Home Bias and International Risk Sharing: Twin Puzzles Separated at Birth*

Bent E. Sørensen
University of Houston and CEPR

Yi-Tsung Wu
Binghamton University

Oved Yosha
Tel Aviv University

Yu Zhu
Binghamton University

June 2005

Abstract

We show that international home bias in bond and equity holdings has declined during the late 1990s at the same time as international risk sharing has increased. Also, countries with less home bias, on average, tended to obtain more risk sharing in international markets. Using panel data estimations, we demonstrate that less home bias is associated with more international risk sharing when both cross-sectional and time-series dimensions are taken into account. This indicates that lack of risk sharing and international home bias are closely related empirical phenomena.

JEL Classification: F36
Keywords: consumption smoothing, income smoothing, international portfolio diversification.

*For helpful comments we thank Mathias Hoffmann, David Papell, Roberto de Santis, René Stulz, and Linda Tesar as well as participants at meetings of the Western Economic Association, the Allied Social Science Meetings in Atlanta and Philadelphia, and seminars at the University of Houston, the University of Dortmund, and the Oved Yosha memorial conference in Tel Aviv. Oved Yosha died from cancer on August 7, 2003. His tragic early death is a great loss to us all.

1 Introduction

Hedging of risk is central to economic and financial theory but macroeconomists and financial economists tend to have different notions of full hedging. The economics literature departs from the benchmark model of perfect markets, which in a setting of endowment economies under standard assumption implies that consumption growth rates are equalized ("perfect risk sharing") while the financial literature typically departs from the benchmark of the international Capital Asset Pricing Model (CAPM) which under standard assumption predicts that countries hold identical international portfolios of risky assets. In the present article, we measure the deviation from the perfect risk sharing allocation (or, equivalently, the amount of risk sharing obtained) and we measure the deviation from the international CAPM allocation ("home bias"). Then, we examine if the measured amount of home bias is associated with low risk sharing for a sample of OECD countries 1993–2001. Our contribution is purely empirical.

The macroeconomic literature on risk sharing and the financial literature on home bias have generally been quite separate which explains the subtitle of this article, although Lewis (1999) considers both literatures in a very readable survey article. Home bias and risk sharing may be manifestations of the same underlying behavior: if agents diversify their portfolios internationally they will likely obtain smoother income streams as domestic shocks partially will be offset by foreign asset income and, of course, smoother income is likely to imply smoother consumption. Consider the (simplified) identity:

$$GNP = GDP + r_D\, A_D - r_F\, A_F \ , \tag{1}$$

where GNP is Gross National Product, A_F is the stock of domestic assets owned by foreign residents, r_F is the rate of return on these assets, and A_D and r_D are domestically owned foreign assets and the return on those, respectively. If the term $r_D\, A_D - r_F\, A_F$ is not perfectly correlated with GDP, the GNP of a country

may be less variable than it would be in the absence of international assets.[1]

Home bias and risk sharing *need* not be close twins. As explained by Lewis (1999), there are several circumstances where home bias may not lead to lack of risk sharing. In particular, even if agents do not smooth income through cross-ownership of assets they can smooth consumption through borrowing and lending. Such behavior may be optimal, by the logic of permanent income theory, if income shocks are temporary;[2] however, aggregate shocks seem to be better characterized as permanent. Also, full international diversification of equity portfolios may not lead to smooth income if overall equity investment is small relative to GDP or if equity provides little hedging of returns to human capital (wage income)—see Baxter and Jermann (1997). Most countries hold fairly small amounts of *net* foreign assets. In the context of equation (1), this implies approximately $A_F = A_D$ and if returns on foreign and domestic assets are highly correlated it is immediately obvious that GNP will differ little from GDP. Such could be the case if foreign investment is not primarily determined by hedging considerations.

This paper empirically provides the missing link between the home bias and risk sharing literatures by demonstrating that disappearing home bias and increasing risk sharing indeed move hand-in-hand. We use a sample of countries from the Organization of Economic Cooperation and Development (OECD) and show that in countries where home bias declines, risk sharing increases. This is not just an aggregate time series correlation: panel data regressions confirm that risk sharing increases faster in states where home bias is declining faster. In terms of equation (1), a larger domestic stock of foreign assets (A_D) (variously transformed) predicts higher risk sharing. We do not consider the role of foreign liabilities because our data source measures foreign *asset* holdings and because foreign assets and liabilities are too correlated to sort out the relative

[1]The term $r_D\, A_D - r_F\, A_F$ typically makes up the larger part of "net factor income from abroad" in the national accounts.

[2]See Baxter and Crucini (1993) and Heaton and Lucas (1996).

contribution of each.

We use two alternative measures of risk sharing. Ultimately, economic agents care about consumption and the macroeconomic literature focusses on testing for perfect consumption risk sharing or measuring how far consumption growth deviates from the perfect market allocation. However, consumption data are affected by taste shocks (broadly defined) and because net foreign capital income, such as dividends and interest from foreign assets, directly affect GNP, we also consider "income" based risk sharing based on GNP in the hope of getting a better "signal-to-noise" ratio. On the other hand, consumption data may be preferable if the return to foreign assets are dominated by yet-to-be-realized capital gains which will affect consumption but not be recorded in net foreign asset income (or, it may be recorded at points in time that, for our purpose, are incorrect).

We find that country-level GNP fluctuations are becoming less correlated with country-specific GDP fluctuations and that this effect related to country level holdings of foreign bonds and (less robustly) equity. Similarly, we find that consumption smoothing on average has increased over time and, according to our empirical analysis, this increase is fully due to countries with more foreign assets obtaining more consumption smoothing.

Previously, very little systematic empirical evidence has been brought to bear on this issue and, surprisingly, the empirical research so far does *not* strongly support the notion that less home bias is associated with higher international risk sharing. Lane (2001) studies this question and concludes that "positive gross international investment positions in general are not associated with income-smoothing at business-cycle frequencies." But in a study of the Irish case, Lane (2000) finds that international equity positions do contribute to Ireland's risk sharing with other European countries. However, international security holdings have been rapidly increasing throughout the 1990s and, therefore, any impact on risk sharing should now be easier to detect.

In Section 2, we describe data sources and take a first look at asset holdings and risk sharing. In Section 3, we discuss home bias in more detail. We construct measures of home bias in equity and bond holdings and show that home bias have declined rapidly from 1997 to 2001. In Section 4, we discuss risk sharing in more detail. We calculate measures of risk sharing and show that international risk sharing has increased significantly in the 1990s. In Section 5, we examine the central empirical question of the article and ask if countries with less (or decreasing) home bias obtain better (or increasing) income and consumption smoothing. Section 6 concludes the paper.

2 A first look at the data

We obtain asset holdings from the International Monetary Fund's (IMF) 1997 and 2001 Coordinated Portfolio Investment Surveys (CPIS). These surveys were conducted using consistent guidelines for measuring holdings of equity and "bonds" across countries and the data are likely to be of high quality.[3] The surveys were conducted for *investor* countries, including most OECD countries. High quality data on international asset holdings are hard to come by and the IMF surveys seem to contain the best available data for our purpose by far. The data are not available for any other recent years. In our regressions, we therefore also show results based on annual equity holdings from Lane and Milesi-Ferretti (2001).[4]

Data for stock market capitalizations are from Standard & Poor's (2002).[5] "Stock market capitalization" for a country is measured as the value of publicly traded equity listed on the stock market exchange(s). We define "world market capitalization" as the sum of the stock market capitalizations of the 30 developed and 81 emerging stock markets listed in this source.

We measure the size of the total equity portfolio of country i as market

[3]For brevity, we use the word "bonds" for long-term debt securities.
[4]Milesi-Ferretti generously made updated data available to us.
[5]Note that earlier editions of this source report erroneous U.S. dollar figures for Ireland.

capitalization of country i *plus* foreign equity held by country i *minus* the amount of country i equity held by foreigners. We take that latter number to be the sum of equity holdings in country i owned by other countries in the CPIS. Since these surveys focus on assets and not on liabilities, these numbers are likely to be measured with some amount of noise. The CPIS data are not limited to exchange listed equity and it is, therefore, not quite consistent with data for stock market capitalizations. One obvious inconsistency occurs for Ireland, where the CPIS reported equity liabilities in 2001 are in excess of 96 billions (U.S. $), while the stock market capitalization of Ireland is less than 76 billions (U.S. $) according to Standard & Poor's (2002). In general, the standard measure of home bias, which we use in our regressions, will be subject to measurement error and we, therefore, also apply a simpler measure: the amount of foreign equity relative to domestic GDP—a number which is not subject to the mentioned measurement problems. The drawback of this measure of "home bias" is, obviously, that it is not related to any theoretical benchmark.

We obtain data for the market capitalization of bond markets from the Bank for International Settlements (BIS) *Quarterly Review*. We measure the size of a country's total bond market capitalization as outstanding domestic debt securities minus outstanding short term (less than one year remaining maturity) domestic securities plus outstanding international bonds and notes. Holdings of foreign bonds are from the CPIS and the size of the total bond portfolio of a country is then calculated in the same fashion as the equity portfolio.

Data for GDP, GNP, Population, Final Consumption, and Consumer Prices are from the OECD National Accounts 1970–2001. The sample of countries consists of the OECD countries (as of 1994) for which the IMF data are available (for example, the CPIS does not include 1997 asset holdings for Germany) and for which OECD data were available for all years including 2001 (which rules out New Zealand among others). The sample used then reduces to all OECD countries minus Germany, Greece, Luxembourg, Mexico, New Zealand, Switzer-

land, and Turkey.[6] For our alternative regressions, using data from Lane and Milesi-Ferretti (2001), the sample of countries includes Germany, Greece, and Switzerland but not Ireland. We calculate the growth-rate of per capita real GDP, GNP, and (Final) Consumption by calculating per capita values and deflating all series by the implicit private consumption deflator of the corresponding country. We do not use quantity indices for real GDP because we are interested in measuring how much the purchasing value of GDP gets insured internationally. We compute Purchasing Power Parity (PPP) adjusted aggregate (OECD-wide) GDP growth rates as follows. We deflate GDP of each country with the price index normalized to 1 in 1995 and translate to PPP-adjusted U.S. dollar values using 1995 U.S. dollar exchange rates (taken from the OECD National Accounts). These PPP-adjusted series are then aggregated to OECD-wide real GDP. GNP and Consumption are aggregated similarly.

In Table 1, we display holdings of foreign equity and bonds for the 18 developed countries that comprise our sample for the years 1997 and 2001. In order to get a first impression of the potential macroeconomic importance, we normalize the foreign asset holdings of each country by its nominal GDP.

It is immediately clear that holdings for foreign assets have increased steeply from 1997 to 2001. Table 1 also reveals large differences across countries. For example, in 2001 Ireland held large amounts of foreign equity and bonds. In fact, the amount of each exceeds the level of Irish GDP. Ireland is clearly an outlier with much larger holdings of foreign stocks and bonds relative to GDP than other countries; the next highest ratio of foreign equity to GDP is found for the Netherlands with a ratio of 61 percent. At the other end of the spectrum, Japan held an amount of foreign equity equal to only 6 percent of GDP in 2001. One cannot help but wonder if Japan might have softened the blow of her long recession in the 1990s through further international diversification.

[6]The complete list of countries is Australia, Austria, Belgium, Canada, Denmark, Finland, France, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and United States.

Foreign bond holdings are for many countries quite similar to foreign equity holdings. Japan and the United States are among those for which this is not true: Japan holds significantly more bonds than equity and the United States holds significantly more equity than bonds. In any event, the striking aspect of the numbers in Table 1 is the steep increase in foreign asset holdings from 1997 to 2001. To take an example, foreign equity holdings in Italy increased from 6 percent of GDP to 22 percent of GDP during this short time span. While this might partly be due to a run-up in the value of foreign equity holdings, we observe the same pattern, although slightly less pronounced, for international bond holdings—these more or less doubled relative to GDP for many countries.[7] For our purpose, the large variation across time and across countries delivers the variation that will allow us to test econometrically if home bias and risk sharing are related.

3 International portfolio holdings and home bias

3.1 Theoretical background and previous literature

Much recent research has departed from the mean-variance framework which assumes that agents prefer high mean returns and low variance. Forty odd years ago, Grubel (1968) pointed out that international diversification can improve the mean-variance trade-off compared to holding a purely domestic portfolio. This seems to be a robust conclusion: Lewis (1999) illustrates that this conclusion hasn't changed since then. If investors rank according to mean and variance of returns then in the presence of a safe asset, the simplest CAPM-model holds. This model predicts that all investors hold a mix of the safe asset and the market portfolio. If assets trade freely across borders, that "market portfolio" could be approximated by a world index. (The literature mainly focuses on equity.)

[7] Lane and Milesi-Ferretti (2001) shows that the level of foreign direct investment has been roughly stable in later years, so while portfolio investment is gaining in relative importance the increase in portfolio assets is not simply a substitution away from foreign direct investment.

Alternatively, if agents in different countries have similar mean-variance utility trade-offs, all agents will hold the same world portfolio even in the absence of a safe asset. Neither set of assumptions is likely to be literally true, but the model has been a long-term work-horse in finance and provides a useful yardstick which has been used extensively in the literature.

However, countries typically hold the vast majority of their asset portfolio in domestic assets. This phenomenon is referred to as international home bias and documented by, e.g., French and Poterba (1991) and Tesar and Werner (1995). Parts of the literature on home bias focus on the amount of international asset *holdings* relative to benchmarks, such as the CAPM, and parts of the literature focus on *returns* to domestic versus more internationally diversified portfolios. In this article, we calculate home bias for equity and bonds while we do not consider returns. Before we define our precise measure of home bias, we will briefly survey some of the literature that aims at justifying theoretically the deviations from the international CAPM model observed in the data. Our empirical work is not dependent on which, if any, of these models holds true but the patterns we observe in the data may be interpreted in light of the insights from the literature.

Hedging of currency risk is a likely "suspect" in explaining deviations from the simplest CAPM model: the international version of the CAPM alluded to above implicitly assumes Purchasing Power Parity (PPP). In the absence of PPP, investors may optimally want to deviate from the aggregate world portfolio in order to hedge currency risk as detailed by Adler and Dumas (1983). However, Cooper and Kaplanis (1994) do not find that inflation hedging is a likely explanation of home bias.

Transactions costs associated with international asset trading is another likely candidate for explaining home bias. Domowitz, Glen, and Madhavan (2001) find that such costs are important, especially for emerging markets although Cooper and Kaplanis (1994) find that with reasonable level of risk aversion, observable costs of holding foreign equity do not explain home bias in equity holdings—

they also show that inflation hedging is an unlikely explanation. Tesar and Werner (1995) find that foreign equity is being turned over at a higher rate than domestic equity which is hard to reconcile with higher trading costs of foreign equity. Warnock (2002) argues that the measurement of turnover rates may be problematic although he, similarly, finds no direct effect of transactions costs on home bias, while Mann and Meade (2002) find statistically significant but small effects of (directly measured) transactions costs. Overall, it seems that transactions costs may have a small effect on home bias but on their own cannot fully explain home bias.

A third class of potential explanations of home bias centers on the role of information. Specifically, lack of information adding to the riskiness of foreign investment—see for example Gehrig (1993). Kang and Stulz (1997) demonstrate that Japanese investors overinvest in large firms, consistent with a role for informational costs and, in a recent article, Ahearne, Griever, and Warnock (2004) show that patterns of U.S. equity investments in foreign countries are consistent with informational asymmetries.[8] Portes and Rey (2005) find that informational variables, such as telephone traffic, help explain home bias, consistent with a role for informational asymmetry. Coval and Moskowitz (1999) and Huberman (2001) even suggest that informational asymmetry may explain intranational investment patterns within United States.

Further suggested explanations for home bias include Obstfeld and Rogoff (2000), who suggest that home bias is caused by cost of trading goods internationally while Strong and Xu (2003) find that fund managers are relatively more optimistic about high future returns for their home markets. Moral hazard and enforcement issues can also affect international investment. Moral hazard in international markets often takes the form of sovereign risk (Eaton and Gersovitz 1981, Bulow and Rogoff 1989). Within the OECD defaults on government

[8]Consistent with this, Edison and Warnock (2004) find, examining security-level holdings of emerging market equities by U.S. investors, that equities that are cross-listed on a U.S. exchange are incorporated into U.S. portfolios with full international CAPM weights.

bonds are unlikely events, but tax and other policy variables can be tailored to fall disproportionally on foreign investors.

Finally, some authors raise the possibility that the extent of home bias is less than what meets the eye at first. For example, Dahlquist, Pinkowitz, Stulz, and Williamson (2003) argue that the simplest CAPM model that uses stock market capitalizations for calculating the world benchmark fails to take into account that closely held stocks typically are not available (or not attractive) to foreigners—a fact which partly explains deviations from the international CAPM. Alternatively, one might conjecture that international diversification might be obtained indirectly through multinational corporations but Jacquillat and Solnik (1978) demonstrate that this channel is not able to provide much diversification.[9]

For further discussion of potential explanations for equity home bias, see Lewis (1999)—who finds none of them particularly convincing—and Karolyi and Stulz (2003). These surveys should also be consulted for more extensive references to the literature.

We will not test any explanations of home bias, but the strong decline in equity and bond home bias during the late 1990s is consistent with trading costs and informational asymmetries declining due to falling costs of trading and information. While currency risk has been eliminated for mutual investments among members of the European Monetary Union (EMU), countries—such as Norway—that are not members of any currency union also display rapidly declining home bias. This makes it less likely that hedging of currency risk is the main reason for home bias.

[9]This is still an active research area: Cai and Warnock (2004) show that allowing for foreign operations of U.S. listed multinationals doesn't explain home bias although it makes the apparent home bias smaller. Rowland and Tesar (1998), looking at returns, find weak evidence that investing in multinationals helps provide diversification, but that further gains can be obtained from holding international assets.

3.2 Measuring home bias

Based on the international version of the CAPM, we define a measure "Equity Home Bias" such that (Equity) Home Bias is 0 if the share of country i's equity investment that is invested domestically equals the share of country i's equity market in the total world equity market—in other words, a country will have Home Bias equal to 0 if it shows no preference for equity issued domestically. We normalize Equity Home Bias to be 1 if a country is 100 percent invested domestically. More precisely, we define Equity Home Bias of country $i = 1$ *minus* (share of country i's holdings of foreign equity in country i's total equity portfolio / the share of foreign equity in the world portfolio).

While the financial literature typically focuses on equity markets, international diversification need not be limited to corporate equity. Investments can be diversified through foreign direct investment, real estate, bank deposits, etc.[10] In this paper, we examine home bias in bond markets along with home bias in equity markets and leave the study of home bias in other markets for future research—we make this choice because internationally consistent and comprehensive data are less available for other assets than equity and bonds. Burger and Warnock (2004) consider home bias in bond holdings. They find that U.S. investors could have obtained better risk-return trade-offs by investing more in foreign bonds during the 1994–2001 period, as long as currency risk were hedged. Burger and Warnock (2004) also find that international bond holdings clearly are much lower than a CAPM benchmark might suggest. It appears that the home bias puzzle only gets deeper if bond holdings are considered simultaneously with equity. We define "Bond Home Bias" in the same way as Equity Home Bias—substituting "bonds" for "equity" in the definition.

Table 1 revealed that foreign asset holdings have increased relative to GDP in all countries except the United States (for which the ratio is little changed).

[10] Buch, Driscoll, and Ostergaard (2003) show that banks over-invest domestically relative to simple benchmarks.

However, during this period equity market capitalizations have increased rapidly in most countries, as can be seen from the left-most two columns in Table 2, so this doesn't necessarily imply that Equity Home Bias has decreased. Similarly, from the right-most two columns of Table 2, it is clear that the value of outstanding bonds has increased for most countries from 1997 to 2001. For a few countries, like Portugal, the value of bonds outstanding has increased rapidly but, in general, bond markets grew slower than equity markets during this period.

In Table 3, the left-most columns show the (percentage) share of foreign equity in the aggregate portfolio of each country. (This number is logically less than 100 even though it is measured to be 118.42 for Ireland due to the problems mentioned in Section 2.) It is clear that foreign equity holdings have increased (much) faster than the overall domestically held portfolios for all countries in our sample, except Spain. For most countries—see the middle columns of Table 3—domestic market capitalization has been a fairly constant share of world market capitalization. Notable exceptions are Austria, whose equity market capitalization dropped from 0.15 percent to 0.09 percent of world market capitalization, and Finland and France whose relative equity market capitalizations nearly doubled. The right-most columns of Table 3 display numbers for Equity Home Bias in 1997 and 2001 as well as the change over this period. The negative Equity Home Bias for Ireland in 2001 follows mechanically from the problem discussed above. Considering that Ireland holds much more foreign equity relative to GDP than other countries, the conclusion that Ireland has less home bias than other countries is likely to hold up even if the inconsistencies in the data could be reconciled. The other countries with Equity Home Bias less than 0.5 in 2001 are the Netherlands and Austria. Equity Home Bias in both of these countries has declined rapidly, for example, in Austria Equity Home Bias has declined at an amazing rate from 0.71 to 0.33 in just 4 years. Equity Home Bias has indeed declined for all countries except Spain.

In Table 4, we display—see columns labelled (1)—shares of foreign bonds in

domestic bond portfolios, (2) the size of national bond markets relative to the world-wide bond market, and (3) Bond Home Bias. The numbers are, over-all, very similar to those for Equity Home Bias. For example, average Bond (Equity) Home Bias is 0.79 (0.79) in 1997 and 0.68 (0.63) in 2001. Bond Home Bias has declined for all countries, except Canada and the United States, and the increase in Bond Home Bias is small for these two countries. All countries have positive Bond Home Bias but, as for equity, Ireland has the lowest at only 0.07 in 2001 while Canada has a very high Bond Home Bias of 0.96 in 2001. One may also note that Bond Home Bias clearly has declined more for countries in the EU than for the other countries in our sample (whereas the difference for Equity Home Bias is minor).

Overall, home bias in bond and equity holdings has been rapidly declining and we will next turn to the question of whether this has been associated with increasing international risk sharing.

4 International risk sharing

4.1 Theoretical background and previous literature

The macroeconomic literature focuses on aggregate consumption and income patterns rather than financial returns. We will refer to the case where consumption growth rates in all countries are identical as "full (or perfect) consumption risk sharing (or consumption smoothing)". This condition will hold for endowment economies if consumers have identical Constant Relative Risk Aversion utility functions and access to a complete set of Arrow-Debreu markets. In this case, the market equilibrium will be one where each country consumes a constant country-specific fraction of world output (which in this setting is also world consumption).[11] This is a market equilibrium in which countries with output

[11] Obstfeld and Rogoff (1996) demonstrate in a clear textbook derivation that under the assumption of complete Arrow-Debreu markets and identical Constant Relative Risk Aversion utility functions, the rate of consumption growth should be identical across consumers and,

that is more stable than world output get compensated for taking on more risk (higher variance of consumption) by being allocated a larger average share of world output, and *vice versa* for countries with volatile output.

The simple characterization of the equilibrium allocation makes it obvious that the existence of a full set of Arrow-securities is not necessary for the implementation of the equilibrium. Countries can sell the right to their total output at competitive prices and invest the proceeds in claims to the output of other countries in such a way that all countries hold a similar world portfolio whose yield is proportional to world output. Assets linked to the GDP of individual countries do not trade on stock exchanges (although Shiller (1993) has suggested the creation of such assets as a way to hedge macro risk). However, it is feasible that such assets can be well mimicked by investment in international equity and bonds. Common stocks, which have state dependent returns, may seem the most natural instrument for mimicking GDP-linked returns but the ex post returns on fixed rate bond investments are also *de facto* state dependent. Bankruptcy is the most obvious form of state dependency of bond returns but international debt is often renegotiated—see Obstfeld and Rogoff (1996) for a textbook discussion or Lewis (1999).

Similarly, we use the term "full (or perfect) income risk sharing (or income smoothing)" to describe the situation where the growth rate of GNP is identical in all countries. In this case, we would expect consumption growth rates to also be similar (at least if taste shocks are not too large).

Actual consumption growth rates (for OECD countries) are very far from being perfectly correlated. Backus, Kehoe, and Kydland (1992) find that the correlation of country-level consumption with world-consumption is less than one and even less correlated than output growth rates! This finding is referred to as the international risk sharing puzzle (lack of "risk sharing"). Economists have also tested for perfect risk sharing using regressions: for example, Obst-

---

therefore, also across countries.

feld (1994b) regresses country-level consumption growth on world consumption growth and own-country income growth. Under perfect risk sharing the coefficient to world consumption should be one and that to own-country income should be zero, but that prediction squares badly with the data.[12] Sørensen and Yosha (1998) perform regressions that are similar to those of Mace (1991) and Obstfeld (1994b) but nested within a decomposition of the cross-sectional variance of country-level Gross Domestic Product (GDP). Their analysis shows that GNP is typically not smoothed at all before 1990 while consumption is far from perfectly smoothed.[13]

The textbook endowment economy is obviously ignoring many aspects of real economies and research has centered on several extensions of the basic model. Backus, Kydland, and Kehoe (1992) allow for optimal capital investment and leisure choice in a Real Business Cycle (RBC) model with productivity shocks. Their model predicts that consumption movement are less than perfectly correlated across countries but the predicted correlation is still high and much higher than what they find in the data. Stockman and Tesar (1995) show that taste shocks in consumption potentially explain why international consumption correlations are low but one still would like to know what "taste shocks" captures more precisely.

Part of the explanation for low international consumption correlations likely has to do with the existence of goods that are not tradeable across borders. Lewis (1996) shows, in a regression framework, that non-tradeables potentially explain the lack of risk sharing under a set of assumptions about functional forms etc. Likely non-tradeables are part of the explanation but not the full explanation for low international risk sharing.[14] The impact of non-tradeables depends strongly

[12]Mace (1991) was the first to run such regressions, using individual-level data and panel-data regressions.

[13]Their paper uses the methodology developed in Asdrubali, Sørensen, and Yosha (1996) applying to U.S. states; see also Becker and Hoffmann (2003). Canova and Ravn (1996) use a different methodology but also reject perfect consumption smoothing.

[14]Hedging against shocks to endowments of non-tradeables may also be an explanation for home bias see, for example, Pesenti and van Wincoop (2002) who find it unlikely that this

on the form of utility functions, for example if non-tradeable enters the utility function in an additively separable way consumption of tradeables should be perfectly correlated across countries. In this article, we do not consider tradeables separately from non-tradeables, partly because of the uncertainty about functional forms and about which goods really are non-tradeable, but mainly because our goal is not to test for perfect risk sharing but rather to demonstrate that risk sharing changes with home bias.

A final issue is whether risk sharing is important. Obstfeld (1994a) illustrates that welfare gains from risk sharing in representative agent models are small unless endowment shocks are highly persistent. However, country level output shocks typically are highly persistent and output typically behaves approximately like a random walk in OECD countries. van Wincoop (1994) finds welfare gains equivalent to a permanent increase in consumption of about a couple of percent.[15] See Tesar (1995) for a more extensive discussion of this issue.

4.2 Measuring risk sharing

Cross-sectional measures of risk sharing

Our empirical estimations quantify deviations from perfect income smoothing and perfect consumption smoothing, respectively. Consider a group of countries and the following set of cross-sectional regressions—one for each year t:

$$\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t \;=\; \text{constant} + \beta_{K,t} \;(\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}\,. \quad (2)$$

GNP_{it} and GDP_{it} are country i's year t per capita GNP and GDP, respectively, and GNP_t and GDP_t are the year t per capita aggregate GNP and GDP for the group. The coefficient $\beta_{K,t}$ measures the average co-movement of the countries' idiosyncratic GNP growth with their idiosyncratic GDP growth in year t (where

mechanism can explain a large fraction of home bias.

[15] Kalemli-Ozcan, Sørensen, and Yosha (2001) derive closed form expressions for welfare gains and find similar magnitudes for most U.S. states in a framework of interstate risk sharing.

"idiosyncratic" refers to the deviation of a country's growth rate of some variable from that of the group). Of course, aggregate fluctuations cannot be eliminated by the sharing of risk, which is why the aggregate component is deducted from the growth rates. Under perfect risk sharing, the left-hand side of equation (2) will be zero which implies $\beta_{K,t}$ will be zero. The smaller the co-movement of idiosyncratic GDP with GNP, the more GNP is buffered against GDP fluctuations and the smaller the estimated value of $\beta_{K,t}$. Since GNP equals GDP plus net factor income from abroad, this regression provides a measure of the extent to which net factor income flows provide income smoothing—the lower $\beta_{K,t}$, the higher is income smoothing within the group in year t.[16] The estimated series of $\beta_{K,t}$ coefficients measures the evolution of risk sharing over time.[17] Often it is more instructive to look at the equivalent series $1-\beta_{K,t}$—this series will take the value 1 if risk sharing is perfect and the value 0 if GNP moves one-to-one with output.

In a similar manner, we estimate year-by-year the relation

$$\Delta \log \mathrm{C}_{it} - \Delta \log \mathrm{C}_t \;=\; \text{constant} \;+\; \beta_{C,t}\,(\Delta \log \mathrm{GDP}_{it} - \Delta \log \mathrm{GDP}_t) \;+\; \epsilon_{it}\,, \quad (3)$$

where C_{it} is country i's year t per capita final consumption, and C_t is the year t per capita aggregate final consumption for the group. The coefficient $\beta_{C,t}$ measures the average co-movement of the countries' idiosyncratic consumption growth with their idiosyncratic GDP growth in year t. The smaller the co-movement, the more consumption is buffered against GDP fluctuations. Therefore, this regression provides a measure of the extent of consumption smoothing.

[16] See Asdrubali, Sørensen, and Yosha (1996), Sørensen and Yosha (1998), Mélitz and Zumer (1999), and Becker and Hoffmann (2003).

[17] The equation in (2) can be estimated as a panel yielding an average measure of income smoothing for the relevant time period or it can be estimated for each country separately as in Lane (2000, 2001). In this section, we estimate it cross-sectionally for each year separately in order to obtain a time-series of income smoothing measures. In the next section, we turn to panel estimates.

Time-series measures of risk sharing by country

We estimate the deviation from perfect country-level income smoothing for each country i as:

$$\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t \;=\; \text{constant} + \beta_{K,i} \;(\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}\,. \quad (4)$$

The interpretation of β_i is similar to that of β_t except that β_i is specific to country i. This type of regression is similar to those performed by Obstfeld (1994b).

We, similarly, estimate the deviation from perfect country-level consumption smoothing as:

$$\Delta \log \text{C}_{it} - \Delta \log \text{C}_t \;=\; \text{constant} \;+\; \beta_{C,i} \;(\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) \;+\; \epsilon_{it}\,. \quad (5)$$

5 Does higher foreign asset holdings predict better income and consumption smoothing?

5.1 Graphical presentation of time-series and cross-sectional evidence

Figure 1 displays estimates of the series of year-to-year income smoothing measures $1-\beta_{K,t}$ together with the logarithm of equity holdings normalized by GDP. The $\beta_{K,t}$'s are the estimated coefficients from equation (2) estimated for the sample of OECD countries.[18] More precisely, we display $100 * (1 - \beta_{K,t})$ which we interpret as the percent income smoothing obtained. The year-by-year risk sharing estimates fluctuate a fair amount so the graph displays the time series of regression coefficients after smoothing the time-variation using a Normal kernel with bandwidth (standard deviation) 2. For OECD sample countries, risk

[18] We use the data from Lane and Milesi-Ferretti (2001) in order to show the year-by-year evolution of equity holdings. The sample then is Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

sharing is strongly negative in the early 1990s. We found that this—somewhat strange—result is due to Finland and Sweden, two countries which were severely affected by economic crises in the early 1990s (banking crisis in Sweden and the aftermath of the Soviet break-up in Finland). We therefore also show the risk sharing coefficients without Finland and Sweden.[19] The graphs indicate that international risk sharing has been increasing quite steeply through the 1990s. Comparing with the graph for international equity holdings it is highly suggestive that when equity holdings increase risk sharing increases—even the flattening out of foreign equity holdings in the last two years of the sample seems to be reflected in a flattening out of the income smoothing curve.

Figure 2 displays kernel smoothed estimates for year-to-year consumption smoothing; i.e., $100 * (1 - \beta_{C,t})$, where the $\beta_{C,t}$'s are the estimated coefficients from equation (3) for the same countries. The graphs for equity holdings is the same as in Figure 1. The graphs are similar with or without Finland and Sweden: the large drops in GNP experienced by these countries in the early 1990s did not affect consumption significantly by this measure. If the banking crisis at the time was expected to be temporary (as it turned out to be) this is what would be expected from permanent income theories of consumption. Overall, this graph confirms the pattern observed in Figure 1 with consumption smoothing increasing after 1995 roughly at the same time as foreign equity holdings start increasing.

The time series patterns displayed in Figures 1 and 2 could, of course, be the results of some left-out trending variable. We, therefore, further show graphs that display the cross-sectional patterns of risk sharing and home bias. We examine graphically if the *country level* risk sharing obtained over our sample is related to the average foreign equity or bond holdings where the average is taken over the 1997 and 2001 CPIS data relative to GDP. Our country-by-country measure of risk sharing is $100 * (1 - \beta_{K,i})$ for income smoothing, where $\beta_{K,i}$ is measured

[19]The graph leaves the impression that income smoothing might have been negative before the sample we consider but if we extend the graph further back we basically zero income smoothing.

from equation (4) and $100 * (1 - \beta_{C,i})$ for consumption smoothing, where $\beta_{C,i}$ is measured from equation (5).

Figure 3 plots the amount of income risk sharing obtained by country against the log of equity holdings by country with a fitted regression line. We see a fairly clear positive slope indicating that countries with high holdings of foreign equity obtains higher income smoothing. The slope of the fitted line is clearly positive although this slope to some extent is determined by two countries with high foreign equity holdings and high income smoothing, namely, Ireland and the Netherlands. The country with the lowest foreign equity holdings relative to GDP, Japan, obtains the least income smoothing (a negative point estimate). Figure 4 displays consumption smoothing versus foreign equity holdings. This figure reveals a slope that is only slightly positive.

Figure 5 displays income smoothing versus holdings of foreign bonds relative to GDP. The graph shows a pattern quite similar to that of Figure 3, again with the results somewhat dominated by Ireland and the Netherlands. Figure 6 shows a pattern similar to that of Figure 4 except the positive fitted sloped is slightly steeper in this case with foreign bond holdings on the x-axis.

The results of this section provide highly suggestive time-series and cross-sectional evidence that decreasing home bias and increasing international risk sharing are manifestations of the same phenomenon. The next subsection explores whether the correlation between risk sharing and home bias also holds across the dimensions of the panel data.

5.2 Panel data regression method

We estimate panel data regressions of the form:

$$\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t \;=\; \text{constant} \;+\; \kappa \;(\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) \;+\; \epsilon_{it}\,. \quad (6)$$

This regression is similar to that in (2) except that it is now estimated as a panel pooling a number of years. In this specification, suggested by Asdrubali,

Sørensen, and Yosha (1996), $1-\kappa$ is a scalar that measures the average amount of income smoothing within the group during the time-period considered. The coefficient κ measures the average co-movement of the countries' idiosyncratic GNP-growth with their idiosyncratic GDP-growth over the sample period.[20] In this regression, subtracting from each variable the aggregate value is crucial because aggregate GDP-growth of the group is not insurable.[21]

Mélitz and Zumer (1999) impose structure on κ so that $\kappa = \kappa_0 + \kappa_1 \gamma_i$, where γ_i is an "interaction" variable that affects the amount of smoothing that country i obtains. The estimated value of $1-\kappa_0-\kappa_1 \gamma_i$ then measures the average amount of income smoothing obtained by country i during the time-period in question. We enhance this method by allowing κ to change over time, besides including an interaction variable, as follows:

$$\kappa \;=\; \kappa_0 \;+\; \kappa_1 \left(t \;-\; \bar{t}\right) \;+\; \kappa_2 \left(\text{EHB}_{it} \;-\; \overline{\text{EHB}}_t\right), \tag{7}$$

where

$$\text{EHB}_{it} \;\equiv\; \text{Equity Home Bias}_{it}$$

is our Equity Home Bias measure for country i at time t interpolated linearly through the 1997 and 2001 observations and extrapolated back to 1993. Interpolation based on the 1997 and 2001 observations is likely to lead to some amount of measurement error in other years. This is, however, less important for our purpose: the question we ask is if countries with a trend in home bias experience a proportional trend in risk sharing. To the extent that the state-specific trends in home bias are mis-measured, the estimate of κ_2 will be biased towards zero.[22]

[20] The estimated value of κ will approximately be a weighted average of the $\beta_{K,t}$ coefficients as shown by Asdrubali, Sørensen, and Yosha (1996). (Strictly so, if aggregate growth is controlled for using time-specific dummy variables rather than simply subtracting aggregate growth-rates. The inclusion of time-specific dummy variables will give results that are very close to the ones reported and we, therefore, use the slightly simpler setup.)

[21] In the regressions in equation (2), subtracting from each variable its time-specific mean, rather than the aggregate value, will not affect the results because each regression is cross-sectional and includes a constant.

[22] Measurement error might be more severe for the extrapolated data (1993–1996). We,

$\bar{t}$ is the middle year of the sample period, and $\overline{\text{EHB}}_t$ is the (un-weighted) average across countries of EHB_{it} at time t. The estimated value of $1-\kappa_0$ corresponds to the average amount of income smoothing within the group during the period $\bar{t}$. The estimated value of $1-\kappa_0-\kappa_1\,(t-\bar{t})-\kappa_2(\text{EHB}_{it}\,-\,\overline{\text{EHB}}_t)$ then measures the amount of income smoothing obtained in period t by country i with Equity Home Bias EHB_{it}. We include a time trend in order to guard against the downward trending home bias measure spuriously capturing trend changes in risk sharing that may be caused by other developments in international markets.

The parameter $-\kappa_1$ captures the average year-by-year increase in income risk sharing. In this respect, the specification implied by (6) and (7) is a "middle-of-the-road" specification between the specification in (2)—where the amount of income smoothing can change freely from period to period—and the specification in (6) where the amount of income smoothing does not change over time. In the specification implied by (6) and (7), the amount of income smoothing is allowed to change over time with the trend and with Equity Home Bias.

The parameter $-\kappa_2$ (which will be negative) captures the extent to which higher than average Equity Home Bias in a country lowers the amount of income risk sharing obtained by country i. In fact, $-\kappa_2$ can be interpreted as an "exchange ratio" that translates fractions of Equity Home Bias to percentage points of idiosyncratic shocks absorbed via income smoothing.

We repeat the analysis using foreign equity holdings relative to GDP rather than the Equity Home Bias measure. In the case where total asset portfolios are small relative to GDP, little risk sharing can be obtained even by internationally well diversified portfolios. In such cases foreign holdings relative to GDP may be the more relevant "home bias" measure for macroeconomic income and consump-

---

therefore, also performed all regressions limiting ourself to the 1997–2001 sample. We do not tabulate these results, but almost all point estimates were similar to the ones we report for the full sample. Naturally, standard errors are larger with the shorter sample but the number of coefficients that are statistically significant is almost the same. Based on this, we do not suspect that the extrapolated data for 1993–1996 years are of significantly lower quality than the rest of the sample.

tion smoothing. Further, this simpler measure is not subject to the problem of measuring liabilities or stock market capitalizations in a manner consistent with the data for equity holdings.

In this case,

$$\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 (\mathrm{E}_{it} - \overline{\mathrm{E}}_t), \tag{8}$$

where

$$\mathrm{E}_{it} \equiv \log[(\text{foreign equity holdings})_{it}/\mathrm{GDP}_{it}]$$

is the ratio of (gross) foreign equity holdings to GDP for country i interpolated log-linearly through the observations in 1997 and 2001 and extrapolated similarly back to 1993. The reason for the log-linear transformation is that for some countries the increase in foreign equity holdings is so steep that a linear extrapolation would result in negative numbers for the early 1990s.

We perform an analogous analysis using Bond Home Bias or bond holdings relative to GDP. In the case of bond home bias, we will model $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [\mathrm{BHB}_{it} - \overline{\mathrm{BHB}}_t]$, where BHB_{it} measures (interpolated) Bond Home Bias in country i at time t. To measure the impact of bond holdings (as a share of GDP), we define $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [\mathrm{B}_{it} - \overline{\mathrm{B}}_t]$ where $\mathrm{B}_{it} \equiv \log[(\text{foreign bond holdings})_{it}/\mathrm{GDP}_{it}]$ is the ratio of foreign gross bond holdings to GDP for country i interpolated from the 1997 and 2001 observations.

If the impact of foreign bond holdings on risk sharing is similar to the impact of foreign equity holdings we may obtain more significant results if we allow risk sharing to increase proportionally with the total amount of foreign asset holdings (taken here to mean the sum of equity and bond holdings) relative to GDP. In this case, we let $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_3 [\mathrm{EB}_{it} - \overline{\mathrm{EB}}_t]$ where $\mathrm{EB}_{it} \equiv \log[(\text{foreign equity+ bond holdings})_{it}/\mathrm{GDP}_{it}]$ is the log-ratio of foreign bond+equity holdings to GDP for country i interpolated from the 1997 and 2001 observations.

We further estimate the contribution of Equity Home Bias to the amount of

consumption risk sharing within the group using regressions of the form:

$$\Delta \log \mathrm{C}_{it} - \Delta \log \mathrm{C}_t \;=\; \text{constant} \;+\; \eta \,(\Delta \log \mathrm{GDP}_{it} - \Delta \log \mathrm{GDP}_t) \;+\; \epsilon_{it}\,, \qquad (9)$$

where

$$\eta \;=\; \eta_0 \;+\; \eta_1 \,(t \;-\; \bar{t}) \;+\; \eta_2 \,(\mathrm{EHB}_{it} \;-\; \overline{\mathrm{EHB}}_t)\,. \qquad (10)$$

In the same manner as the analysis performed for income smoothing, we allow for interaction terms based on the ratio of foreign equity holdings to GDP, Bond Home Bias, the ratio of foreign bond holdings to GDP, and the ratio of foreign (bond+equity) holdings to GDP.

Results from panel regressions (CPIS data)

All estimations are performed as two-stage estimations that allow the error variance to differ across countries. Table 5 displays results for income and consumption smoothing as a function of Equity Home Bias for the OECD-sample. We find a near-zero statistically insignificant (at the conventional 5 percent level) coefficient to the time trend. For income smoothing, we find highly significant coefficients to Equity Home Bias. The point estimates are clearly also significant in economic terms: the coefficient estimate for Equity Home Bias is –47 when fixed effects are included, which implies that a country lowering Equity Home Bias by 0.1 will increase income smoothing by about 5 percent. This is a very strong impact of home bias on risk sharing. When fixed effects are not included, the estimated impact of Equity Home Bias is slightly smaller with a coefficient of –35. For consumption smoothing, the average estimated amount of risk sharing is much higher at about 47 percent, but the impact of Equity Home Bias is small and insignificant.

However, we argued previously that the Home Bias measure may be inferior to the simple ratio of foreign equity to GDP. In Table 6, we ask if the ratio of foreign equity holdings to GDP predicts income and consumption risk sharing. We find a

clear positive effect of higher foreign equity holdings (relative to GDP) on income risk sharing. The results are similar to those obtained using the Equity Home Bias measure—the estimated coefficients have different orders of magnitude but this just reflects that the Equity Home Bias measure has a different scale than the ratio of equity to GDP. However, the t-statistics for the impact of Equity Home Bias on income risk sharing are higher than those obtained when we simply use the ratio of foreign equity holdings to GDP. For consumption risk sharing, we find an insignificant interaction term for "home bias" when country fixed effects are not included. More interesting, the interaction term is larger and significant at the conventional level when country fixed effects *are* included.

The difference between estimates with or without country fixed effects has a simple interpretation. Because the inclusion of a fixed effect is equivalent to removing the country-level average over the sample of all variables, the regressions with country fixed effects are more clearly interpreted as reflecting year-by-year risk sharing while the results from regressions without country-level fixed effects partly reflect "long-run" risk-sharing. We do not attempt to more systematically estimate longer-run risk sharing because our short sample is not well suited for such an exercise. Nonetheless, based on the results above, our interpretation is that the integration of asset markets in the OECD still hasn't reached a level where high output growth in a country will not be followed by high income and consumption growth in the longer run. (Although, as indicated, we base this on just one historical period and other "long-run" periods may be different.)

Table 7 considers the impact of Bond Home Bias on income and consumption smoothing. The estimated impact of Bond Home Bias on income smoothing is quite similar to that found for Equity Home Bias. However, Bond Home Bias is estimated significantly to have a large effect on consumption smoothing only when country fixed effects are included.

Table 8 uses foreign bond holdings relative to GDP as the interaction variable and, as we found for Equity Home Bias, there is little difference in the quali-

tative results whether we use Bond Home Bias or the simple GDP-normalized bond holdings. As for Equity Home Bias, the estimated coefficients for income smoothing are somewhat more significant when the Home Bias measures are used, while the simple ratio of foreign bonds to GDP is slightly more significant for consumption smoothing.

In Table 9, the interaction term is the sum of bond and stock holdings relative to GDP. The results are similar to those of Tables 6 and 8. The estimated coefficients are somewhat larger, although the t-statistics, in the case of income smoothing, are of roughly the same order of magnitude as those found for bonds in Table 8. The t-statistic, in the case of consumption smoothing, now points to a very clear effect of high foreign asset holdings on consumption smoothing at the annual frequency in the case with country fixed effects.

Holdings of foreign bonds and equity are highly correlated so the data cannot rigorously sort out the relative roles of foreign bonds vs. equity in international risk sharing; nonetheless, the results in Table 9 are consistent with both bonds and equity providing income smoothing and consumption smoothing—the estimated coefficients are larger when the sum of bonds and equity is used than when any of the components is used separately.

It is of interest to examine if economic integration in the EU has led to higher risk sharing and if the impact of foreign asset holdings is different when we consider the sample of EU countries rather than the full OECD sample. Table 10 shows the effect of the ratio of foreign equity to GDP on risk sharing in the EU and Table 11 displays corresponding results for foreign bond holdings relative to GDP. As the process of economic integration in Europe moves ahead, risk sharing within the EU is likely to increase, so we expect to find a positive trend. Tables 10 and 11 confirm this conjecture for income smoothing, where the coefficient to the time trend is estimated to be positive and significant. For consumption smoothing the estimate for the trend is not significantly different from 0.

We find an effect of foreign equity holdings on income smoothing that is similar to what we found for the OECD, although the coefficient to the interaction term is not significant when country fixed effects are included. The effect of foreign equity on consumption smoothing is borderline significant at the conventional 5 percent level and of the same order of magnitude as we found for the OECD when country fixed effects are included. Again, we find no impact on consumption smoothing when country fixed effects are left out. The impact of foreign bond holdings—see Table 11—is somewhat larger than was found for the OECD. For consumption smoothing, the effect is large and significant when country fixed effects are included but not quite significant when country fixed effects are not included. Overall, the results for the impact of foreign assets in the EU are roughly similar to those found in the larger sample. There seems to be some tendency for foreign bond holdings to have larger effects within the EU, but our data series are too short for us to make strong conclusions on this issue.

Table 12 examines if any country is an influential observation (statistical outlier) by examining if the results change when countries are left out one-by-one. For brevity, we limit this analysis to the case of foreign equity and bonds to GDP with country fixed effects included. For the impact of foreign equity on income smoothing, the United States is an influential observation and leaving it out renders the estimated interaction term small and insignificant. Leaving out Ireland has a similar, but weaker, effect. The results for the impact of foreign bond holdings on income smoothing are remarkably robust with no countries having a large influence and the coefficient being clearly significant in all cases. The impact of foreign equity on consumption smoothing is fairly robustly estimated, although the coefficient is insignificant (but not strongly so) if Finland, Japan, or Spain is left out. The impact of foreign bonds on consumption smoothing is robustly estimated and it is significant in all cases. Overall, the robustness checks indicate that the estimated impact of foreign equity holdings on income and consumption smoothing is somewhat fragile, while the results regarding the effect of foreign

bond holdings on income and consumption smoothing are robustly estimated.

Results from panel regressions (annual equity data)

One might worry that using annual data for foreign asset holdings constructed by interpolating data from two years might bias the results. We have annual equity holdings available from Lane and Milesi-Ferretti (2001) and we, in Table 13, display results from panel data regressions similar to those reported in Table 6 and use the logarithm of year-by-year foreign equity relative to GDP. The results are overall extremely close to the results obtained using the CPIS data, which indicates that the interpolation of the equity holdings is innocuous for our present purpose.

The results show that there is a positive relation between foreign equity holdings and income smoothing when country fixed effects are included. The relation is, however, not statistically significant. This agrees with the results displayed in Table 12 when Ireland is left out. What materialize is that consumption smoothing is robustly and significantly affected by foreign equity holdings when country fixed effects are included. The point estimate for the interaction terms in Table 13 is 12, in Table 6 it is 13, and in Table 12 it is 15 for the entry without Ireland. We also fitted a trend to the year-by-year foreign equity holdings and used these data in the interaction terms in order to examine if the year-by-year variation is important. The results were virtually identical to those of Table 13.

6 Concluding remarks

Our results clearly confirm that foreign asset holdings help countries achieve macroeconomic income and consumption smoothing although the results for income smoothing are only significant when Ireland is included. Maybe surprisingly, the impact of foreign bond holdings appears stronger than the impact of foreign equity holdings. We observe noticeable income smoothing only since late in the 1990s, so it seems that foreign asset holdings need to become very large (in

the order of magnitude of GDP) before they are big enough to have an impact on the volatility of GNP and consumption. Our results are similar for equities (we didn't examine this issue for bonds) whether year-by-year or a fitted trend in equity holdings relative to GDP is used.

Overall, the best interpretation of our results is probably that countries with larger foreign asset holdings obtain better consumption smoothing and that increasing foreign asset holdings lead to increased consumption smoothing. Our methods and data are not effectively able to separate out the separate effects of equity versus bonds because these series are highly correlated for most countries. Our evidence also indicates that year-by-year fluctuations in asset holdings are less important, likely because forward looking agents adjust consumption in response to expected future returns and do not react strongly to annual fluctuations in valuations.

Our work focuses on macro-level covariations. We believe that this complements the many studies that aim at identifying the underlying structural determinants of risk sharing.

References

Adler, Michael and Bernard Dumas (1983), "International Portfolio Choice and Corporation Finance: A Synthesis," *Journal of Finance* 38, 925–84.

Ahearne, Alan G., William L. Griever and Francis E. Warnock (2004), "Information Costs and Home Bias: An Analysis of U.S. Holdings of Foreign Equities," *Journal of International Economics* 62, 313–336.

Asdrubali, Pierfederico, Bent E. Sørensen and Oved Yosha (1996), "Channels of Interstate Risk Sharing: United States 1963–90," *Quarterly Journal of Economics* 111, 1081–110.

Backus, David, Patrick Kehoe and Finn Kydland (1992), "International Real Business Cycles," *Journal of Political Economy* 100, 745–75.

Baxter, Marianne and Mario Crucini (1993), "Explaining Saving-Investment Correlations," *American Economic Review* 83, 416–436.

Baxter, Marianne and Urban J. Jermann (1997), "The International Diversification Puzzle is Worse than You Think," *American Economic Review* 87, 170–180.

Becker, Sascha and Mathias Hoffmann (2003), "Intra- and International Risk-Sharing in the Short Run and the Long Run," CESifo Working Paper Series No. 1111.

Buch, Claudia M., John C. Driscoll and Charlotte Ostergaard (2003), "Cross-Border Diversification in Bank Asset Portfolios," mimeo. Kiel Institute for World Economics, Federal Reserve Board, and Norwegian School of Management.

Bulow, Jeremy I. and Kenneth Rogoff (1989), "Sovereign Debt: Is to Forgive to Forget?" *American Economic Review* 79, 43–50.

Burger, John D. and Francis E. Warnock (2004), "Foreign Participation in Local-Currency Bond Markets," Federal Reserve Board, International Finance Discussion Papers no. 794.

Cai, Fang and Francis E. Warnock (2004), "International Diversification at Home and Abroad," Federal Reserve Board, International Finance Discussion Papers no. 793.

Canova, Fabio and Morten Ravn (1996), "International Consumption Risk Sharing," *International Economic Review* 37, 573–601.

Cooper, Ian A. and Evi Kaplanis (1994), "Home Bias in Equity Portfolios, Inflation Hedging, and International Capital Market Equilibrium," *Review of Financial Studies* 7, 45–60.

Coval, Joshua D. and Tobias J. Moskowitz (1999), "Home Bias at Home: Local Equity Preference in Domestic Portfolios," *Journal of Finance* 54, 2045–2073.

Dahlquist, Magnus, Lee Pinkowitz, René M. Stulz and Rohan Williamson (2003), "Corporate Governance and the Home Bias," *Journal of Financial and Quantitative Analysis* 38, 87–110.

Domowitz, Ian, Jack Glen and Ananth Madhavan (2001), "Liquidity, Volatility and Equity Trading Costs across Countries and over Time," *International Finance* 4, 221–255.

Eaton, Jonathan and Mark Gersovitz (1981), "Debt with Potential Repudiation: Theory and Estimation," *Review of Economic Studies* 48, 289–309.

Edison, Hali J. and Francis E. Warnock (2004, "U.S. Investors' Emerging Market Equity Portfolios: A Security-Level Analysis," *Review of Economics and Statistics* 86, 691–704.

French, Kenneth and James Poterba (1991), "Investor Diversification and International Equity Markets," *American Economic Review: Papers and Proceedings* 81, 222–226.

Gehrig, Thomas (1993), "An Information Based Explanation of the Domestic Bias in International Equity Investment," *Scandinavian Journal of Economics* 95, 97–109.

Grubel, Herbert L. (1968), "Internationally Diversified Portfolios: Welfare Gains and Capital Flows," *American Economic Review* 58, 1299–1314.

Heaton, John and Deborah Lucas (1996), "Evaluating the Effects of Incomplete Markets on Risk Sharing and Asset Pricing," *Journal of Political Economy* 104, 443–487.

Huberman, Gur (2001), "Familiarity Breeds Investment," *Review of Financial Studies* 14, 659–680.

Jacquillat, Bertrand and Bruno Solnik (1978), "Multinationals Are Poor Tools for Diversification," *Journal of Portfolio Management* 4, 8–12.

Kalemli-Ozcan, Sebnem, Bent E. Sørensen and Oved Yosha (2001), "Economic Integration, Industrial Specialization and the Asymmetry of Macroeconomic Fluctuations," *Journal of International Economics* 55, 107–137.

Kang, Jun-Koo and René 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, G. Andrew and René M. Stulz (2003), "Are Financial Assets Priced Locally or Globally?" in George Constantinides, Milton Harris and René Stulz (eds.), *The Handbook of the Economics of Finance*, New York: North Holland.

Lane, Philip (2000), "International Diversification and the Irish Economy," *Economic and Social Review* 31, 37–54.

Lane, Philip (2001), "Do International Investment Income Flows Smooth Income?" *Weltwirtschaftliches Archiv* 137, 714–736.

Lane, Philip and Gian Maria Milesi-Ferretti (2001), "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Nations," *Journal of International Economics* 55, 263–294.

Lewis, Karen (1996), "What Can Explain the Apparent Lack of International Consumption Risk Sharing?" *Journal of Political Economy* 104, 267–97.

Lewis, Karen (1999), "Trying to Explain Home Bias in Equities and Consumption," *Journal of Economic Literature* 37, 571–608.

Mace, Barbara, (1991), "Full Insurance in the Presence of Aggregate Uncertainty," *Journal of Political Economy* 99, 928–956.

Mann, Catherine and Ellen Meade (2002), "Home Bias, Transactions Costs, and Prospects for the Euro: A More Detailed Analysis," Working Paper. Centre of Economic Performance, London School of Economics.

Mélitz, Jacques and Frédéric Zumer (1999), "Interregional and International Risk Sharing and Lessons for EMU," *Carnegie-Rochester Conference Series on Public Policy* 51, 149–88.

Obstfeld, Maurice (1994a), "Evaluating Risky Consumption Paths: The Role of Intertemporal Substitutability," *European Economic Review* 38, 1471–86.

Obstfeld, Maurice (1994b), "Are Industrial-Country Consumption Risks Globally Diversified?" in Leonardo Leiderman and Assaf Razin, eds., *Capital Mobility: The Impact on Consumption, Investment and Growth*, New York: Cambridge University Press.

Obstfeld, Maurice and Kenneth Rogoff (1996), *Foundations of International Macroeconomics*, Cambridge, Massachusetts: MIT Press.

Obstfeld, Maurice and Kenneth Rogoff (2000), "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?" *NBER Macroeconomics Annual 2000.*

Pesenti, Paolo and Eric van Wincoop (2002), "Can Nontradables Generate Substantial Home Bias?" *Journal of Money, Credit and Banking* 34, 25–50.

Portes, Richard and Hélène Rey (2005), "The Determinants of Cross Border Equity Flows," *Journal of International Economics* 65, 269–296,

Rowland, Patrick F. and Linda L. Tesar (1998), "Multinationals and the Gains from International Diversification," NBER Working Paper No. 6733.

Shiller, Robert (1993), *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks,* London, U.K.: Oxford University Press.

Sørensen, Bent E. and Oved Yosha (1998), "International Risk Sharing and European Monetary Unification," *Journal of International Economics* 45, 211–38.

Standard & Poor's (2002), *Emerging Stock Markets Factbook*. New York: Standard & Poor's.

Stockman, Alan and Linda Tesar (1995), "Tastes and Technology in a Two-Country Model of the Business Cycle: Explaining International Comovements," *American Economic Review* 85, 168–185.

Strong, Norman and Xinzhong Xu (2003), "Understanding the Equity Home Bias: Evidence from Survey Data," *Review of Economics and Statistics* 85, 307–12.

Tesar, Linda (1995), "Evaluating the Gains from International Risksharing," *Carnegie-Rochester Conference Series on Public Policy* 42, 95–143.

Tesar, Linda and Ingrid Werner (1995), "Home Bias and High Turnover," *Journal of International Money and Finance* 14, 467–92.

Warnock, Francis E. (2002), "Home Bias and High Turnover Reconsidered," *Journal of International Money and Finance* 21, 795–805.

van Wincoop, E. (1994), "Welfare Gains from International Risk Sharing," *Journal of Monetary Economics* 34, 175–200.

Table 1

County-level Holdings of Foreign Bonds and Equity Relative to GDP

Country	Equity/GDP		Bonds/GDP	
	1997	2001	1997	2001
Australia	0.08	0.17	0.02	0.04
Austria	0.06	0.20	0.19	0.43
Belgium	0.27	0.47	0.35	0.73
Canada	0.17	0.29	0.03	0.03
Denmark	0.13	0.29	0.13	0.22
Finland	0.03	0.17	0.06	0.29
France	0.07	0.15	0.15	0.35
Iceland	0.05	0.23	0.01	0.02
Ireland	0.46	1.33	0.74	1.84
Italy	0.06	0.22	0.15	0.28
Japan	0.04	0.06	0.17	0.24
Netherlands	0.34	0.61	0.31	0.64
Norway	0.06	0.25	0.16	0.35
Portugal	0.05	0.07	0.13	0.29
Spain	0.04	0.10	0.04	0.18
Sweden	0.21	0.46	0.07	0.18
United Kingdom	0.35	0.39	0.36	0.47
United States	0.15	0.16	0.07	0.05

Notes. Foreign equity and bond holdings are from the IMF Coordinated Portfolio Investment Surveys conducted at the end of 1997 and 2001. The term "Bonds" refers to long-term debt securities with maturity of more than one year. GDP data are from the OECD National Accounts 2003.

Table 2

Stock Market Capitalization and Value of Bonds Outstanding

Country	Stock Market Capitalization		Value of Bonds Outstanding	
	1997	2001	1997	2001
Australia	295.79	374.27	148.30	187.80
Austria	35.72	24.51	213.10	255.90
Belgium	136.97	165.84	301.00	284.60
Canada	567.64	700.75	575.80	638.50
Denmark	93.77	94.96	270.10	259.80
Finland	73.32	190.46	92.60	79.10
France	674.37	1174.43	968.30	1114.40
Iceland	1.86	3.55	6.20	10.80
Ireland	49.37	75.30	55.70	74.90
Italy	344.67	527.40	1106.00	1226.80
Japan	2216.70	2251.81	3670.90	4629.40
Netherlands	468.74	458.22	529.70	864.50
Norway	66.50	69.05	70.30	85.70
Portugal	38.95	46.34	59.10	84.50
Spain	290.38	486.20	278.10	363.00
Sweden	272.73	232.56	286.20	203.70
United Kingdom	1996.23	2217.32	844.20	1284.30
United States	11308.78	13810.43	9755.00	14083.70
Share of world capitalization (%):				
Above countries	80.39	82.34	66.14	67.82
EU countries	18.92	20.48	17.21	16.06
Non-EU countries	61.47	61.86	48.93	51.75

Notes. U.S. $ billions, end-of-year levels. Stock market capitalization is from *Emerging Stock Markets Factbook*, Standard & Poor's (2002). Stock market capitalization of the world is the sum of all stock market capitalizations listed in this source.

"Bonds outstanding" is the sum of domestic long-term debt securities outstanding plus international bonds and notes outstanding from the Bank for International Settlements (BIS). "Domestic long-term debt securities" are calculated using data of domestic debt securities minus domestic debt securities with remaining maturity up to one year from BIS. The world number for "bonds outstanding" is calculated as the sum of bonds outstanding for all countries listed by the BIS. "EU" refers to Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and UK. "Non-EU countries" are the remaining six countries listed in the table.

Table 3

Equity Home Bias 1997 and 2001

Country	(1) Foreign Equity in Portfolio (%)		(2) Domestic Market Share of World (%)		(3) Equity Home Bias		
	1997	2001	1997	2001	1997	2001	Diff.
Australia	11.97	17.22	1.26	1.35	0.88	0.83	–0.05
Austria	28.49	66.45	0.15	0.09	0.71	0.33	–0.38
Belgium	35.09	44.89	0.58	0.60	0.65	0.55	–0.10
Canada	17.89	24.76	2.41	2.52	0.82	0.75	–0.07
Denmark	21.83	37.87	0.40	0.34	0.78	0.62	–0.16
Finland	5.92	20.19	0.31	0.68	0.94	0.80	–0.14
France	16.31	20.40	2.87	4.22	0.83	0.79	–0.05
Iceland	17.52	35.08	0.01	0.01	0.82	0.65	–0.18
Ireland	63.11	118.42	0.21	0.27	0.37	–0.19	–0.56
Italy	21.98	36.96	1.47	1.90	0.78	0.62	–0.15
Japan	7.44	10.58	9.43	8.09	0.92	0.88	–0.03
Netherlands	29.50	57.84	1.99	1.65	0.70	0.41	–0.29
Norway	15.22	43.86	0.28	0.25	0.85	0.56	–0.29
Portugal	14.21	19.22	0.17	0.17	0.86	0.81	–0.05
Spain	19.00	13.58	1.23	1.75	0.81	0.86	0.05
Sweden	9.57	38.65	1.16	0.84	0.90	0.61	–0.29
U.K.	21.53	27.04	8.49	7.97	0.76	0.71	–0.06
U.S.A.	9.91	11.18	48.08	49.64	0.81	0.78	–0.03
Average:							
All	20.36	35.79	4.47	4.57	0.79	0.63	–0.16
EU	23.88	41.79	1.59	1.71	0.76	0.58	–0.18
Non-EU	13.33	23.78	10.25	10.31	0.85	0.74	–0.11

Notes. Equity Home Bias in column (3) = 1–column (1)/[1–column (2)]. Column (1) = total foreign equity held by country / country's total equity portfolio, where the total equity portfolio of a country = stock market capitalization + foreign equity held – amount of country's equity held by foreigners. Column (2) = stock market capitalization of country/ stock market capitalization of the world. Data sources: foreign equity holdings and domestic equity held by foreigners are from the IMF Coordinated Portfolio Investment Surveys, 1997 and 2001; stock market capitalizations are from *Emerging Stock Markets Factbook*, Standard & Poor's (2002). (The numbers in the first two columns are logically between 0 and 100 but can be outside that range due to measurement problems.)

Table 4

Bond Home Bias 1997 and 2001

Country	(1) Foreign Bonds in Portfolio (%)		(2) Domestic Market Share of World (%)		(3) Bond Home Bias		
	1997	2001	1997	2001	1997	2001	Difference
Australia	6.51	12.60	0.65	0.61	0.93	0.87	–0.06
Austria	22.28	35.20	0.94	0.84	0.78	0.64	–0.13
Belgium	24.09	40.38	1.32	0.93	0.76	0.59	–0.16
Canada	4.24	4.02	2.53	2.09	0.96	0.96	0.002
Denmark	8.14	13.29	1.19	0.85	0.92	0.87	–0.05
Finland	13.83	45.68	0.41	0.26	0.86	0.54	–0.32
France	20.87	38.92	4.25	3.65	0.78	0.60	–0.19
Iceland	1.78	2.37	0.03	0.04	0.98	0.98	–0.01
Ireland	72.62	92.82	0.24	0.25	0.27	0.07	–0.20
Italy	14.20	22.63	4.85	4.01	0.85	0.76	–0.09
Japan	16.84	18.14	16.11	15.14	0.80	0.79	–0.01
Netherlands	29.46	42.07	2.32	2.83	0.70	0.57	–0.13
Norway	34.23	56.02	0.31	0.28	0.66	0.44	–0.22
Portugal	23.32	33.81	0.26	0.28	0.77	0.66	–0.11
Spain	6.18	26.14	1.22	1.19	0.94	0.74	–0.20
Sweden	11.18	24.04	1.26	0.67	0.89	0.76	–0.13
U.K.	47.69	52.35	3.70	4.20	0.50	0.45	–0.05
U.S.A.	5.60	4.09	42.80	46.07	0.90	0.92	0.02
Average:							
All	20.17	31.36	4.69	4.68	0.79	0.68	–0.11
EU	24.49	38.94	1.83	1.66	0.75	0.60	–0.15
Non-EU	11.53	16.21	10.41	10.71	0.87	0.83	–0.05

Notes. Bond Home Bias in column (3) = 1–column (1)/[1–column (2)]. Column (1) = total foreign bonds held by country / country's total bond portfolio, where the total bond portfolio of a country = value of country's bonds outstanding + foreign bonds held – amount of country's bonds held by foreigners. Column (2) = bond market capitalization of country/ bond market capitalization of the world. Data sources: foreign bond holdings and domestic bonds held by foreigners are from the IMF Coordinated Portfolio Investment Surveys, 1997 and 2001; bond market capitalizations are from the Bank for International Settlements.

Table 5

Risk Sharing and Equity Home Bias: OECD 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	equity home bias
Income Smoothing	yes	1	0	–47
		(0.55)	(0.37)	(3.55)
	no	1	0	–35
		(0.43)	(0.33)	(4.36)
Consumption Smoothing	yes	47	0	3
		(9.57)	(0.23)	(0.16)
	no	47	2	12
		(12.07)	(1.17)	(0.91)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t = \text{constant} + \kappa \ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [(\text{EHB}_{it}) - (\overline{\text{EHB}}_t)]$, EHB_{it} is the period t equity home bias index of country i, and $\overline{\text{EHB}}_t$ is the (un-weighted) average across countries of EHB_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \text{C}_{it} - \Delta \log \text{C}_t = \text{constant} + \eta \ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1 (t - \bar{t}) + \eta_2 [(\text{EHB}_{it}) - (\overline{\text{EHB}}_t)]$.

The last column shows the predicted increase in percent risk sharing attained by moving from extreme equity home bias (a value of 1) to no home bias. See the text for further details. The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and United States. Numbers in parentheses are t-values.

Table 6

Risk Sharing and Foreign Equity Holdings: OECD 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	equity/GDP
Income Smoothing	yes	3	0	8
		(0.99)	(0.11)	(2.69)
	no	2	0	7
		(1.40)	(0.50)	(3.50)
Consumption Smoothing	yes	49	0	13
		(10.20)	(0.21)	(2.45)
	no	45	2	1
		(11.88)	(1.28)	(0.36)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t = \text{constant} + \kappa\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [(\text{E}_{it} - \overline{\text{E}}_t)]$, E_{it} is the period t natural logarithm of the ratio of foreign equity owned to GDP for country i, and $\overline{\text{E}}_t$ is the (un-weighted) average across countries of E_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \text{C}_{it} - \Delta \log \text{C}_t = \text{constant} + \eta\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1 (t - \bar{t}) + \eta_2 [(\text{E}_{it}) - (\overline{\text{E}}_t)]$.

The predicted increase in percent risk sharing attained by increasing the ratio of foreign equity holdings to GDP by x percent equals the number in the last column times $x/100$. See the text for further details. The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and United States. Numbers in parentheses are t-values.

Table 7

Risk Sharing and Bond Home Bias: OECD 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	bond home bias
Income Smoothing	yes	1	0	–52
		(0.49)	(0.44)	(4.33)
	no	–1	0	–29
		(0.37)	(0.20)	(4.14)
Consumption Smoothing	yes	50	–1	–68
		(10.42)	(0.48)	(2.46)
	no	44	2	–6
		(11.22)	(1.22)	(0.41)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \mathrm{GNP}_{it} - \Delta \log \mathrm{GNP}_t = \text{constant} + \kappa \ (\Delta \log \mathrm{GDP}_{it} - \Delta \log \mathrm{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [(\mathrm{BHB}_{it}) - (\overline{\mathrm{BHB}}_t)]$, BHB_{it} is the period t bond home bias index of country i, and $\overline{\mathrm{BHB}}_t$ is the (un-weighted) average across countries of BHB_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \mathrm{C}_{it} - \Delta \log \mathrm{C}_t = \text{constant} + \eta \ (\Delta \log \mathrm{GDP}_{it} - \Delta \log \mathrm{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1 (t - \bar{t}) + \eta_2 [(\mathrm{BHB}_{it}) - (\overline{\mathrm{BHB}}_t)]$.

The last column shows the predicted increase in percent risk sharing attained by moving from extreme bond home bias (a value of 1) to no home bias. See the text for further details. The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and United States. Numbers in parentheses are t-values.

Table 8

Risk Sharing and Foreign Bond Holdings: OECD 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	bonds/GDP
Income Smoothing	yes	2	0	8
		(0.97)	(0.26)	(3.87)
	no	1	0	6
		(0.44)	(0.57)	(3.98)
Consumption Smoothing	yes	51	0	13
		(10.86)	(0.20)	(2.97)
	no	44	2	3
		(11.64)	(1.33)	(1.12)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t = \text{constant} + \kappa\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [(\text{B}_{it} - \overline{\text{B}}_t)]$, B_{it} is the period t natural logarithm of the ratio of foreign bonds owned to GDP for country i, and $\overline{\text{B}}_t$ is the (un-weighted) average across countries of B_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \text{C}_{it} - \Delta \log \text{C}_t = \text{constant} + \eta\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1 (t - \bar{t}) + \eta_2 [(\text{B}_{it}) - (\overline{\text{B}}_t)]$.

The predicted increase in percent risk sharing attained by increasing the ratio of foreign bond holdings to GDP by x percent equals the number in the last column times $x/100$. See the text for further details. The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and United States. Numbers in parentheses are t-values.

Table 9

Risk Sharing and International Asset Holdings: OECD 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	assets/GDP
Income Smoothing	yes	4	0	13
		(1.42)	(0.16)	(3.79)
	no	1	0	8
		(0.63)	(0.63)	(3.89)
Consumption Smoothing	yes	52	0	21
		(10.93)	(0.11)	(3.59)
	no	44	2	4
		(11.71)	(1.37)	(1.03)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t = \text{constant} + \kappa\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1\,(t - \bar{t}) + \kappa_2\,[(\text{EB}_{it} - \overline{\text{EB}}_t)]$, EB_{it} is the period t natural logarithm of the ratio of (foreign equity and bonds) owned to GDP for country i, and $\overline{\text{EB}}_t$ is the (un-weighted) average across countries of EB_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \text{C}_{it} - \Delta \log \text{C}_t = \text{constant} + \eta\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1\,(t - \bar{t}) + \eta_2\,[(\text{EB}_{it}) - (\overline{\text{EB}}_t)]$.

The predicted increase in percent risk sharing attained by increasing the ratio of foreign asset holdings to GDP by x percent equals the number in the last column times $x/100$. See the text for further details. The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and United States. Numbers in parentheses are t-values.

Table 10

Risk Sharing and Foreign Equity Holdings: EU 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	equity/GDP
Income Smoothing	yes	–2	4	5
		(0.46)	(2.78)	(1.28)
	no	3	4	7
		(1.06)	(3.09)	(2.88)
Consumption Smoothing	yes	34	–2	11
		(4.47)	(1.04)	(1.90)
	no	35	0	4
		(6.09)	(0.27)	(0.96)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t = \text{constant} + \kappa\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [(\text{E}_{it}) - (\overline{\text{E}}_t)]$, E_{it} is the period t natural logarithm of the ratio of foreign equity owned to GDP for country i, and $\overline{\text{E}}_t$ is the (un-weighted) average across countries of E_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \text{C}_{it} - \Delta \log \text{C}_t = \text{constant} + \eta\ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1 (t - \bar{t}) + \eta_2 [(\text{E}_{it}) - (\overline{\text{E}}_t)]$.

The predicted increase in percent risk sharing attained by increasing the ratio of foreign equity holdings to GDP by x percent equals the number in the last column times $x/100$. See the text for further details. The countries included in the sample are Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom. Numbers in parentheses are t-values.

Table 11

Risk Sharing and Foreign Bond Holdings: EU 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	bonds/GDP
Income Smoothing	yes	0	3	12
		(0.09)	(2.71)	(2.47)
	no	0	4	10
		(0.12)	(2.89)	(3.60)
Consumption Smoothing	yes	37	–2	16
		(5.31)	(1.63)	(2.74)
	no	33	–1	6
		(5.90)	(0.51)	(1.35)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \mathrm{GNP}_{it} - \Delta \log \mathrm{GNP}_t = \text{constant} + \kappa\ (\Delta \log \mathrm{GDP}_{it} - \Delta \log \mathrm{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1 (t - \bar{t}) + \kappa_2 [(\mathrm{B}_{it}) - (\overline{\mathrm{B}}_t)]$, B_{it} is the period t natural logarithm of the ratio of foreign bonds owned to GDP for country i, and $\overline{\mathrm{B}}_t$ is the (un-weighted) average across countries of B_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \mathrm{C}_{it} - \Delta \log \mathrm{C}_t = \text{constant} + \eta\ (\Delta \log \mathrm{GDP}_{it} - \Delta \log \mathrm{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1 (t - \bar{t}) + \eta_2 [(\mathrm{B}_{it}) - (\overline{\mathrm{B}}_t)]$.

The predicted increase in percent risk sharing attained by increasing the ratio of foreign bond holdings to GDP by x percent equals the number in the last column times $x/100$. See the text for further details. The countries included in the sample are Austria, Belgium, Denmark, Finland, France, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom. Numbers in parentheses are t-values.

Table 12

Risk Sharing and Foreign Equity and Bond Holdings: Sensitivity Test

	Income Smoothing				Consumption Smoothing			
Left-out Country	equity/ GDP		bonds/ GDP		equity/ GDP		bonds/ GDP	
Australia	8	(2.71)	8	(3.84)	13	(2.39)	15	(3.23)
Austria	8	(2.72)	8	(3.76)	14	(2.62)	12	(2.69)
Belgium	9	(2.87)	8	(4.03)	12	(2.20)	13	(2.74)
Canada	9	(2.90)	7	(2.92)	11	(2.14)	15	(3.42)
Denmark	8	(2.56)	8	(3.81)	13	(2.44)	13	(3.02)
Finland	8	(2.43)	7	(3.51)	11	(1.79)	12	(2.60)
France	8	(2.68)	8	(3.90)	12	(2.34)	12	(2.79)
Iceland	8	(2.71)	10	(4.49)	11	(2.09)	11	(2.53)
Ireland	3	(1.12)	5	(2.39)	15	(2.71)	17	(3.47)
Italy	8	(2.86)	8	(3.98)	11	(2.13)	14	(3.07)
Japan	8	(2.38)	8	(3.58)	8	(1.54)	11	(2.54)
Netherlands	7	(2.41)	7	(3.62)	16	(2.97)	15	(3.37)
Norway	8	(2.66)	10	(4.36)	12	(2.48)	9	(2.12)
Portugal	8	(2.79)	8	(3.81)	13	(2.57)	13	(2.90)
Spain	8	(2.90)	8	(3.89)	10	(1.78)	10	(2.04)
Sweden	12	(3.94)	8	(3.90)	17	(3.00)	13	(2.92)
UK	9	(2.97)	8	(3.97)	13	(2.44)	13	(2.81)
U.S.A.	1	(0.39)	6	(2.73)	14	(2.60)	11	(2.24)

Notes. The table reports the results from regressions of the same form as those with country fixed effects presented in Table 6 (foreign equity holdings) and Table 8 (foreign bond holdings) leaving out one country at a time. Only the coefficients of the ratios of foreign assets owned to GDP are listed in order to highlight the focus of our paper. Numbers in parentheses are t-values. See notes to Tables 6 and 8 for further details.

Table 13

Risk Sharing and Foreign Equity Holdings by Year: OECD 1993–2001

			interaction terms	
	country fixed effects	average risk sharing	trend	equity/GDP
Income Smoothing	yes	0	0	2
		(0.16)	(0.17)	(1.10)
	no	–2	1	0
		(0.91)	(0.98)	(0.21)
Consumption Smoothing	yes	46	3	12
		(10.29)	(1.76)	(3.27)
	no	42	4	6
		(11.16)	(2.93)	(1.79)

Notes. The columns in the top half of the table present 100 times $1-\kappa_0$, $-\kappa_1$ and $-\kappa_2$, where the parameters κ_0, κ_1, and κ_2 are estimated from panel-data regressions for income smoothing of the form $\Delta \log \text{GNP}_{it} - \Delta \log \text{GNP}_t = \text{constant} + \kappa \ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\kappa = \kappa_0 + \kappa_1 \left(t - \bar{t}\right) + \kappa_2 \left[(\text{E}_{it} - \overline{\text{E}}_t)\right]$, E_{it} is the period t natural logarithm of the ratio of foreign equity owned to GDP for country i, and $\overline{\text{E}}_t$ is the (un-weighted) average across countries of E_{it}.

The lower half of the table presents 100 times $1-\eta_0$, $-\eta_1$, and $-\eta_2$, where the parameters η_0, η_1, and η_2 are estimated from panel-data regressions for consumption smoothing of the form $\Delta \log \text{C}_{it} - \Delta \log \text{C}_t = \text{constant} + \eta \ (\Delta \log \text{GDP}_{it} - \Delta \log \text{GDP}_t) + \epsilon_{it}$ where $\eta = \eta_0 + \eta_1 \left(t - \bar{t}\right) + \eta_2 \left[(\text{E}_{it}) - (\overline{\text{E}}_t)\right]$.

The predicted increase in percent risk sharing attained by increasing the ratio of foreign equity holdings to GDP by x percent equals the number in the last column times $x/100$. See the text for further details. The countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. Numbers in parentheses are t-values. Foreign equity holdings are from Lane and Milesi-Ferretti (2001) (updated to 2002).

Figure 1: Income Risk Sharing and Equity Asset Holdings in the OECD

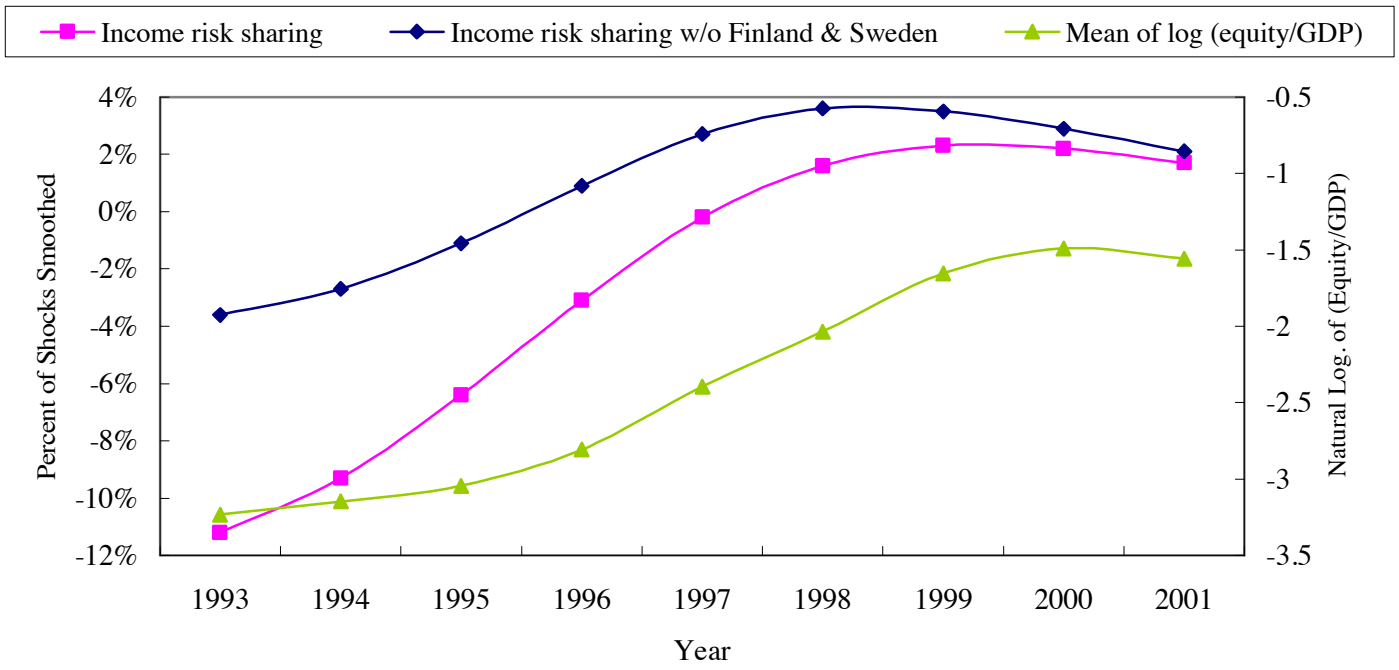
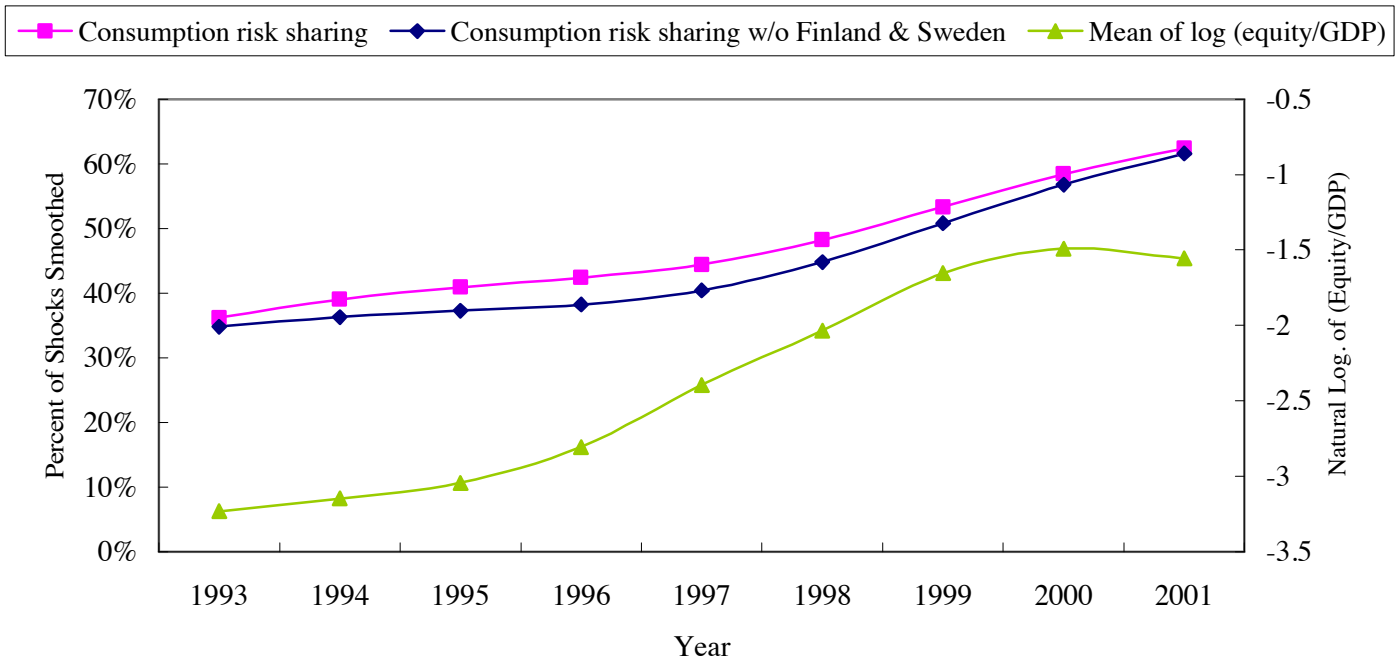


Figure 2: Consumption Risk Sharing and Equity Asset Holdings in the OECD



Notes. Mean of log (equity/GDP) is the cross-sectional mean of foreign equity holdings normalized by GDP for 20 OECD countries. The countries comprise the subset of OECD for which data are available (see text). Risk sharing is estimated cross-sectionally year-by-year and is smoothed by using a Normal kernel with bandwidth (standard deviation) equal to 2.

Figure 3: Country-level Income Risk Sharing vs. Mean of 1997 & 2001 log (Equity/GDP)

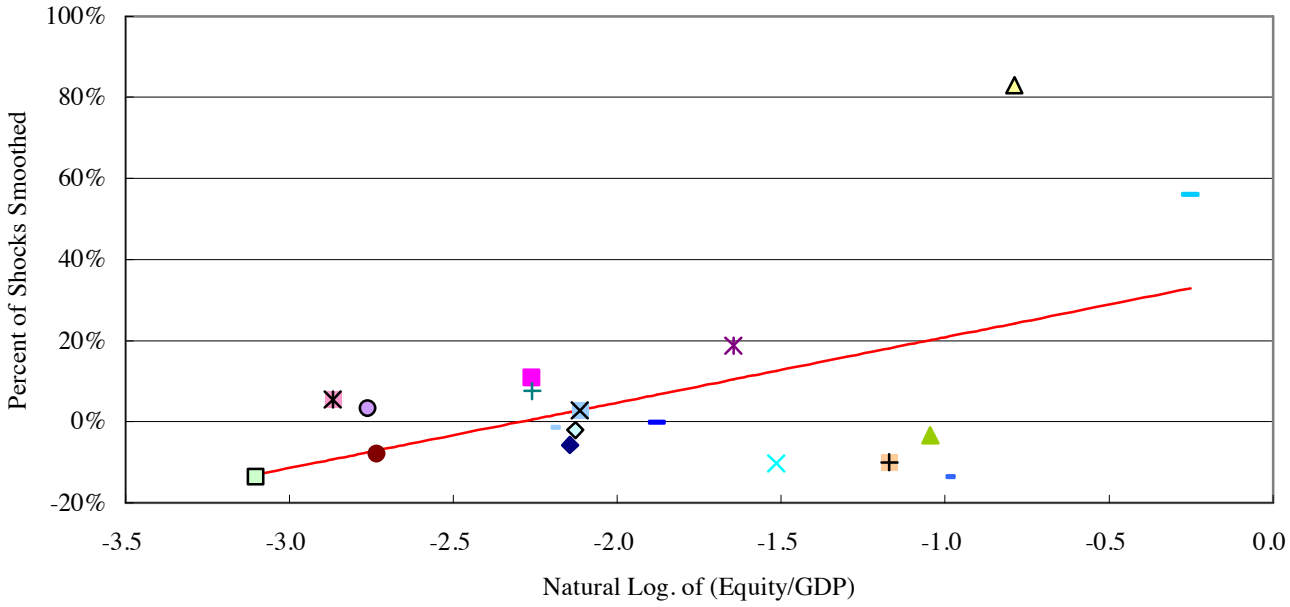


Figure 4: Country-level Consumption Risk Sharing vs. Mean of 1997 & 2001 log (Equity/GDP)

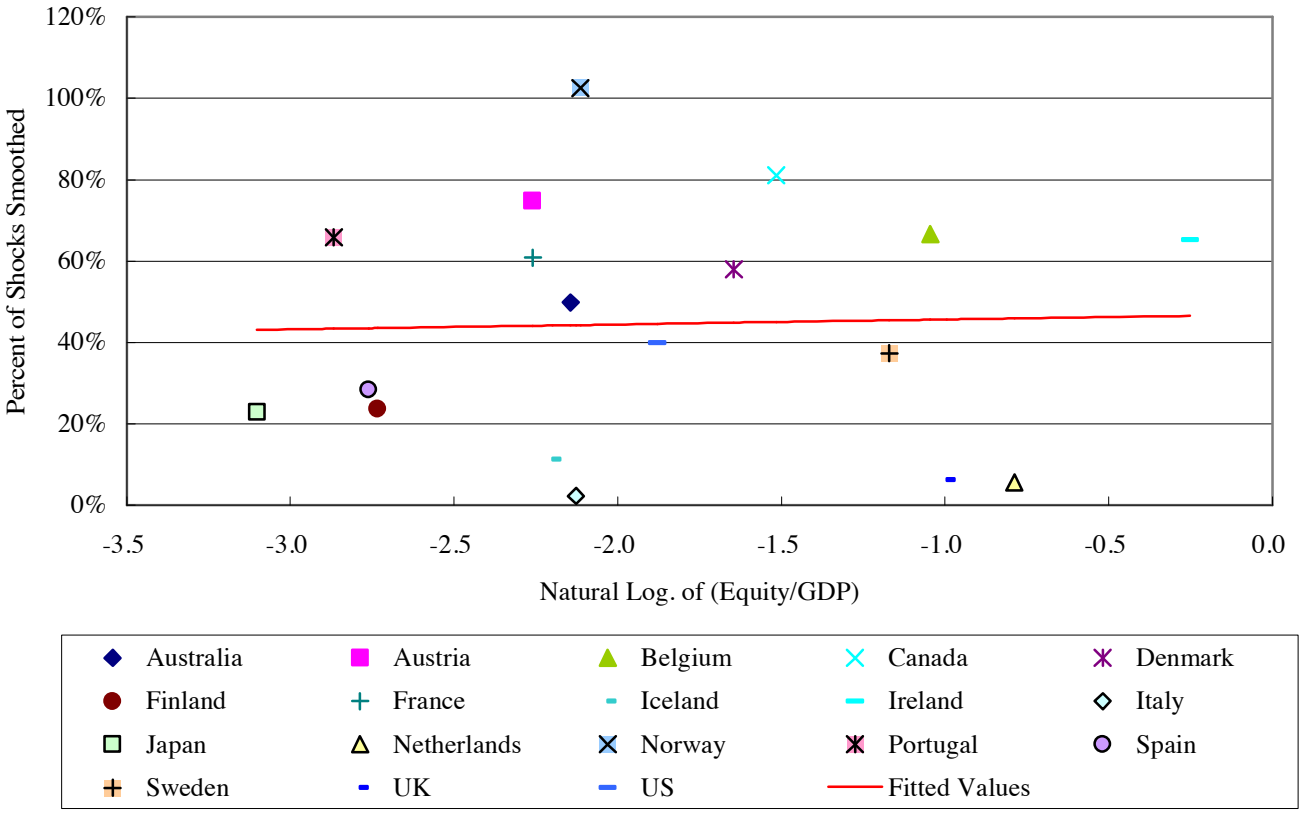


Figure 5: Country-level Income Risk Sharing vs. Mean of 1997 & 2001 log (Bonds/GDP)

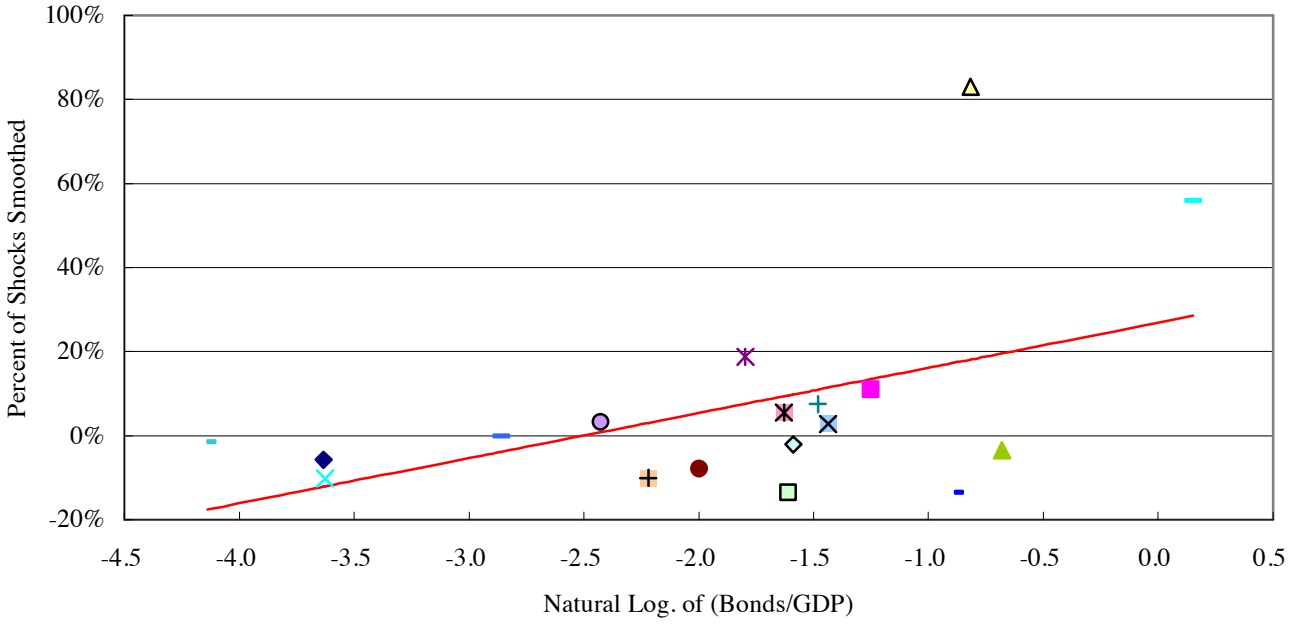


Figure 6: Country-level Consumption Risk Sharing vs. Mean of 1997 & 2001 log (Bonds/GDP)