohn, H., and L. Tesar, 1996, U.S. equity investment in foreign markets: Portfolio rebalancing or return chasing?, American Economic Review 86, 77-81.

Bottazzi, L., P. Pesenti, and E. Van Wincoop, 1996, Wages, profits and the international portfolio puzzle, European Economic Review 40, 219-254.

Breeden, D., 1979, An intertemporal asset pricing model with stochastic consumption and investment opportunities, Journal of Financial Economics 7, 265-296.

Brennan, M. J., and H. Cao, 1997, International portfolio flows, Journal of Finance 52, 1851-1880.

Britten-Jones, M., 1999, The sampling error in estimates of mean-variance efficient portfolio weights, Journal of Finance 54, 655-671.

Calvo, G., and C. M. Reinhart, 1996, Capital flows to Latin America: Is there evidence of a contagion effect?, in Private capital flows to emerging markets after the Mexican crisis, eds., G. A. Calvo, M. Golstein and E. Hochreiter, Institute for International Economics, Washington, D.C.

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

Chan, K.C., G. A. Karolyi, and R. M. Stulz, 1992, Global financial markets and the risk premium on U.S. equity, Journal of Financial Economics 32, 137-168.

Chan, L., and J. Lakonishok, 1993, Institutional trades and intraday stock prices behavior, Journal of Financial Economics 33, 173-200.

Chan, L., and J. Lakonishok, 1995, The behavior of stock prices around institutional trades, Journal of Finance 50, 1174-1174.

Chan, L., and J. Lakonishok, 1997, Institutional equity trading costs: NYSE versus nasdaq, Journal of Finance 52, 713-735.

Chari, A., and P. Henry, 2001, Stock market liberalization and the repricing of systematic risk, NBER Working Paper #8265, Cambridge, MA.

Cho, D. C., C. S. Eun, and L. W. Senbet, 1986, International arbitrage pricing theory: An empirical investigation, Journal of Finance 41, 313-330.

Choe, H., B. Kho, and R. M. Stulz, 1999, Do foreign investors destabilize stock markets? The Korean experience in 1997, Journal of Financial Economics 54, 3-46.

Choe, H., B. Kho, and R. M. Stulz, 2001, Do domestic investors have more valuable information about individual stocks than foreign investors?, NBER Working Paper No. 8073, Cambridge, Ma.

Claessens, S., R. Dornbusch, and Y. C. Park, 2002, Contagion: Why crises spread and how this can be stopped, in Stijn Claessens and Kristin Forbes, eds., International financial contagion, Kluwer Academic Publishers, New York, NY.

Claessens, S., and K. Forbes, 2002, International financial contagion, Kluwer Academic Publishers, New York, NY.

Clark, J., and E. Berko, 1996, Foreign investment fluctuations and emerging market stock returns: The case of Mexico, unpublished working paper, Federal Reserve Bank of New York, New York, NY.

Connolly, R., and F. A. Wang, 2001, International equity market co-movement: economic fundamentals or contagion?, Pacific-Basin Finance Journal, forthcoming.

Cooper, I. A., and E. Kaplanis, 1994, Home bias in equity portfolios, inflation hedging and international capital market equilibrium, Review of Financial Studies 7, p. 45-60.

Coval, J. A., and T. J. Moskowitz, 1999, Home bias at home: Local equity preference in domestic portfolios, Journal of Finance 54, 2045-2073.

Coval, J. A., and T. J. Moskowitz, 2001, The geography of investment: Informed trading and asset prices, Journal of Political Economy 109, 811-841.

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

Cumby, R. E., 1990, Consumption risk and international equity returns: Some empirical evidence, Journal of International Money and Finance 9, 182-192.

Dahlquist, M., and T. Sällström, 2001, An evaluation of international asset pricing models, Duke University working paper.

Dahlquist, M., and G. Robertsson, 2001, Direct foreign ownership, institutional investors, and firm characteristics, Journal of Financial Economics 59, 413-440.

De Santis, G., 1993, Asset pricing and portfolio diversification: Evidence from emerging financial markets, Portfolio investment in developing countries, ed. S. Claesens and S. Gooptu, Washington, D.C.: World Bank 145-168.

De Santis, G., and B. Gerard, 1997, International asset pricing and portfolio diversification with time-varying risk, Journal of Finance 52, 1881-1912.

De Santis, G., and B. Gerard, 1998, How big is the premium for currency risk?, Journal of Financial Economics 49, 375-412.

Diamond, D., and P. Dybvig, 1983, Bank runs, deposit insurance, and liquidity, Journal of Political Economy 91, 401-419.

Domowitz, I., J. Glen, and A. Madhavan, 1997, Market segmentation and stock prices: Evidence from an emerging market, Journal of Finance 52, 1059-1085.

Dumas, B., 1992, Dynamic equilibrium and the real exchange rate in a spatially separated world, Review of Financial Studies 5, 153-180.

Dumas, B., and B. Solnik, 1995, The world price of foreign exchange risk, Journal of Finance 50, 445-479.

Edelen, R., and J. Warner, 2001, Aggregate price effects of institutional trading: A study of mutual fund flow and market returns, Journal of Financial Economics 59, 195-220.

Edison, H. J., and F. E. Warnock, 2001, Cross-border listings, capital controls, and equity flows to emerging markets, Unpublished paper, Federal Reserve Board, Washington, DC.

Eichengreen, B., A. Rose, and C. Wyplosz, 1996, Contagious currency crises: First tests, Scandinavian Journal of Economics 98, 463-484.

Engel, C., and J. H. Rogers, 1996, How wide is the border?, American Economic Review 86, 1112-1125.

Errunza, V., K. Hogan, and M. Hung, 1999, Can the gains from international diversification be achieved without trading abroad?, Journal of Finance 54, 2075-2107.

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

Eun, C. S., and S. Janakiramanan, 1986, A model of international asset pricing with a constraint on the foreign equity ownership, Journal of Finance 41, 897-914.

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

Fama, E., 1976, Foundations of finance, Basic Books Inc., New York, NY.

Fama, E., and K. French, 1993, Common risk factors in the returns on stocks and bonds, Journal of Financial Economics 33, 3-56.

Fama, E., and K. French, 1998, Value versus growth: The international evidence, Journal of Finance 53, 1975-1999.

Fama, E., and G. Schwert, 1977, Human capital and capital market equilibrium, Journal of Financial Economics 4, 95-125.

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

Ferson, W., and C. Harvey, 1994, Sources of risk and expected returns in global equity markets, Journal of Banking and Finance 18, 775-803.

Ferson, W., and C. Harvey, 1995, Predictability and time-varying risk in world equity markets, Research in Finance 13, 25-87.

Ferson, W., and C. Harvey, 1997, Fundamental determinants of national equity market returns: A perspective on conditional asset pricing, Journal of Banking and Finance 21, 1625-1665.

Forbes, K., and R. Rigobon, 1998, Measuring contagion: Conceptual and empirical issues, MIT working paper.

Forbes, K., and R. Rigobon, 2002, No contagion, only interdependence: Measuring stock market comovements, Journal of Finance, forthcoming.

Foerster S., and A. Karolyi, 1999, The effects of market segmentation and investor recognition on asset prices: evidence from foreign stocks listing in the U.S., Journal of Finance 54, 981-1014.

Foerster, S. R., and G. A. Karolyi, 2000, The long run performance of global equity offerings, Journal of Financial and Quantitative Analysis 35, 499-528.

Frankel, J., and S. Schmukler, 1998, Crises, contagion, and country funds: Effects on East Asia and Latin America, in Management of Capital Flows and Exchange Rates: Lessons from the Pacific Rim, R. Glick, ed., Cambridge University Press.

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

Froot, K., and T. Ramadorai, 2001, The information content of international portfolio flows, Journal of Financial Economics, forthcoming.

Froot, K., and K. Rogoff, 1995, Perspectives on PPP and long-run real exchange rates, Handbook of International Economics, vol. III, edited by G. Grossman and K. Rogoff, North-Holland.

Froot, K., P. O'Connell, and M. Seasholes, 2001, The portfolio flows of international investors, Journal of Financial Economics 59, 151-193.

Froot, K., and R. H. Thaler, 1990, Anomalies: Foreign exchange, Journal of Economic Perspectives 4, 179-192.

Gehrig, T., 1993, An information based explanation of the domestic bias in international equity investment, Scandinavian Journal of Economics 95, 97-109.

Giovannini, A., and P. Jorion, 1989, The time variation of risk and return in the foreign exchange and stock markets, Journal of Finance 44, 307-326.

Glassman, D. A., and L. A. Riddick, 2001, What causes home asset bias and how should it be measured?, Journal of Empirical Finance 8, 35-54.

Grauer, F. L. A., R. H. Litzenberger, and R. E. Stehle, 1976, Sharing rules and equilibrium in an international market under uncertainty, Journal of Financial Economics 3, 233-256.

Griffin, J. M., 2001, Are the Fama and French factors global or country-specific?, The Review of Financial Studies, forthcoming.

Griffin, J. M., and G. A. Karolyi, 1998, Another look at the role of the industrial structure of markets for international diversification strategies, Journal of Financial Economics 50, 351-373.

Griffin, J. M., and R. M. Stulz, 2001, International competition and exchange rate shocks: A cross-country industry analysis of stocks, Review of Financial Studies, 215-241.

Grinblatt, M., and M. Keloharju, 2000, The investment behavior and performance of various investor-types: A study of Finland's unique data set, Journal of Financial Economics 55, 43-67.

Grinblatt, M., and M. Keloharju, 2001, How distance, language, and culture influence stockholdings and trades, Journal of Finance, 56, 1053-1073.

Gultekin, M. N., N. B. Gultekin, and A. Penati, 1989, Capital controls and international capital market segmentation: The evidence from the Japanese and American stock markets, Journal of Finance 44, 849-870.

Hamao, Y., R. W. Masulis, and V. Ng, 1990, Correlations in price changes and volatility across international stock markets, Review of Financial Studies 3, 281-308.

Hamilton, J. D., 1989, A new approach to the economic analysis of nonstationary time series and the business cycle, Econometrica 57, 357-384.

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

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

Harvey, C., 1995, Predictable risk and returns in emerging markets, Review of Financial Studies 8, 773-816.

Hau, H., 2001, Location matters, Journal of Finance 56, 1959-1983.

Henry, P., 2000, Stock market liberalization, economic reform, and emerging market prices, Journal of Finance 55, 529-564.

Heston, S. L., and K. G. Rouwenhorst, 1994, Does industrial structure explain the benefits of international diversification?, Journal of Financial Economics 36, 3-27.

Hietala, P., 1989, Asset pricing in partially segmented markets: Evidence from the Finnish market, Journal of Finance 44, 697-718.

Ilmanen, A., 1995, Time-varying expected returns in international bond markets, Journal of Finance 50, 481-506.

Jorion, P., 1990, The pricing of exchange rate risk in the stock market, Journal of Financial and Quantitative Analysis 26, 363-376.

Jorion, P., and E. Schwartz, 1986, Integration vs. segmentation in the Canadian stock market, Journal of Finance 41, 603-613.

Kaminsky, G., R. Lyons, and S. Schmukler, 2000, Managers, investors, and crises: Mutual fund strategies in emerging markets, NBER working paper #7855, Cambridge, MA.

Kaminsky, G., and S. Schmukler, 1999, What triggers market jitters? A chronicle of the East Asian crisis, Journal of International Money and Finance 18, 537-560.

Kang, J., and R. M. Stulz, 1997, Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan, Journal of Financial Economics 46, 3-28.

Karolyi, A., 1998, Why do companies list shares abroad?: A survey of the evidence and its managerial implications, Financial Markets, Institutions, and Instruments 7, Blackwell Publishers, Boston.

Karolyi, G. A., 2002, Did the Asian financial crisis scare foreign investors out of Japan?, Pacific Basin Finance Journal, forthcoming.

Karolyi, G. A., and R. M. Stulz, 1996, Why do markets move together? An investigation of U.S.-Japan stock return comovements, Journal of Finance 51, 951-986.

Keim, D., and A. Madhavan, 1997, Transactions costs and investment style: An interexchange analysis of institutional equity trades, Journal of Financial Economics 46, 265-292.

Kim, W., and S.-J. Wei, 2002, Foreign portfolio investors before and during a crisis, Journal of International Economics 56, 77-96.

King, M., 1999, Reforming the international monetary system: The middle way, Bank of England, London, U.K.

King, M., E. Sentana, and S. Wadhwani, 1994, Volatility and links between national stock markets, Econometrica 62, 901-933.

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

Korajczyk, R. A., and C. J. Viallet, 1989, An empirical investigation of international asset pricing, Review of Financial Studies 2, 553-586.

Krugman, P., 1981, Consumption preferences, asset demands, and distribution effects in international financial markets, NBER Working Paper No. 651.

Krugman, P., 1998, Saving Asia: It's time to get radical, Fortune, September 7.

Lewis, K. K, 1999, Trying to explain home bias in equities and consumption, Journal of Economic Literature 37, 571-608.

Li, K., 2001, Home bias in equities: An investor perspective, UBC working paper.

Lin W., Engle, R., and T. Ito, 1994, Do bulls and bears move across borders? International transmission of stock returns and volatility, Review of Financial Studies 7, 507-538.

Longin, F., and B. Solnik, 1995, Is the correlation in international equity returns constant: 1970-1990?, Journal of International Money and Finance 14, 3-26.

Longin, F., and B. Solnik, 2001, Extreme correlation of international equity markets, Journal of Finance 56, 649-676.

Lucas, R., Jr., 1982, Interest rates and currency prices in a two-country world, Journal of Monetary Economics 10, 335-360.

Mark, N., 1988, Time-varying betas and risk premia in the pricing of forward foreign exchange contracts, Journal of Financial Economics 22, 335-354.

Mayers, D., 1973, Nonmarketable assets and the determination of capital asset prices in the absence of a riskless asset, Journal of Business 46, 258-267.

McCurdy, T., and I. Morgan, 1992, Evidence of risk premiums in foreign currency futures markets, Review of Financial Studies 5, 65-84.

Merton, R. C., 1973, An intertemporal capital asset pricing model, Econometrica 41, 867-888.

Merton, R. C., 1980, On estimating the expected return on the market: An exploratory investigation, Journal of Financial Economics 8, 323-361.

Merton, R. C., 1987, Presidential address: A simple model of capital market equilibrium with incomplete information, Journal of Finance 42, 483-510.

Miller, D., 1999, The market reaction to international cross-listing: evidence from depositary receipts, Journal of Financial Economics 51, 103-123.

Mittoo, U., 1992, Additional evidence on integration in the Canadian stock market, Journal of Finance 47, 2035-2054.

Mussa, M., and A. Richards, 1999, Capital flows in the 1990s before and after the Asian crisis, Research Department Working Paper, International Monetary Fund.

Ng, A., 2000, Volatility spillover effects from Japan and the US to the pacific-basin, Journal of International Money and Finance 19, 207-233.

O'Connell, P. J., 1998, The overvaluation of purchasing power parity, Journal of International Economics 44, 1-19.

Pastor, L., 2000, Portfolio selection and asset pricing models, Journal of Finance 55, 179-223.

Perold, A. F., and E. C. Schulman, 1988, The free lunch in currency hedging: Implications for investment policy and performance standards, Financial Analyst Journal 44, 45-52.

Pinkowitz, L., R. Stulz, and R. Williamson, 2001, Corporate control and the home bias, working paper, The Ohio State University.

Radelet, S., and J. Sachs, 1998, The onset of the East Asian financial crisis, working paper, Harvard Institute for Economic Development, Cambridge, MA.

Roll, R., 1992, Industrial structure and the comparative behavior of international stock market indexes, Journal of Finance 47,3-42.

Rouwenhorst, K. G., 1999, Local return factors and turnover in emerging stock markets, Journal of Finance 54, 1439-1464.

Sachs, J. D., A. Tornell, and A. Velasco,1996, Financial crises in emerging markets: The lessons from 1995, Brookings Papers 27, 147-199.

Sarno, L., and M. P. Taylor, 2001, Purchasing power parity and the real exchange rate, CEPR discussion paper 2913, CEPR, London, England.

Seasholes, 2000, Smart foreign traders in emerging markets, working paper, University of California at Berkeley, Berkeley, CA.

Sercu, P., 1980, A generalization of the international asset pricing model, Revue de l'Association Française de Finance 1, 91-135.

Shiller, R. J., F. Kon-Ya, and Y. Tsutsui, 1996, Why did the Nikkei crash? Expanding the scope of expectations data collection, Review of Economics and Statistics 78, 156-164.

Shukla, R. K., and G. B. van Inwegen, 1995, Do locals perform better than foreigners? An analysis of UK and US mutual fund managers, Journal of Economics and Business 47, 241-254.

Siegel, J. J., 1972, Risk, interest, and forward exchange, Quarterly Journal of Economics 86, 303-309.

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

Solnik, B., 1983, International arbitrage pricing, Journal of Finance 38, 449-457.

Solnik, B., 1993, Currency hedging and Siegel's paradox: On Black's universal hedging rule, Review of International Economics 1, 180-187.

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

Stiglitz, J., 1998, Boats, planes and capital flows, Financial Times, March 25.

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

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

Stulz, R. M., 1983, The demand for foreign bonds, Journal of International Economics 26, 271-289.

Stulz, R. M., 1987, An equilibrium model of exchange rate determination and asset pricing with non-traded goods, Journal of Political Economy 95, 1024-1040.

Stulz, R. M., 1995, The cost of capital in internationally integrated markets: The case of Nestlé, European Financial Management 1, 11-22.

Stulz, R. M., 1999, International portfolio flows and security markets, in International Capital Flows, M. Feldstein ed., University Chicago Press, 257-293.

Stulz, R. M., and W. Wasserfallen, 1995, Foreign equity investment restrictions, capital flight, and shareholder wealth maximization: Theory and evidence, Review of Financial Studies 8, 1019-1057.

Svensson, L. E. O., 1985, Currency prices, terms of trade, and interest rates: A general equilibrium asset-pricing cash-in-advance approach, Journal of International Economics 18, 17-42.

Tesar, L., and I. Werner, 1994, International equity transactions and U.S. portfolio choice, in J. Frankel ed, Internationalization of Equity Markets, NBER Project Report, University of Chicago Press, 185-216.

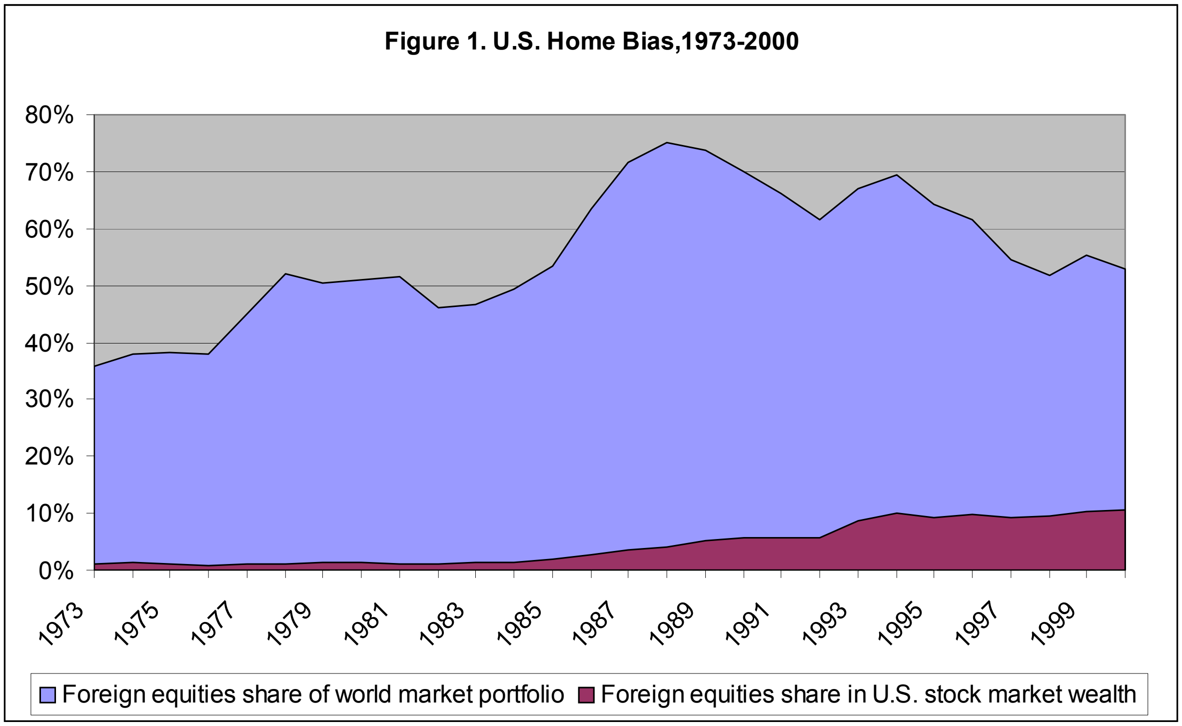
Tesar, L., and I. M. Werner, 1995, Home bias and high turnover, Journal of International Money and Finance 14, 467-493.

Uppal, R., 1993, A General Equilibrium Model Of International Portfolio Choice, Journal of Finance 48, 529-553.

Warther, V. A., 1995, Aggregate Mutual Fund Flows and Security Returns, Journal of Financial Economics 39, 209-235.

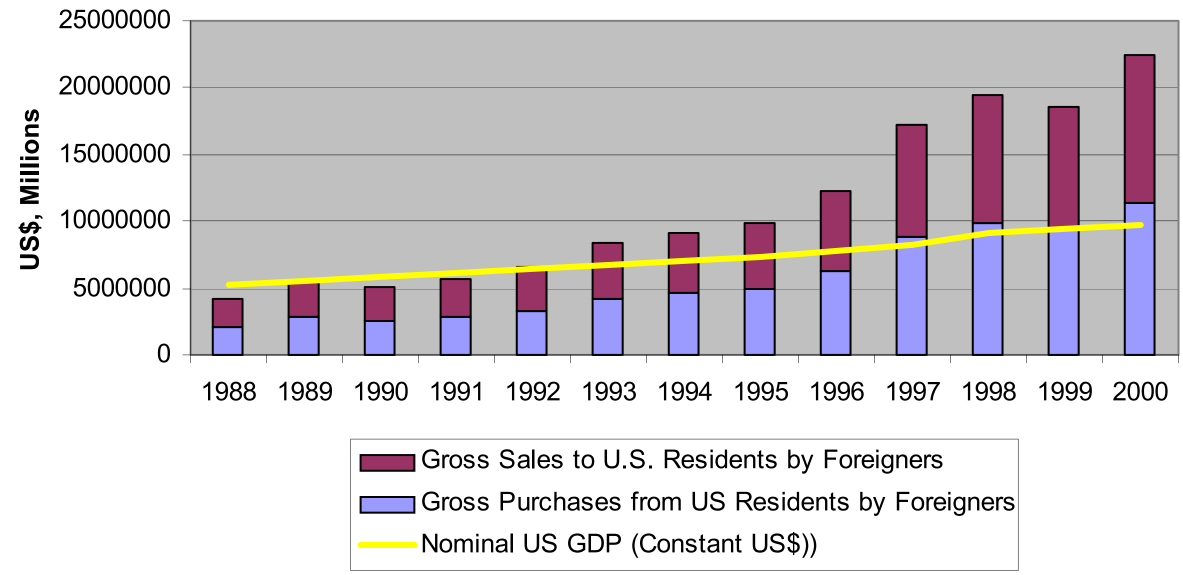
Wheatley, Simon, 1988, Some Tests Of International Equity Market Integration, Journal of Financial Economics 21, 177-212.

Zhang, Xiaoyan, 2001, Specification Tests of Asset Pricing Models in International Markets, Columbia University working paper.



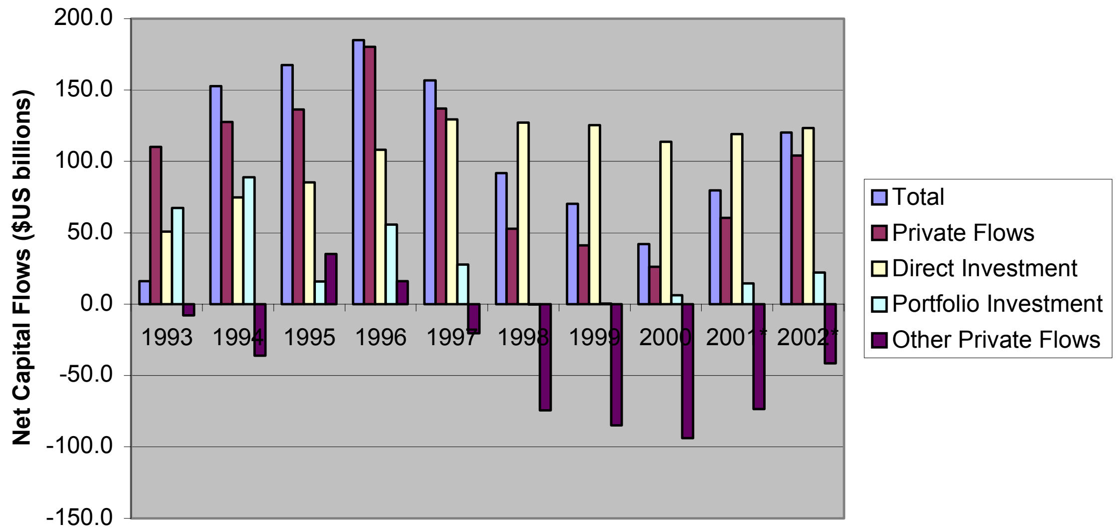
Source: Flow of Funds Accounts of the United States, Flows and Outstandings, Federal Reserve Board.

Figure 2. Foreign Purchases of Bonds and Stocks from U.S. Residents and Foreign Sales of Bonds and Stocks to Domestic U.S. Residents versus U.S. GDP



Source: Treasury International Capital (TIC) Reporting System, U.S. Treasury (http://www.treas.gov/tic/), International Monetary Fund, World Economic Outlook: Fiscal Policy and Macroeconomic Stability, World Economic and Financial Surveys, May 2001. (http://www.imf.org/external/pubs/ft/weo/2001/01/index.htm)

Figure 3. Net Capital Flows to Developing Countries, 1993-2002



Source: International Monetary Fund, World Economic Outlook: Fiscal Policy and Macroeconomic Stability, World Economic and Financial Surveys, May 2001. Statistical Appendix (http://www.imf.org/external/pubs/ft/weo/2001/01/index.htm)