The Home Bias, Capital Income Flows and improved Long-Term Consumption Risk Sharing between Industrialized Countries[1]

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This version: August 2011. To appear in *International Finance*

[1]An earlier version of this paper was circulated as *The Home Bias and Capital Income Flows between Countries and Regions*. We thank the editor, Benn Steil, and two anonymous referees for useful suggestions.

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Abstract

Is financial globalization associated with improved international consumption risk sharing? We focus on the long-term (i.e. low frequency) comovement of consumption and output in answering this question. Theoretically, the impact of financial globalization should show up first and most robustly in the lower frequencies of the data. We show that this is the case empirically: by the end of our sample period (1960-2007) up to 40 percent of long-term idiosyncratic consumption risk get shared between industrialized countries – as compared to less than 10 percent before 1990. This dramatic increase is associated with a huge increase in international capital income flows: while capital income flows remain relatively limited as a channel of risk sharing at business cycle horizons, their contribution to international risk sharing at longer horizons has increased substantially. Much of this increase can be attributed to the growth in international asset positions over the recent globalization period.

Keywords: Consumption Risk Sharing, Financial Globalization, International and regional business cycles, Capital flows, Home Bias, Non-stationary panel data

JEL classification: E21, F36, F4

1 Introduction

Financial market integration should lead to better international consumption risk sharing. In this paper, we suggest to focus on the long-term comovement of consumption and output in identifying this effect. We first show that long-term consumption risk sharing among OECD countries has indeed increased considerably during the recent globalization period, i.e. in particular after 1990. Towards the end of our sample period, which ranges from 1960 to 2004 between 30 and 40 percent of long-term idiosyncratic consumption risk get shared at an international level. Secondly, the paper identifies a considerable increase in long-term international capital income flows as the main channel through which these improvements in international risk sharing have come about. Third, we empirically tie the rising importance of capital income flows for consumption insurance to the dramatic increase in international cross-holdings of financial assets that has been documented in the recent literature.

There are number of reasons why we think it is important to examine the link between globalization, risk sharing and international capital income flows with a focus on the long-term trend (i.e. low frequency) interactions of the data.

The first reason concerns the magnitude of the potential welfare benefits from financial globalization. As is well known since Lucas (1987), eliminating purely transitory variation in consumption will carry only negligible welfare benefits. If, however, idiosyncratic shocks are very persistent, the benefits from better consumption insurance may be huge.[1] It remains an open question to what extent international risk sharing has actually in-

[1]See e.g. the calculations in Athanasoulis and van Wincoop (2000) and the literature surveyed there

creased at lower frequencies. We address this question in this paper.

Secondly, while a number of earlier studies have documented that the growth in international asset positions is associated with improved risk sharing at the business cycle frequency,[2] most studies that have not explicitly conditioned on international asset holdings have not been able to detect improvements in consumption risk sharing.[3] Thus, while higher international asset holdings seems to be associated with better risk sharing *ceteris paribus*, it seems hard to conclude from the literature that consumption risk sharing has actually increased unconditionally over the globalization period. As we argue, focusing on the low frequency makes it easier to detect an increase in risk sharing even without explicitly having to condition on international asset holdings. One reason why conventional measures of risk sharing – cross-country correlations between (mostly annual) consumption growth rates or the volatility of consumption growth conditional on output growth — may fail to pick up the effects of financial globalization is that the onset of financial globalization in the 1980s has coincided with a period of major changes in the comovement and volatility of international business cycles. Even if financial markets are incomplete and risk sharing is imperfect, one should expect consumption mainly to react to permanent shocks in income. Therefore, as we have argued in a companion paper (Artis and Hoffmann (2008*b*)), if the relative contribution of trend and cyclical shocks to business cycles changes, this may affect extant consumption-based measures of risk sharing, blurring the effect that financial is having on these measures at the same time. For example, if the relative importance of permanent shocks to output increases (e.g. because

[2]See Sørensen et al. (2007) and Kose, Prasad and Terrones (2009) as well as the literature surveyed there.

[3]See Heathcote and Perri (2004) or Bai and Zhang (2005)

cycles become less volatile, as has been the case during the Great Moderation of the last two decades), and consumption reacts primarily to permanent shocks, this will increase the volatility of consumption conditional on output – thus offsetting the effect of financial globalization which would tend to lower this conditional volatility. Our approach here is to ask from the outset how consumption reacts to low frequency shocks in output. Unlike measures at the business-cycle frequency, our low-frequency measure of risk sharing signals a steady increase in international risk sharing over the globalization period even if we do not condition on international asset positions.

We believe that it is very useful to have at hand a measure that signals this increase in risk sharing over the globalization period unconditionally. Financial globalization is a complex, multi-faceted, phenomenon that—most likely—cannot simply be captured in the increase in international asset positions and other conditioning factors as they have been studied in the recent literature. Many (hard to observe) institutional and cultural factors could matter and some of them could actually work to offset the positive impact that we would believe globalization to have on risk sharing. The unconditional measure is meant to capture the joint impact of all of these factors on risk sharing. This, again, makes it useful in assessing the welfare benefits from financial globalization. [4]

Third, we would expect the focus on the longer term to allow us to separate the effect on the various risk sharing *channels* more sharply. At busi-

[4]We emphasize that this does not rule out the possibility that risk sharing might increase mainly due to the growth in international asset positions. In fact, we follow Sørensen et al. (2007) in arguing that improved risk sharing and the decline in international home bias are two sides of the same medal. Still it is important to construct a measure that allows us to detect an increase in risk sharing without *a priori* having to condition on the growth in international asset position: in this way it becomes possible to ask *how much* of the increase in that measure can be accounted for by the increase in international asset holdings. To our knowledge, this perspective is new to the literature.

ness cycle frequencies and as long as macroeconomic fluctuations are transitory it will not make a big difference for consumption allocations whether countries smooth their consumption through savings and dis-savings or through capital income flows derived e.g. from equity (Baxter and Crucini (1995)). However, if shocks are sufficiently persistent or even permanent, intertemporal consumption smoothing through borrowing and lending will not be possible. Risk sharing will therefore more likely take the form of state contingent international income flows.[5] This, again, indicates that we should expect to see the impact of declining home bias on capital income flows most strongly in the lower frequency of the data.[6]

Fourth, a recent influential literature in asset pricing starting with Bansal and Yaron (2004) teaches us that long-term consumption risks are key drivers of expected returns in financial markets. Long-term consumption growth rates seem to be much more highly correlated with asset returns than are short-term fluctuations (see e.g. Parker and Julliard (2005)). These facts suggests that the risks that are priced in financial markets are predominantly long-term risks which lends further support to the notion that we should expect improvements in consumption risk sharing to manifest themselves most strongly at longer horizons.

The remainder of this paper is structured as follows: we first place the

[5]Which, in turn, will require state-contingent assets, e.g. equity rather than bonds. Eijffinger and Wagner (2010) provide an elegant model of how moral hazard may make permanent shocks hard to insure because it may be hard to enforce state-contingent contracts at an international level.

[6]Another reason for focusing on the longer term in identifying the impact of declining home bias on international capital income flows could be valuation effects (Lane and Milesi-Ferretti (2003), Gourinchas and Rey (2007)) i.e. the role that asset prices, and in particular exchange rate changes, play in the dynamics of foreign asset positions and for the valuation of international income flows. While valuation effects could blur the effect of declining home bias on risk sharing and on capital income flows (either by providing an additional channel of insurance or by acting as a source of shocks), the evidence provided by Gourinchas and Rey suggests that they matter for external adjustment mainly in the short-run.

paper in the context of the literature in the next subsection. Section 2 then presents our empirical framework and the data along with our first important result: consumption risk sharing among industrialized has unambiguously increased once we focus on the lower frequencies of the data. In section 3 we relate this result to the patterns of risk sharing, showing that most of this increase is driven by an increase in capital income flows. Finally we relate the increase in consumption risk sharing to the growth in international gross asset positions. Section four summarizes and concludes.

Placement in the literature

Recent contributions to which our paper is directly related are Lane and Milesi-Ferretti (2007) and Sørensen et al. (2007), Becker and Hoffmann (2006), Leibrecht and Scharler (2008) and Imbs and Fratzscher (2009). Whereas Lane and Milesi-Ferretti document the virtual explosion in international asset cross-holdings during the 1990s, Sørensen et al. (2007) show that countries with higher shares of foreign assets in their net wealth tend to enjoy better income smoothing through higher international factor income flows. Therefore, the equity home bias and the lack of international consumption risk sharing appear as 'twin puzzles separated at birth'.[7] We follow Sørensen et al. (2007) and empirically link the rise in consumption risk sharing to the growth in industrialized countries' international asset

[7] Imbs and Fratzscher (2009)reach similar conclusions as Sørensen et al. (2007) but their focus is not on the increase in risk sharing over time but rather on the impact on risk sharing of the interaction between institutional quality and financial openness. They show that financial openness can mitigate the negative impact of bad domestic institutions.

positions. Importantly, our analysis differs from theirs in its focus on the lower-frequency movements in the data. As we have argued above, this focus is important in evaluating the long-term benefits from financial globalization: we will only expect these benefits to be substantial if there is an impact of financial globalization on the extent to which *persistent* idiosyncratic shocks are shared. Our results here also complement those of Sørensen et al. (2007) and Asdrubali, Sørensen and Yosha (1996) in showing that the increase in capital flows is ultimately the main channel of improvements in risk sharing: as discussed above, from a theoretical point of view, it should not be possible to insure against permanent idiosyncratic shocks through intertemporal asset trade (i.e. by de-coupling consumption and income) but only through international diversification trade (i.e. by de-coupling income from output). One of our contributions in this paper is to confirm that this theoretical conjecture is borne out by the data as financial globalization has progressed.[8] In achieving this de-coupling of income from output, international cross-holdings of state-contingent assets should play a key role. Again, our findings confirm this intuition: interestingly, the effects of international cross-holdings of equity on long-term risk sharing and capital income flows appear stronger than for debt assets, suggesting that in particular the decline in equity home bias was instrumental in lowering countries' exposure to long-term idiosyncratic risk.

The studies by Becker and Hoffmann (2006) and Leibrecht and Scharler (2008) are direct precursors to ours in their focus on the lower frequency of the data – both papers use panel cointegration and vector auto-regressive

[8] See Crucini (1999), Heathcote and Violante (2007) and Artis and Hoffmann (2008*b*) for theoretical models with partial insurance that formalize this idea.

techniques to study risk sharing between countries. Here, we go substantially beyond these analyses by exploring how low-frequency risk sharing has increased over time as globalization has progressed.

The idea that improved risk sharing shold be easier to detect in the lower frequency was first laid out in a previous working paper version of the present paper (Artis and Hoffmann (2006)) that also provides a simple theoretical model. In Artis and Hoffmann (2008*a*) we use this framework to explore the shifting patterns of risk sharing within the European Monetary Union. Different from this companion paper, our analysis here focuses on the key finding that the increase in international risk sharing is ultimately explained by a dramatic increase in the role of capital income flows. In addition, the present paper uses the actual time variation in international asset positions over the last several decades to study how the financial globalization has affected international risk sharing and how this lines up quantitatvely with the increase in risk sharing detected by our unconditional measure.

A recent, concurrent study in the same mold is Matsumoto, Flood and Marion (2009) who also look at the long-term volatility of consumption shares as a measure of risk sharing and reach similar conclusions concerning the increase in long-run risk sharing. However, the methodology of Matsumoto, Flood and Marion (2009) focuses on consumption volatility, which does not allow them to identify whether declining volatility in consumption shares is actually driven by changes in the underlying risks (e.g. shocks to output shares becoming less volatile) or by changes in the risk sharing 'technology' (better integration of financial markets, i.e. financial globalization). Their approach therefore also does not allow to consider the role of various risk sharing channels nor do they explore the role that in-

creased international asset holdings have played for the rise in long-term risk sharing. We offer such an integrated perspective here.

2 Empirical Implementation

2.1 A risk sharing regression in levels

Our empirical analysis builds on a key prediction from economic theory: standard models with complete financial markets such as the one first studied by Backus, Kehoe and Kydland (1992) imply that fluctuations in relative (i.e. idiosyncratic) marginal utility growth should be independent of idiosyncratic risk. To the extent that marginal utility can be captured by consumption, the coefficient of a regression of relative consumption growth on indicators of idiosyncratic risk, such as relative output growth rates, should be close to zero. This coefficient – typically between zero and one in the data – has subsequently been interpreted as the fraction of idiosyncratic risk that remains unshared, e.g. because financial markets are incomplete: if the coefficient is unity, no risk is shared, if it is zero, all risk is shared. Generally, such risk sharing regressions have been estimated with data that has been rendered stationary through first differencing. An important novelty of our approach is to use the information implicit in the levels of relative consumption and output. Specifically, we focus on regressions of the form

$$c_t^k - c_t^* = \beta_U \left[y_t^k - y_t^* \right] + constant + \phi^k + \varepsilon_t^k \tag{1}$$

where c and y stand for the (natural logarithm) of consumption and output in country k respectively, the asterisk denotes world-averages, ϕ^k is a country fixed effect and ε_t^k the residual.

This equation is reminiscent of the equations estimated in Mace (1991), Asdrubali, Sørensen and Yosha (1996), Cochrane (1991*a*) or Crucini (1999) and its interpretation is quite analogous. The decisive difference vis-à-vis the earlier literature is that equation (1) relates relative log-levels whereas earlier implementations were formulated in differences. The levels-regression can be thought of as a differenced regression with a very long differencing horizon and as such emphasizes the low-frequency comovement between relative consumption and output levels.[9]

We argue that this emphasis on the low frequencies is essential in identifying the effect of financial globalization on risk sharing. Simple specifications of the risk sharing regression with the data differenced at the annual frequency do not consistently pick up an increase in risk sharing over time (see e.g. the results in Artis and Hoffmann (2008*b*) and Imbs (2006), Bai and Zhang (2005) and the discussion in Kose, Prasad and Terrones (2009)). Heathcote and Perri (2004) even report that international consumption correlations have decreased for the U.S. Conversely, our results below clearly show an increase in risk sharing (a drop in the estimated coefficient) when we use the levels regression (1) that emphasizes the low-frequency comovement between relative output and consumption.

[9]This is easily derived from the first order-condition of the representative consumer in country k: when financial markets are complete, $\delta u'(C^k_{t+1})/u'(C^k_t) = \Lambda_{t+1}/\Lambda_t$ where $u(.)$ is utility, δ the time preference rate and $\Lambda_t$the shadow price associated with the aggregate resource constraint. With constant relative risk aversion utility, this yields the familiar condition that consumption growth in country k should depend only on aggregate variables (i.e. those affecting Λ_{t+1}). Multiplying that condition over T periods, we get $\left(C^k_{t+T}/C_t\right) = \left(\frac{\Lambda_{t+T}/\Lambda_t}{\delta^T}\right)^{-1/\rho}$ where ρ is relative risk aversion. At time $t=0$, $C^k_0 = \Phi_k C^*_0$where $C^*_0$is aggregate consumption and $\Phi_k$is country k's (ex ante) consumption share. Then recognizing that $C^*_{t+T}/C^*_t = \left(\frac{\Lambda_{t+T}/\Lambda_t}{\delta^T}\right)^{-1/\rho}$and taking logs we have $c^k_{t+T} - c^*_{t+T} = \phi_k$, i.e. relative (log) consumption shares should be constant and, in particular, independent of relative output levels for T large enough.

2.2 Data

We examine annual data for 23 OECD countries ranging from 1960 to 2004. Consumption, GDP and GNP (income) and population are from the Penn World Table, release 6.2 (PWT 6.12.) by Heston, Summers and Aten (2006). All data are in constant (2000) prices. The countries included in our estimation are:

1. Canada, 2. the United States, 3. Japan, 4. Austria, 5. Belgium, 6. Denmark , 7. Finland, 8. France, 9. Germany (West), 10. Greece, 11. Iceland, 12. Ireland, 13. Italy, 14. Luxembourg, 15. Netherlands, 16. Norway, 17. Portugal, 18. Spain, 19. Sweden, 20. Switzerland, 21. United Kingdom, 22. Australia, 23. New Zealand.

We also obtain results for U.S. state level data. While interesting in their own right — level risk sharing regressions as we propose them here have not previously been estimated on regional data — the regional results from a financially highly integrated economy such as the U.S. will provide a natural benchmark against which we can evaluate our international results. The US-data set is the one used in the seminal paper by Asdrubali, Sørensen and Yosha (1996) where it is also described in detail. Output and income are measured by gross-state product and state-level personal (disposable) income data respectively, both from the Bureau of Economic Analysis (BEA) regional economic accounts. Consumption data at the state level are not available. We follow Asdrubali, Sørensen and Yosha (1996) and virtually the entire literature on regional risk sharing in the U.S. by using retail sales data. State-level retail sales data are re-scaled by the share of retail sales in aggregate (US-wide) consumption to obtain measures of state level consumption. We follow the general practice in the US regional business cycle literature and drop Washington D.C. from the sample. All data are deflated

by the US-wide consumption price index and range from 1960 to 1990.

We express all data in per capita terms. Rest of the World (RoW) aggregates are the US- or OECD-wide average per capita values. Population data are from the BEA and PWT respectively.

Over the sample period covered by our international data set, international financial markets have become increasingly liberalized. To take account of this change, we will report results obtained for two sub-periods: the first covers the period 1960-1990, the second covers 1990-2004. The results we obtain from the first sub-period can be compared directly to others in the literature (the studies by Sørensen and Yosha (1998) and Crucini (1999) cover the same period), while the results from the second sub-period should provide insights into the effects of the dramatic growth in gross international asset positions since the beginning of the 1990s.

2.3 The increase in long-term risk sharing

We now turn to estimating the level risk sharing regression (1). This relationship can, in principle, be estimated consistently by OLS. However, we have to acknowledge that relative consumption and output levels may be non-stationary, including the possibility that they are cointegrated. In this case, OLS may suffer from second-order bias due to potential simultaneity and serial correlation of the errors. Phillips and Moon (1999) therefore advocate a panel version of the fully modified least squares (FMLS) method. Since the FMLS estimator is semi-parametric, it may, however, be imperfectly suited to relatively small samples. The panel dynamic OLS (PDOLS) estimator suggested by Mark and Sul (2003) may be preferable in this case. We therefore conduct all our analyses here based on the panel OLS and the

panel dynamic OLS estimator.

The panel dynamic OLS estimator accounts for serial correlation and potential simultaneity by including leads and lags of the differences of the right hand side variables. We experimented with various leads and lags and found our results to be very robust across specifications. All results were also very similar to those obtained from plain panel OLS estimates. The PDOLS parameter estimates in Table 1 are based on one lead and lag for each country which we found sufficient to capture serial dependence in our annual data.[10]

Table 1 presents our first main results. To set the scene, Panel I presents results from pooled regressions (i.e. without fixed effects), whereas Panel II presents results from the fixed-effect level risk sharing regression. The pooled or 'between' regressions emphasizes the cross-sectional dimension of the data even more, thus bringing out the long-run interaction between the data. This serves as an interesting comparison.[11] Our findings carry a clear message: for US federal states, we find that around 50 percent of long-run risk gets shared. Virtually the same coefficient is obtained once we control for fixed effects. In international data, based on the pooled estimate, we detect that risk sharing is below 10 percent – the estimate of β_U exceeds 0.9 in the 1960-90 period. For the later (i.e. the globalization) period, estimates of the coefficient are around 0.75. This is considerably

[10] We note that it is inconsequential for the estimation of the regression coefficient in (1) whether relative consumption and output are indeed cointegrated or not. As Mark and Sul (2003) note, the coefficient of a non-stationary panel regression is meaningful even if there is no cointegration between the variables. The spurious-regression problem is alleviated through the panel dimension. Still, it may facilitate theoretical interpretation of our results below, if we can treat (1) as a panel cointegrating relation. Pedroni (2004) group mean test for panel cointegration on the residuals of the country-wise PDOLS-regressions strongly rejects the null of no cointegration in all samples and sub-periods. The test statistics are reported as memorandum items at the bottom of Table 1.

[11] Of course, the pooled estimate is also potentially more susceptible to unobserved heterogeneity across countries. Therefore, our main tool in the sequel of the paper is the fixed-effect panel regression.

lower than in the 1960-90 period and the difference does appear to be significant. Turning to the fixed-effect estimates, the increase in international risk sharing in the post-1990 period appears even more marked: for the 1960-90 period we now find virtually no risk sharing ($\beta_U = 0.98$), whereas for the globalization period the corresponding value is around $\beta_U = 0.65$. Note that the choice of estimation method (OLS vs. PDOLS) has practically no effect on the results.[12]

Our results suggest that there is a lack of (long-run) risk sharing in international data in both sub-periods, but even at the regional level we find that U.S. citizens own a disproportionate share of the claims to output of the federal state in which they live – around 50 percent of the shocks to regional output levels affect consumption in the own federal state. This result is important because it provides perspective on the impact that globalization has had on the 'lack of international risk sharing': [13] our results in Table 1 of the increase in long-term international risk sharing during the 1990s suggests a drop in the value of β_U from 0.91 to 0.74 for the pooled estimate. If our empirical measure of long-term risk sharing among U.S. states (~ 0.5) is taken as a benchmark, then around 40 percent ($(0.91 - 0.75)$ / $(0.91 - 0.47) = 0.17/0.43 \approx 0.4$) of the lack of international risk sharing (gaged not rela-

[12] This result is informative about the empirical relevance of theoretical scenarios in which consumption and output are incidentally correlated for reasons that are unrelated to financial market incompleteness, for example, due to preferences that are non-separable in consumption and leisure as in Backus, Kehoe and Kydland (1992). The fact that we do not find major differences between the PDOLS - which implicitly controls for this incidental correlation – and the panel OLS estimates supports the notion that such non-separabilities are not likely to have an important effect on risk sharing regressions. This is in line with Backus, Kehoe and Kydland's own conclusion that the non-separability between consumption and leisure cannot quantitatively resolve the consumption correlation puzzle.

[13] Note that risk sharing among U.S. federal states will also partly be achieved through net fiscal transfers. Asdrubali, Sørensen and Yosha (1996) show that this channel accounts for roundabout 10-15% of the risk sharing achieved among U.S. federal states at business cycle frequencies. Becker and Hoffmann (2006) report similar results for the long-run. Given these findings, the increase in risk sharing through private capital markets at the international level – where fiscal transfers are virtually absent – would appear relatively even more important.

tive to some theoretical model but to the real-world counterpart of a well-integrated national economy, the United States) has vanished in the years after 1990. Based on the fixed effect estimate, the increase in risk sharing would appear even more dramatic; all this suggests that the increase in risk sharing in international data is not only statistically significant but also economically important.

In Table 2 we provide a number of checks that illustrate that the increase in international risk sharing is indeed a robust feature of the data. First, we run our regressions on the 1975-1990 sub-period which is practically of equal length as the globalization period 1990-2004.[14] Secondly, to rule out that our findings are unduly affected by small but financially very open economies such as Switzerland, Ireland, Luxembourg and Iceland, we experiment with excluding these countries from the sample. For comparison, we also run the regressions for a sample of 11 small open economies only. Third, we further address the issue that relative consumption and output levels may be non-stationary variables. As we have argued before, spurious regression problems are not much of an issue in non-stationary panels (see Phillips and Moon (1999)). In addition, our results in Table 1 suggest that the risk sharing regression identifies a panel cointegrating relationship. Nonetheless we provide additional evidence for the robustness of our general conclusions by differencing the data at horizons of three and

[14] As we argued above, the regression picks up the low-frequency movement between relative consumption and output. Running the regression on a shorter sample could make it more difficult to identify the relevant low-frequency comovement. However, as the results show, there is no major difference between the results for the long (1960-1990) and the short (1975-1990) pre-globalization period. This suggests that with a maximum cycle length of 15 years (and capturing unobserved heterogeneity with fixed effects), we are able to capture most of the low-frequency comovement that is relevant for our analysis here. Given that the pre-1990- and the post-1990 sample now have equal length, we can now also be sure that any differences between the sub-periods cannot be due to a failure of the method to detect the relevant low-frequency components in one of the two periods.

five years.[15] As is apparent from the table, the gist of our results remains unaffected by all of these exercises: the more we emphasize the lower frequency of the data, the more clearly we see a decline in the estimated coefficients over time – there is a clear increase in international risk sharing.[16]

We further illustrate the importance of focusing on the low frequency of the data by running our level risk sharing regression as a sequence of cross-sectional regressions :

$$c_{kt} - c_t^* = \beta_U(t) \left[y_t^k - y_t^* \right] + \tau_t + \varepsilon_t^k \tag{2}$$

The sequence $\{\beta_U(t)\}$ then gives us a detailed time profile of the increase in risk sharing. Figure (1) plots the sequence $\{\beta_U(t)\}$ obtained in this way against the sequence of coefficients $\{\beta_U^\Delta(t)\}$ from the differenced risk sharing regression, again run as a sequence of cross-sectional regressions:[17]

$$\Delta c_{kt} - \Delta c_t^* = \beta_U^\Delta(t) \left[\Delta y_t^k - \Delta y_t^* \right] + \tau_t + \varepsilon_t^k \tag{3}$$

It is clearly apparent from Figure (1) that the coefficient of the level risk

[15] Of course, using data that has been differenced at longer horizons to emphasize the low-frequency interaction will lead to a loss of a substantial number of observations in the annual samples we are considering here, making the method possibly less efficient than our level regressions.

[16] Our focus in this paper is on risk sharing between industrialized economies. However, we also applied our level risk sharing regressions to a sample of 22 emerging economies. Here, the coefficients stay very close to one, irrespective of the sample period. Hence, our level risk sharing corroborates the findings in Kose, Prasad and Terrones (2009) that developing countries are not reaping the benefits from financial globalization. However, we emphasize again that much of the earlier literature has found it difficult to document a consistent increase in risk sharing even among industrialized economies. Along this dimension, our results here differ clearly.

[17] Sequences of cross-sectional regressions of this type have been used by e.g. Sørensen et al. (2007) and Hoffmann and Shcherbakova-Stewen (forthcoming) to illustrate the dynamics of risk sharing in various contexts. The cross-sectional regressions can be thought of as a snapshot of the 'between' or 'steady-state' interaction of the variables. The levels regression emphasizes this 'between'-interaction at the lower frequency , the differenced regression at a higher frequency. See also Cochrane (1991*b*) for the use of cross-sectional regressions to measure risk sharing.

sharing shows a pronounced downward trend. However, it is much harder to discern such a trend from the coefficients of the differenced regressions: first, there is a lot of cyclical variation how much consumption risk gets shared at the business cycle frequency. Secondly, even if we use a filter (here: an HP filter with smoothness parameter 6.25) to smooth the estimates of $\beta_U^{\Delta}(t)$, it is not clear that the estimates clearly trend downwards. This further illustrates our point: in identifying the effects of globalization on risk sharing, one should turn to the lower frequencies of the data.[18]

3 Patterns of risk sharing and international asset positions

In this section, we demonstrate that the main channel through which the increase in international consumption risk sharing has occurred is through an increase in international capital income flows and that both developments – better risk sharing and bigger role for international capital income flows – can directly be traced to this growth in gross international investment positions that has been documented in the literature (Lane and Milesi-Ferretti (2007)).

[18]Note that for the analysis in Figure 1, we extend the data set to 2007 using the Penn World Table release 6.3 so that the estimation period becomes 1975-2007. Our earlier analysis as well as in the remainder of the the paper is based on the PWT 6.2 which ends in 2004. There are some issues of comparability across the two data sets and for the time being we prefer to work with PWT 6.2 as our main data set. 2004 is also a natural choice because we link the increase in risk sharing to the increase in international asset positions in the next section and the data set of choice is Lane and Milesi-Ferretti's External Wealth of Nations data set mark II which ends in 2004. Still, it is reassuring to see that our results extend beyond 2004.

3.1 Channels of risk sharing

One reason why we focus our analysis on the lower frequencies of the data is that we expect to identify the effect of globalization on the various risk sharing *channels* more sharply. From the point of view of a large class of theoretical models, it should not be possible to insure against permanent idiosyncratic shocks through intertemporal asset trade (i.e. by de-coupling consumption and income) but only through international diversification trade (i.e. by de-coupling income (GNP) from output (GDP)). Following this logic, we focus on two channels of risk sharing. We associate the first with the (logarithmic) ratio between a country's or region's output and income and refer to it as the capital-income-flows, income-smoothing or *ex ante* channel. We capture the role of the other channel through variation in the (relative) consumption income ratio. We can think of this second channel as intertemporal consumption smoothing through saving and dissaving. We also refer to it as the *ex post* channel.[19] Our conjecture is that changes in the long-run risk sharing parameter β_U are associated mainly with the first channel, i.e. with capital income flows. Conversely, consumption smoothing should play a much more limited role in the long run. To test this prediction, we follow Asdrubali, Sørensen and Yosha (1996) and decompose our estimate of β_U above. Specifically, to measure the role of the capital income channel, we run the regression

$$\left[y_t^k - y_t^*\right] - \left[inc_t^k - inc_t^*\right] = \beta_K \left[y_t^k - y_t^*\right] + \theta_K^k + \nu_t^k \tag{4}$$

[19] We think of international or interregional capital income flows as being derived from *ex ante* diversification of countries' or regions' portfolios, whereas consumption smoothing happens *ex post*, i.e. after income is observed is observed for the current period. This explains the choice of label.

where '*inc*' denotes the logarithm of income and θ_K^k is a country or state-level fixed effect. The contribution of the consumption-smoothing channel to risk sharing is measured through regressions of the form

$$\left[inc_t^k - inc_t^*\right] - \left[c_t^k - c_t^*\right] = \beta_C \left[y_t^k - y_t^*\right] + \theta_C^k + \xi_t^k \tag{5}$$

Note that we have

$$\beta_C + \beta_K = 1 - \beta_U$$

by construction, i.e. the sum of the two channels must always be equal to one minus the coefficient from our levels risk sharing regression above. However, we emphasize that the empirically interesting questions we face is whether the prediction from theory – that risk sharing in the long-run is mainly coming from capital income flows – is confirmed in the data. This would require that that the increase in $1 - \beta_U$ is driven mainly by an increase in β_K.

We estimate equations (4) and (5) using panel dynamic OLS with one lead and lag, controlling for fixed effects and for common time-specific variation. For the U.S., the real world income data we use for this exercise is state-level personal disposable income. In international data, we measure income through gross national product (GNP). The Penn World Tables contain GNP only after 1970. We therefore limit our analysis of international data from now on to the post-1970 period. This does not affect the interpretation of our results since our estimates of β_U for the 1970-90 period are virtually identical to those obtained for the 1960-90 period.

Table 3, Panel A, reports our results. For the US we find that most risk sharing is done through capital income flows whereas the *ex post* channel is virtually absent. This lines up with the theoretical prediction that risk shar-

ing in the long-run should be associated with capital income flows and not with *ex post* smoothing. In international data, the impact of globalization is also clearly visible: risk sharing is very low in the 19970-1990 period, both the *ex ante* and the *ex post* channel are almost mute. The picture changes completely once we turn to the globalization (1990-2004) period: now there is a considerable amount of risk sharing in international data and most of this falls on capital income flows: roundabout one quarter of idiosyncratic output risk gets shared *ex ante*. There is also a moderate increase in *ex post* consumption smoothing. But this effect is much more subdued and the *ex post* channel appears only marginally significant.

These results confirm our conjecture that international risk sharing should be driven by capital income flows in the long-run. They provide a complementary perspective to an important literature that has shown that international risk sharing is lower than in U.S. data mainly because international capital income flows do not contribute to risk sharing (Sørensen and Yosha (1998), Becker and Hoffmann (2006)). Lane (2001) concludes that international investment income flows have practically no bearing on risk sharing internationally. These analyses have typically focused on business cycle frequencies of the data by looking at versions of the regressions (4) and (5) that are formulated in first differences. In Panel II of Table 3 we estimate such differenced regressions for comparison.

The differenced regressions clearly corroborate the findings in the studies referenced above: The lack of international consumption risk sharing is mainly a lack of *ex ante* income smoothing: for the 1960-90 period we find roundabout 40 percent income smoothing for the U.S. and virtually none in international data. We find a small rise in international consumption risk sharing in the 1990-2004 period, with the sum of the coefficients of the

differenced channel regressions, $\beta_K^\Delta + \beta_C^\Delta$, increasing from 0.27 to 0.33. But this difference seems tiny and appears insignificant. Furthermore, even in the globalization period, only a small share of an increase would be explained by capital income flows; β_K^Δ increases from 0.03 to 0.06 and, again, the increase is insignificant.The fact that the increase in risk sharing is much less pronounced in the differenced regression is consistent with the results and the theoretical channels highlighted in our previous work (Artis and Hoffmann (2008*b*)): changes in the international correlation of business cycles can partially offset the impact of globalization on the regression coefficient of consumption growth and output growth (which corresponds to $1 - \beta_K^\Delta - \beta_C^\Delta$). Another interesting feature of the results is that that the relative ranking of the two channels changes in international data between the short-run and the long-run. This finding is consistent with our earlier conjecture that the assignment of improvements in risk sharing to individual channels may be much less clear-cut across in the short-run and the long-run. While in the short-run improvements in risk sharing can in principle come about both through capital income flows derived from *ex ante* portfolio decisions or from *ex post* sales and purchases of assets, in the long-run risk sharing will have to take place through income flows alone.

Summming up, the results from this subsection show that at short horizons the increase in international risk sharing *a)* appears rather limited and is, *b)*, difficult to associate with a marked shift in risk sharing patterns towards higher international income flows. At longer horizons, however, this increase is much more readily apparent and the patterns of international capital income flows line up with the predictions from a wide class of simple theoretical models.

3.2 The increase in international risk sharing and the growth in gross international asset positions

In this subsection, we show that the increase in long-run risk sharing is closely linked to the internationalization of asset ownership. As our measure of international portfolio diversification we use gross asset positions, the sum of assets and liabilities, relative to GDP. This choice is based on some *a priori* theoretical and empirical considerations. First, Obstfeld (2004) distinguishes between two motives for asset trade: intertemporal or development asset trade, which is reflected in net investment positions and diversification asset trade, which he associates with gross asset positions. Our interest in this paper is clearly in the risk sharing or diversification aspect of asset trade. Secondly, the focus on gross asset positions can also be justified at an empirical level: Lane and Milesi-Ferretti (2007) note that there has been a virtual explosion in cross-holdings of assets whereas net positions have remained quite stable.

We modify our pooled level risk sharing regression to take account of the internationalization of average gross asset positions. Specifically, we parametrize β_U as

$$\beta_U^{GFA}(t) = \kappa_0 + \kappa_1 GFA_t \tag{6}$$

where GFA_t is the average (across countries) gross foreign asset position relative to GDP:

$$\overline{GFA}_t = \frac{1}{K}\sum_{k=1}^{K} GFA_t^k \text{ and } GFA_t^k = \frac{A_t^k + L_t^k}{Y_t^k}$$

Here, K denotes the number of countries, A_t^k is assets and L_t^k liabilities and the bar denotes the cross-sectional mean. Our data source is the March 2006 release of the external wealth of nations data set by Lane and Milesi-Ferretti

(2007). To obtain estimates of κ_0 and κ_1, we plug (6) into our panel level risk sharing regression and estimate the ensuing regression with interaction terms by panel dynamic OLS. Based on these estimates, we can then obtain $\beta_U^{GFA}(t)$ from (6).

We obtain these two time-varying measures of β_U for the period from 1975 to 2004. Using panel dynamic OLS, we estimate

$$\beta_U^{GFA}(t) = 1.01 - 0.1\overline{GFA}_t$$

with t-statistics on κ_0 and κ_1 of 19.97 and -2.94 respectively. There is a statistically significant link between average gross foreign asset positions and risk sharing. Our estimate of κ_0 is virtually unity, suggesting that cross-holdings of assets seem to account for all the consumption risk sharing we see in the data. Finally, it is interesting to appreciate the magnitude of the coefficient κ_1: increasing average gross foreign asset holdings by 100 percent of GDP will increase consumption risk sharing by roundabout 10 percentage points.[20]

In Figure (2) we plot both the estimated coefficients $\beta_U(t)$ from the sequence of cross-sectional regressions in (3) (here based on PWT 6.2 and ending in 2004) as well as the measure based on the parametrization (6), $\beta_U^{GFA}(t)$. Though obtained from different approaches, the two measures both clearly indicate an increase in risk sharing that is of a very similar magnitude. We also obtain standard errors for $\beta_U(t)$ from a jackknife pro-

[20]We emphasize that, very much as in Sorensen et al. (2007) or Imbs and Fratzscher (2009), we do not wish to interpret these coefficients in a causal manner. Plausibly both the explosion in asset holdings and improved risk sharing have their common origin in financial liberalizations around the world. This is what Sorensen et al. (2007) have called "twin puzzles": the lack of international consumption risk sharing and the home bias puzzle go in hand. What we aim to establish here is that this link is also clearly apparent once we focus on consumption risk sharing in the lower frequency. As discussed before, establishing this link also for low-frequency measures of consumption risk sharing is important in evaluating the welfare benefits from financial globalization.

cedure (Efron (1982)), in which we re-estimate the sequence $\beta_U(t)$ (for $t =$ 1975...2004) 23 times, dropping one country from the sample at a time. The tightness of the two standard error bands thus obtained also demonstrates that our conclusions concerning the extent of long-term risk sharing and its increase during the recent globalization period are robust with respect to the inclusion or exclusion of individual countries in our sample. In addition, over most of the sample period, the *GFA*-based measure is generally well within the bands, suggesting that it is almost statistically indistinguishable from $\beta_U(t)$.[21] We find this particularly remarkable since we have not been using any information about asset holdings in estimating the sequence of cross-sectional regressions (3). These findings are suggestive: the decline in our home bias measure and the associated rise in risk sharing seem indeed intimately linked. However, the two variables *GFA* and $\beta_U(t)$ are trending and unless we make use of the cross-sectional variation in international asset positions, it will be hard to distinguish the impact of financial globalization from some other trend, unrelated to the growth in *GFA*, that might be driving our results. We therefore now turn to exploiting information concerning the cross-country variation in asset holding.

A salient feature of the results in Table 2 that distinguishes our findings from most of the earlier literature is that the increase in international risk sharing is strongly associated with a more important role for international income flows. We show that this changing pattern is also directly related to the growth in *GFA*. To this end, we parametrize the pattern of risk shar-

[21] Only towards the end of the sample period, the two measures diverge somewhat, as the decline in $\beta_U(t)$ seems to flatten out for a couple of years. A potential explanation is that the global stock market decline after 2000 has lowered the value of equity and other financial assets relative to real assets, notably human wealth and housing. Since holdings of these assets are not internationally diversified, international risk sharing may well have decreased temporarily only to pick up again in 2003 with the recovery of international stock markets. Since $\beta_U^{GFA}(t)$ is a function of gross foreign asset positions only – which have continued to grow relative to GDP – it does not detect this temporary decrease in risk sharing.

ing so that β_K and β_C,vary across time and countries by using the time t - country k realization of GFA instead of its cross-sectional, mean:

$$\beta_X^k(t) = \beta_{0X} + \beta_{1X} GFA_t^k + \beta_{2X} t.$$

Here X stands for K and C in turn. Plugging this specification into our channel regressions, we again obtain a set of regressions with interaction terms between relative output and GFA and t respectively. Again, we also consider a specification without a linear trend.

The impact of certain asset categories on the patterns of risk sharing may not necessarily be uniform. In particular, we would expect that equity assets and liabilities to have a more direct impact on state-contingent international capital income flows than debt instruments. We therefore also express the pattern of risk sharing as a function of the growth in international gross equity positions and of debt holdings, parametrizing

$$\beta_X^k(t) = \beta_{0X} + \beta_{1X} GFE_t^k + \beta_{2X} t$$
$$\beta_X^k(t) = \beta_{0X} + \beta_{1X} GFD_t^k + \beta_{2X} t$$

where GFE_t^k (GFD_t^k) is the sum of equity (debt) assets and liabilities divided by GDP.

Table 4 reports the results for these interaction term regressions. The analysis here is limited to the 1990-2004 period, for which we have uninterrupted data by asset category for all 23 countries. The first two columns are for total assets, rows 3 and 4 for equity and columns 5 and 6 for debt assets.

The picture emerging from the Table is clearly that the growth in international cross-holdings tends to increase risk sharing – the sum $\beta_{K1} + \beta_{C1}$

is positive and significant for all three categories of assets. Most interestingly however, the growth in GFA, GFE and GFD has a particularly strong effect on β_K, i.e. the contribution of capital income flows to risk sharing. In line with prior expectations, this effect is particularly strong for cross-holdings of equity assets: equity is more likely to deliver state-contingent dividend payments whereas debt assets will not generally provide such income insurance. Conversely, debt assets have a relatively stronger impact on risk sharing through ex post accumulation or decumulation of foreign assets (β_C).

4 Summary and Conclusion

The literature so far has found it relatively difficult to document that financial globalization finds its reflection in better international consumption risk sharing: only studies that have explicitly conditioned on international asset holdings have found consumption risk sharing to have increased. But while this implies that higher international asset holdings are indeed associated with better risk sharing, this does not necessarily imply that consumption risk sharing has increased unconditionally. For example, financial globalization may allow countries to trade in assets more easily. But it may also induce substantial shifts in the patterns of the underlying risks. For example, by altering industrial structures and the patterns of specialization (see Kalemli-Ozcan, Sørensen and Yosha (2003)), financial globalization may make business cycles less symmetric, also leading to a requirement to share more risk.

In this paper, we have argued that one way to get to grips with this issue is to focus on the lower frequency of the data: first, the lower fre-

quency is important from a welfare perspective. Since the seminal work of Lucas (1987) it is known that the welfare effects of the elimination of consumption risk are likely to be small unless idiosyncratic shocks are persistent. At the same time, the lower frequency (i.e. trend) movements of output and consumption are less likely to be affected by changes in the international correlation of business cycles. This, secondly, implies that on theoretical grounds, improvements in risk sharing should show up first and empirically most robustly in the lower frequencies of the data. In our analysis, we have emphasized these lower frequencies by making use of the information implicit in the relative levels of output and consumption. Unlike many earlier econometric specifications that have focused on the business cycle link between consumption and output, this has allowed us to document that risk sharing has indeed increased considerably among industrialized economies – without a need to explicitly condition on the growth in international asset positions . By the end of our sample period, more than 30 percent of the long-term idiosyncratic risk faced by the average OECD country gets shared internationally. The main channel through which these improvements in international risk sharing seem to have come about is through a larger contribution of international capital income flows to the smoothing of national income rather than through direct smoothing of consumption through saving and dis-saving.

In our analysis, we acknowledge that both – higher cross-holdings of assets and higher risk sharing – are likely to be different sides of the same medal. Both are likely to be endogenous reactions to what are common driving forces, such as financial liberalizations, institutional reforms and technological advances. While we do not solve this endogeneity problem, we argue that a large part of the observed increase in long-run risk sharing

can indeed be linked to the growth in international asset positions. We find that higher gross asset positions lead to considerably more long-run insurance and that capital income flows play a more pronounced role as a channel of risk sharing for those countries that have large cross-holdings of asset, notably of equities.

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Table 1: The increase in long-run risk sharing

Panel I: Pooled Regressions (w/o fixed effects)

$$(c_t^k - c_t^*) = const + \tau_t + \beta_U(y_t^k - y_t^*) + u_t^k$$

	United States 1960-90		OECD 1960-90		OECD 1990-2004	
OLS	0.48	(0.01)	0.93	(0.01)	0.75	(0.03)
Panel Dynamic OLS	0.47	(0.02)	0.91	(0.02)	0.74	(0.06)

Panel II: Fixed effect regressions

$$(c_t^k - c_t^*) = const + \tau_t + \phi^k + \beta_U(y_t^k - y_t^*) + u_t^k$$

	United States (1960-90)		OECD 1960-90		OECD 1990-2004	
OLS	0.50	(0.02)	0.98	(0.02)	0.63	(0.02)
Panel Dynamic OLS	0.52	(0.04)	0.99	(0.04)	0.66	(0.03)
			Panel Cointegration tests			
	-2.36		-2.42		-2.17	

NOTES: The results reported for the panel dynamic OLS estimation are based on estimating equations of the form $c_{kt} - c_{kt}^* = \widehat{b}x_{kt} + \sum_{l=-p}^{p} \delta_{kl}\Delta x_{t-l} + v_{kt}$ where $x_{kt} = (y_{kt} - y_{kt}^*)$ and $v_t^k = \tau_t + u_t^k$ or $v_t^k = \tau_t + \phi_k + u_t^k$, depending on whether it is a pooled or fixed regression. Standard errors are given in parentheses. Those for the PDOLS estimates are based on Mark and Sul (2003).All regressions control for time fixed effects. The panel cointegration tests at the bottom of the table are Pedroni's (2004) group mean t-statistics and are based on the PDOLS fixed-effect regressions.

Table 2: The increase in long-run risk sharing – robustness checks

Panel I: Different country groups and sample periods

Panel dynamic OLS estimates of $(c_t^k - c_t^*) = const + \tau_t + \beta_U(y_t^k - y_t^*) + u_t^k$

Country group	1960-90		1975-90		1990-2004	
	pooled	FE	pooled	FE	pooled	FE
All	0.91	0.98	0.93	0.86	0.74	0.65
	(39.38)	(27.27)	(25.91)	(10.96)	(12.29)	(22.35)
All w/o most open SOEs	0.92	1.03	0.90	0.86	0.74	0.86
	(29.46)	(26.82)	(16.39)	(10.41)	(8.796)	(16.12)
SOEs only	0.89	1.04	0.90	1.06	0.73	0.65
	(22.54)	(11.62)	(17.26)	(10.00)	(12.32)	(29.47)

Panel II:long-horizon differenced regressions

OLS estimates of $(c_{t+l}^k - c_{t+l}^*) - (c_t^k - c_t^*) = const + \tau_t + \phi^k + \beta_U \left[(y_{t+l}^k - y_{t+l}^*) - (y_t^k - y_t^*)\right] + u_t^k$

Country group	1960-90		1975-90		1990-2004	
	3 yrs	5yrs	3 yrs	5yrs	3yrs	5yrs
All	0.83	0.84	0.90	0.78	0.78	0.79
	(14.65)	(11.27)	(10.73)	(7.93)	(10.74)	(10.61)
All but SOEs	0.88	0.95	0.92	0.88	0.79	0.78
	(14.30)	(11.56)	(12.74)	(12.92)	(17.22)	(10.09)
SOEs only	0.93	0.92	0.93	0.73	0.76	0.80
	(8.60)	(5.44)	(7.70)	(4.74)	(7.76)	(7.66)

Notes: Table provides estimates of the risk sharing coefficients (β_U) based on different sample periods, estimation methods and country groups. FE denotes the fixed effect estimate. 'All' refers to all 23 OECD countries, 'All but SOEs ' excludes the most open small economies Luxemburg, Ireland, Iceland and Switzerland. 'SOEs only' comprises 11 small open economies: Austria, Belgium, Denmark, Finland, Iceland, Ireland, the Netherlands, Norway, Sweden, Switzerland. t-stats in parentheses.

Table 3: Risk sharing patterns and the rising importance of capital income flows

United States		OECD			
1960-90		1970-90		1990-2004	
ex ante	*ex post*	*ex ante*	*ex post*	*ex ante*	*ex post*
Panel I: Levels Regressions					
β_K	β_C	β_K	β_C	β_K	β_C
0.45	0.03	0.01	0.06	0.26	0.09
(0.03)	(0.03)	(0.05)	(0.06)	(0.04)	(0.04)
Panel II: Differenced Regressions					
β_K^Δ	β_C^Δ	β_K^Δ	β_C^Δ	β_K^Δ	β_C^Δ
0.39	0.46	0.03	0.24	0.06	0.27
(0.01)	(0.03)	(0.02)	(0.04)	(0.03)	(0.05)

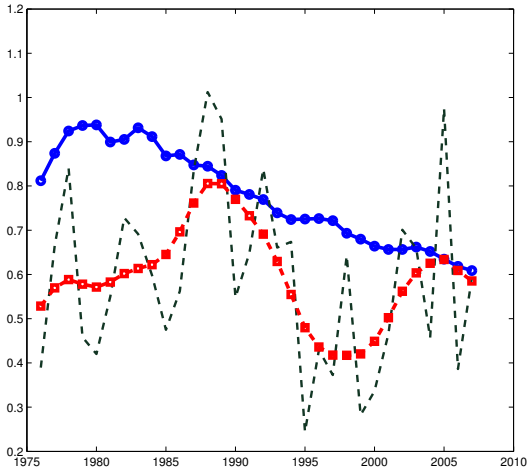
NOTES: regression coefficients from equations (4) (*ex ante*) and (5) (ex post). Panel I reports these regressions in level, panel II their first order differenced version. All regressions control for time-specific and region- or country specific fixed effects. Standard errors in parentheses.

Table 4: Risk sharing patterns as function of international asset positions

Interaction of $\left[y_t^k - y_t^*\right]$ with		total assets (GFA)		equity assets (GFE)		debt assets (GFD)	
		ex ante $\beta_K^k(t)$	*ex post* $\beta_C^k(t)$	*ex ante* $\beta_K^k(t)$	*ex post* $\beta_C^k(t)$	*ex ante* $\beta_K^k(t)$	*ex post* $\beta_C^k(t)$
1	(β_0)	**0.16**	**0.47**	**0.33**	**0.41**	*0.08*	**0.22**
		(4.80)	(8.30)	(16.28)	(8.94)	(1.95)	(3.31)
GFA_t^k	(β_{X1})	**0.08**	**-0.03**				
		(12.69)	(-3.05)				
GFE_t^k	(β_{X1})			**0.21**	**-0.16**		
				(26.73)	(-12.47)		
GFD_t^k	(β_{X1})					**0.09**	**0.05**
						(10.40)	(3.76)
trend	(β_{X2})	**-0.01**	0.01	**-0.02**	**0.01**	**-0.02**	0.0002
		(-4.32)	(0.25)	(-11.49)	(3.84)	(-11.07)	(0.08)

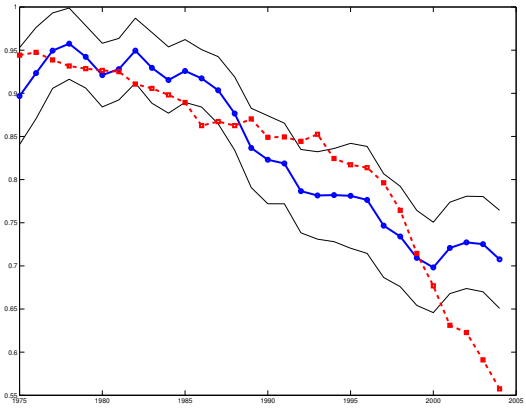
NOTES: The Table reports results for PDOLS regressions of the form $\left[y_t^k - y_t^*\right] - \left[inc_t^k - inc_t^*\right] = \theta_k^K + \beta_{Kt}^k \left[y_t^k - y_t^*\right] + v_t^K$ and $\left[inc_t^k - inc_t^*\right] - \left[c_t^k - c_t^*\right] = \theta_k^C + \beta_C \left[y_t^k - y_t^*\right] + v_t^C$ where $\beta_{Xt}^k = \beta_{0X} + \beta_{1X} GFx_t^k + \beta_{2X} t$ for $X = K, C$ and where GFx stands for GFA, GFE, GFD in turn. t-statistics in parentheses.

Figure 1: The increase in consumption risk sharing 1975-2007 – levels vs. differenced regressions



Notes: The blue (solid /dots) line is the sequence of cross-sectional estimates of the levels-risk sharing regression $\beta_U(t)$. The black dashed line is the sequence of coefficients obtained from the differenced risk sharing regression, β_U^{Δ} . The red (squared) line is the sequence $\{\beta_U^{\Delta}\}$ filtered using an HP-filter with smoothness parameter $\lambda = 6.25$.

Figure 2: The increase in consumption risk sharing and international asset positions 1975-2004



Notes: The blue (solid /dots) line is the sequence of cross-sectional estimates of $\beta_U(t)$. The red (dashed/ squares) line is $\beta_U^{GFA}(t) = 1.01 - 0.1\overline{GFA}_t$ where $\overline{GFA}_t$ is the cross-country mean gross foreign asset position. The thin (black) solid lines are the plus/minus two standard deviation bands for $\beta_U(t)$. These standard deviations are obtained using a jackknife resampling procedure.