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Abstract

This paper tests the importance of international financial assets and liabilities for consumption risk sharing in a general framework which allows for separate effects of equity and debt holdings as well as country-specific sensitivity to aggregate risk. Integration into both the international equity and debt markets is found to be an important determinant of risk sharing for OECD countries over the period 1987-2004, while integration into international equity markets is found to be a robust determinant of risk sharing for emerging and developing countries over the period 1987-2003.

JEL Classification: F36, F41, G15

Keywords: consumption smoothing; financial integration; risk sharing; international portfolio diversification; international business cycles.

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1 Introduction

The expected risk sharing benefits of financial integration have proven difficult to substantiate empirically. This paper attempts to establish the degree of consumption risk sharing that is due to cross border debt and equity assets and liabilities by running panel regressions on a large sample of rich and developing countries over the period 1970-2004, in a framework which relaxes some of the assumptions that have been maintained in the literature.

As pointed out by Backus and Smith (1993), in the presence of segmented goods markets, perfect financial markets need not imply perfect cross-country consumption correlations. This means that the level of consumption correlations may be an unreliable indicator of the use of financial markets for risk sharing. This paper focusses on attempting to establish the marginal effect of debt and equity (foreign direct investment and portfolio equity) assets and liabilities on consumption correlations, rather than looking at the correlation levels. Previous studies have often combined equity and debt holdings into a single financial openness indicator. In contrast, it is argued that it may be necessary to simultaneously allow for separate risk sharing properties of debt and equity, and strong empirical support is found for this contention.

This paper also contributes to the literature by examining risk sharing in a framework which is robust to the possibility that some countries may be more exposed to "global" risk than others, and to the estimation biases to which this could lead. This generalisation of the classic risk sharing regression makes it marginally easier to detect a risk sharing effect of financial openness among OECD countries over the period 1987-2004. The regression setup used allows for a real exchange rate role in consumption dynamics, consistent with many open economy macroeconomic models. The estimation also controls for the possible effects of habit formation in consumption, whereby current consumption may depend on previous values of consumption. The results arising from alternative methods of deflating current price data as well as alternative data sources are compared. The conclusion that financial integration does facilitate risk sharing, particularly in the period 1987-2003/4, appears robust across data sources.

Section 2 reviews some empirical approaches to testing risk sharing. Section 3 develops the framework used to test for the effect of financial integration on risk sharing. Section 4 describes the data sources and empirical methodology, while Section 5 presents the results. Section 6 concludes.

2 Empirical Tests of Risk Sharing

A classic question in international macroeconomics is whether financial integration leads to consumption risk sharing. Trade in contingent claims should enable risk sharing and the decoupling of consumption and output. Such trade should lead to an increase in cross country consumption correlations, as consumption would respond increasingly to common (aggregate) output risk rather than domestic risk. A model in the International Real Business Cycle literature which has this implication is that of Backus, Kehoe and Kydland (1992), who also establish the lack of empirical evidence to support this prediction.

Some of the approaches to measuring consumption risk sharing and the associated empirical results are summarized in Table 1. In the setting of Kose, Prasad and Terrones (2007), aggregate values are subtracted from the domestic series, giving "idiosyncratic" values, as the common risk represented by aggregate values is assumed to be uninsurable. The aggregate values are calculated as the average over the sample of OECD countries examined. The authors' approach allows the dependence of idiosyncratic consumption on idiosyncratic GDP to be a function of financial openness. If risk sharing occurs, increased cross-border financial holdings should allow the two idiosyncratic series to become decoupled, which should lead to a negative β_1.

This is closely related to the approach of Sorensen et al (2007), where the coefficient of idiosyncratic output is allowed to depend on a country's equity home bias and a time trend, among other measures. Equity Home Bias is measured as 1 - (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). Home bias is therefore zero for a country that shows no preference for equity issued domestically, and one for a country whose equity is completely domestically invested. Kose et al examine a set of 72 countries, including 51 developing countries, whereas Sorensen et al concentrate on the OECD countries. Kose et al find that financial flows help improve risk sharing by industrial countries in the globalization period (1987-2004), although the magnitude of the effect would appear small: an increase in the stock of foreign assets and liabilities equal to 100% of GDP is seen to decrease the dependence of idiosyncratic consumption on idiosyncratic output from 0.744 to 0.725. The average value of the stock of foreign assets and liabilities for the industrial countries is 265%. Cross-border financial holdings do not appear to facilitate risk sharing for emerging countries or over other periods than the globalization era.

Other studies examine variants of the above regression equation. Artis and Hoffmann (2007) run a regression in log levels instead of log differences on OECD countries over the period 1960-2000, which

should capture more long term risk sharing. They find an increase in risk sharing by OECD countries in the globalization period, but also find that international financial holdings do not completely explain this increase. Bai and Zhang (2005), following Cochrane (1991), run two cross-section regressions on a sample of 40 countries from 1973-1985 and 1986-1996, and find that risk sharing remained static between these two periods. Following a study by Mace (1991) that examined individual level data, Bai and Zhang also run a panel regression with aggregate consumption as an explanatory variable and again find no improvement in risk sharing. The introduction of aggregate consumption on the right hand side allows a second test of risk sharing based on this coefficient, with the prediction under perfect risk sharing being a unitary coefficient. Crucini (1999) examines a similar equation to that of Bai and Zhang (2005), which has the growth rate of permanent income in place of that of output. Crucini finds significantly more risk sharing among the Canadian and United States than among G7 countries. Huizinga and Zhu (2004) also test an equation similar to that of Bai and Zhang, where aggregate consumption is omitted and the coefficient of GDP is allowed to depend on domestic and international equity and debt market development. They find that development of the domestic debt market is important for OECD countries, whereas development of the international market is important for non-OECD countries. Moser et al (2004) run a panel regression on a sample of EU countries and test for break points in the coefficients. They conclude that the increasing financial links among EU countries between 1960 and 2002 have not lead to more efficient consumption risk sharing.

The above studies primarily examine the dependence of personal consumption on GDP. Obstfeld (1995) examines the dependence of consumption on GDP net of government consumption and investment (hereinafter referred to as "net output"), rather than simply GDP. Yakhin (2004) also argues that net output is the more relevant measure for studying consumption risk. Yakhin examines G7 countries and runs cross-section regressions of consumption correlation on GDP and net GDP. The author finds that netting out government consumption and investment reverses the rank of the consumption and net output correlation coefficients for many pairs of countries, suggesting that examining net output may be important.

Several hypotheses have attempted to explain the weak empirical evidence for the risk sharing benefits of financial integration. The presence of non-tradable and durable goods may help to explain the discrepancy. Stockman and Tesar (1995) present a model with non-traded goods, but find that this cannot reduce predicted consumption correlations to a realistic level. Lewis (1995) finds that allowing for non tradable goods in conjunction with capital market restrictions leads to the finding of some risk sharing among OECD countries,

however, as the author points out, this result may be due to the low power of the test she conducts. Heathcote and Perri (2000) examine the role of market incompleteness and conclude that observed correlations match those expected under financial autarkey better than other asset structures, which begs the question of why international financial holdings continue to grow exponentially if they do not provide the expected risk sharing benefits. Kose, Prasad and Terrones (2007), inter alia, suggest that the absence of financial derivatives based on a broad measure of national output may partly explain the low observed correlations, however it seems possible that such "Shiller securities" (Shiller, 1993) could be adequately proxied by a portfolio of currently available securities.

If purchasing power parity does not hold, consumption may be expected to depend on the real exchange rate. Obstfeld and Rogoff (2000) claim that segmented goods markets can account for low observed consumption correlations, which is one of the reasons why the present paper concentrates on finding a marginal risk sharing effect of financial integration. Ravn (2001) points out that allowing for the possible effect of the real exchange rate is necessary in consumption risk sharing regressions, since if countries face the same nominal interest rate then real exchange rate movements are equivalent to real interest rate differentials, and will lead to intertemporal substitution of consumption. Ravn regresses consumption growth on aggregate consumption growth and the growth in the real exchange rate, and finds that the real exchange rate is rarely a significant predictor, which casts doubt on the role given to it in a number of international macroeconomic models. He concludes that the data do not consistently support a role for financial markets in risk sharing, based on a sample of twelve OECD countries. His results are robust to non-separabilities in the utility function and the decomposing of consumption goods into durables, non-durables and services. Ravn also finds evidence in favour of habit persistence, although introducing lagged consumption growth to allow for this does not alter the results. Fuhrer and Klein (2006) develop a model incorporating habit persistence and show that habit formation can generate positive consumption correlation in the absence of risk sharing, suggesting that the evidence in favour of international portfolio diversification may be even weaker than it appears.

The model developed below incorporates many of the features mentioned in this review, while relaxing some of the assumptions. In contrast to the approach of Kose et al (2007) among others, the exposure to aggregate risk is not assumed to be common across all countries. The risk sharing benefits of international debt and equity holdings are also allowed to differ.

Study	*Sample*	*Findings and Remarks*
$\Delta c_{it} - \Delta c_{at} = \alpha_i + \delta_t + (\beta_0 + \beta_1 fo_{it})(\Delta y_{it} - \Delta y_{at}) + \varepsilon_{it}$		
Kose et al (2007)	21 OECD + 51 Developing Countries	Risk sharing only by OECD countries during the period 1987-2004. Financial Openness is measured in a number of alternative ways, including as equity and debt stocks and flows.
$\Delta c_{it} - \Delta c_{at} = \alpha_i + (\beta_0 + \beta_1(EHB_{it} - \overline{EHB_t}) + \beta_2(t - \bar{t}))(\Delta y_{it} - \Delta y_{at}) + \varepsilon_{it}$		
Sorensen et al (2007)	OECD Countries, 1993-2003	Strong equity home bias effect on consumption smoothing.
$c_{it} - c_{at} = \beta_i(y_{it} - y_{at}) + \varepsilon_{it}$		
Artis and Hoffmann (2007)	23 OECD Countries and US States	Large increase in consumption risk sharing which international capital income flows cannot completely explain. β_i is allowed to depend on a country's cumulative asset and equity trade relative to its total financial wealth.
$\Delta c_t = \alpha + \gamma \Delta y_t + \varepsilon_t$ $\Delta c_{it} = \alpha + \eta \Delta c_{at} + \gamma \Delta y_{it} + \varepsilon_{it}$		
Bai and Zhang (2005)	21 Developed and 19 Developing Countries	Panel and cross-section regressions were run over 1973-85 and 1986-1996. In both cases there was no increase in risk sharing despite the increase in financial integration.
$\Delta c_{it} = \alpha_i + \eta_i \Delta c_{at} + \gamma_i(\Delta y_{it} - \Delta y_{at}) + \varepsilon_{it}$		
Moser et al (2004)	Sample of EU Countries	Coefficients were tested for structural breaks. No improvement in risk sharing was found.
$\Delta c_t = \alpha + \eta \Delta c_{at} + \gamma(\Delta y_t - \Delta i_t - \Delta g_t) + \varepsilon_t$		
Obstfeld (1995)	Germany and Japan	Increasing comovement with aggregate net output in the period 1973-1988.

Table 1: Some Empirical Studies of Consumption Risk Sharing. c stands for per capita private consumption, y for per capita GDP, the i subscript indicates country, a indicates aggregate, and fo stands for financial openness. EHB is Equity Home Bias, i is investment and g is government expenditure, both per capita.

3 Risk Sharing Model

As pointed out by Backus and Smith (1993), perfect consumption correlation is not expected in the presence of non-traded goods, so this paper focusses on attempting to establish an effect of financial holdings on consumption correlations and hence risk sharing, as opposed to testing the null hypothesis of perfect correlation. Mace (1991) derived the equation

$$\Delta c_{it} = \alpha_i + \eta \Delta c_{at} + \gamma \Delta y_{it} + \varepsilon_{it} \tag{1}$$

where $\Delta c_{at} = \sum_{i \neq j} \frac{\Delta c_{it}}{n-1}$ and y_{it} stands for household i's income at time t, as the solution to a social planning problem in the presence of common endowment shocks. In Mace's case the sum was over all households in an economy, here it is over all *other* countries in a sample. Aggregate consumption (and output) thus vary by country, however the country index is omitted for clarity. Under the null hypothesis of perfect risk sharing $\eta = 1$ and $\gamma = 0$. As Mace points out, the errors include preference shocks and measurement errors. The risk sharing implications were shown to hold under general conditions for the number, separability and durability of goods. Bai & Zhang (2004) tested this equation on international data with output substituted for income. Moser et al (2003) tested a similar equation, in which aggregate output was subtracted from domestic output. Here it is proposed to replace aggregate consumption by aggregate output:

$$\Delta c_{it} = \alpha_i + \gamma \Delta y_{it} + \beta \Delta y_{at} + \varepsilon_{it} \tag{2}$$

This equation can also be seen as a generalisation of the equation examined by Kose et al (2007), where the coefficient of aggregate output is not constrained to be $-\gamma$. This is done because some countries may display greater sensitivity to aggregate risk than others. Under perfect risk sharing and abstracting from problems such as market frictions and non-traded goods, one would expect $\gamma = 0$ and $\beta = 1$. The aggregate output series is intended to capture movements in output that are common across the OECD and potentially other countries, however the appropriate aggregate series is not known and must be estimated. Section 3.2 presents some arguments in favour of allowing the coefficients of aggregate and domestic output to differ.

It seems plausible that net output (output net of government consumption and investment) is more appropriate than output in such regressions, since consumers can only share the output remaining after government consumption and investment, as Obstfeld and Rogoff (2000) argue. Yakhin (2004) provides an

alternative intuition: net exports can be thought of as a shock absorber for smoothing private consumption. Regressing consumption on consumption plus the shock absorber will give a measure of the degree of risk sharing. The empirical analysis in this paper is therefore run with net output in place of output. It should be noted that for the purpose of regressions run in this paper, y refers to GDP net of investment and government consumption.

3.1 Modelling Domestic Comovement

Comovement of domestic consumption with domestic GDP may depend on financial integration. In the context of Equation (2), one possible formulation for this dependence is:

$$\Delta c_{it} = \alpha_i + (\gamma_0 + \gamma_1 eo_{it} + \gamma_2 do_{it})\Delta y_{it} + \beta \Delta y_{at} + \varepsilon_{it} \tag{3}$$

where eo_{it} and do_{it} designate equity (portfolio equity and FDI) and debt openness (assets plus liabilities as a proportion of GDP), respectively. Equity holdings imply state contingent returns. If a portion of the returns to output is not available to domestic consumers because it is claimed by foreign equity liability holders, this should decrease the dependence of domestic consumption on domestic output. The same is true of foreign equity assets held by domestic investors to the extent that an increase in such assets indicates less exposure to domestic equity.

Whereas equity openness may provide insurance against domestic output risk, debt assets and liabilities may allow buffer lending and saving, respectively. This would also decrease the dependence of consumption on domestic output. These considerations would lead to negative γ_1, γ_2. The returns to debt assets are also state contingent since default may occur and because the returns to longer term debt assets may vary with a country's monetary policy. Since the mechanisms affecting the predictions for γ_1 and γ_2 are different, it appears necessary to allow separate terms for equity and debt openness. While high debt openness indicates access to international debt markets, low openness does not necessarily imply low access, but perhaps only low utilisation, which would not rule out use of debt to buffer risk in bad times. Equity openness could also be an effective indicator of access to debt markets, which highlights the difficulty of separating the effects of debt and equity.

It may be the case that equity and debt provide alternative and not complementary methods of decoupling consumption from output. If a large portion of the returns to domestic output are claimed by foreign

investors, the marginal risk sharing and buffering benefits of debt assets and liabilities may be less than for a country with low equity liabilities. Similarly, a country which can effectively buffer domestic risk may benefit less from equity portfolio diversification. For these reasons the interaction term $eo_{it}do_{it}y_{it}$ is also examined in the empirical analysis. It would be expected that this term would enter with a positive coefficient, decreasing the decoupling of consumption and net output caused by the risk sharing terms.

The estimation of the risk sharing effects of financial openness may be subject to a number of biases. It is possible that debt and equity holdings may appear to increase the dependence of domestic consumption on GDP. Suppose during some period GDP growth in excess of the long term rate (the constant should remove the long term rate from consumption growth) follows an autoregressive process. If not all consumers are forward looking, then comovement between consumption and GDP will increase during this period. More precisely, if GDP does not follow a random walk, so that $E[\Delta y_{it+1}|I_{it}]$ need not equal long term growth, where I_{it} is some information set, then in the presence of "rule of thumb" consumers (consumers who are not forward looking, in other words whose consumption varies with income), it may be expected that comovement with domestic GDP increases during periods when growth exceeds long term trend growth, and vice versa. Equity and debt holdings may also respond to such short or medium term trends, in other words $eo_{it} = e^{+}(E[\Delta\tilde{y}_{it}])$ and $do_{it} = d^{+}(E[\Delta\tilde{y}_{it}])$, where the tilde indicates the excess over the long term growth rate and E is the expectation operator. Kose et al (2007) note that financial flows may be procyclical, and suggest that this procyclicality may prevent consumption smoothing, presumably by the simple mechanism that there are less financial assets available for insurance when insurance is most needed. The concern here is rather with the potential bias caused by the procyclicality of both financial holdings and domestic comovement. In periods of positive (expected) excess growth, which may also be periods of high comovement, debt and equity liabilities might increase as companies seek funding for expansion. Thus a positive association could arise between comovement and financial asset holdings, leading to positive γ_1, γ_2. This would constitute a bias against finding a risk sharing effect of financial openness.

3.2 Modelling Aggregate Comovement

The aggregate output term is intended to capture global risk, in other words risk to which every country is exposed. As such aggregate movements in output may also be reflected in domestic consumption. If aggregate output reflects global risk, this would suggest adopting a simpler formulation, such as that of

Kose, Prasad & Terrones (2007):

$$\Delta c_{it} - \Delta c_{at} = \alpha_i + \delta_t + \beta(\Delta y_{it} - \Delta y_{at}) + \gamma fo_{it}(\Delta y_{it} - \Delta y_{at}) + \varepsilon_{it} \tag{4}$$

Here the dependent variable is idiosyncratic consumption, that is, consumption controlling for (subtracting) its aggregate value. Supposing a negative γ, Equation (4) assumes that, under risk sharing, financial openness increases dependence on aggregate GDP to the same extent to which it decreases dependence on domestic GDP. An alternative approach is to allow a varying effect. This could be introduced to Equation (2) by allowing the aggregate coefficient to depend on financial openness:

$$\Delta c_{it} = \alpha_i + (\gamma_0 + \gamma_1 eo_{it} + \gamma_2 do_{it})\Delta y_{it} + (\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it})\Delta y_{at} + \varepsilon_{it} \tag{5}$$

The reasons for allowing this freedom are:

1. The possible bias in the estimation of the coefficients of the interaction variables with domestic net GDP, γ_1 and γ_2 (discussed in the previous section), does not apply to the coefficients of the interaction variables with aggregate net GDP, β_1 and β_2. If the bias exists, adding the constraints $\gamma_1 = -\beta_1$ and $\gamma_2 = -\beta_2$ may make it more difficult to detect a risk sharing effect than if β_1 and β_2 are unconstrained.

2. The estimation of β_1 and β_2 may be subject to a bias that does not apply to γ_1 and γ_2, such as the possibility that periods of high domestic/aggregate comovement are associated with high financial asset holdings because high domestic/aggregate comovement is associated with stability, which could lead to an increase in foreign investment. This would bias in favour of finding risk sharing in the aggregate resource interaction variables. Constraining the coefficients may make it more difficult to detect such a bias.

3. Domestic and aggregate (global) shocks may be different in nature, aggregate shocks may for instance be more permanent (Sorensen et al, 2007). The ability of financial holdings to insure or buffer against risk may therefore depend on the source of that risk, which would make the constraints $\gamma_1 = -\beta_1$ and $\gamma_2 = -\beta_2$ inappropriate.

For these reasons the equation estimated by Kose et al (2007) and others:

$$\Delta c_{it} - \Delta c_{at} = \alpha_i + \delta_t + (\beta_0 + \beta_1 fo_{it})(\Delta y_{it} - \Delta y_{at}) + \varepsilon_{it} \tag{6}$$

is generalised to

$$\Delta c_{it} - \Delta c_{at} = \alpha_i + (\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it})(\Delta y_{it} - \Delta y_{at}) + \beta_3 eo_{it} + \beta_4 do_{it} + \Gamma Z_{it} + \varepsilon_{it} \tag{7}$$

and further to

$$\begin{aligned} \Delta c_{it} = \alpha_i + (\gamma_0 + \gamma_1 eo_{it} + \gamma_2 do_{it})\Delta y_{it} + (\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it})\Delta y_{at} \\ + \beta_3 eo_{it} + \beta_4 do_{it} + \Gamma Z_{it} + \varepsilon_{it} \end{aligned} \tag{8}$$

where ΓZ_{it} signifies other explanatory and control variables, listed below. Both equations are estimated and the results are compared. The equation is also estimated allowing for an interaction effect between risk sharing due to debt and equity assets and liabilities:

$$\begin{aligned} \Delta c_{it} - \Delta c_{at} = \alpha_i + (\beta_0 + \beta_1 eo_{it} + \beta_1 do_{it} + \beta_3 eo_{it} do_{it})(\Delta y_{it} - \Delta y_{at}) \\ + \beta_3 eo_{it} + \beta_4 do_{it} + \beta_5 eo_{it} do_{it} + \Gamma Z_{it} + \varepsilon_{it} \end{aligned} \tag{9}$$

It should be noted that an "adding up constraint" may apply to the coefficient of aggregate net output. As mentioned above, y_{at} and c_{at} both vary by country. The constraint can be expressed as $\sum_i \frac{\Delta c_{at}^i}{n} = \sum_i \frac{\Delta c_{it}}{n}$. The coefficient of aggregate consumption would be trivially one in the the absence of other regressors. This constraint may also apply to some extent to aggregate net output, since aggregate net output is correlated with aggregate consumption. The financial openness variables still explain deviations from average comovement, but in the presence of this constraint average comovement is constrained to be unity for OECD countries. The implications of this constraint are discussed in Appendix B..

3.3 Other Explanatory Variables

The growth rate of the real exchange rate (Δr_{it}, the Purchasing Power Parity exchange rate) is incorporated to allow for the possibility (suggested by Giannone & Reichlin (2005) and Ravn (2001), inter alia) that consumption depends on the real exchange rate.

In the presence of risk sharing, consumption should be high in countries where prices are low. One model

with this implication is that of Obstfeld and Rogoff (2000), where the first order condition

$$\frac{C_{it+1}^{-\rho}/P_{it+1}}{C_{it}^{-\rho}/P_{it}} = \frac{C_{at+1}^{-\rho}/P_{at+1}}{C_{at}^{-\rho}/P_{at}} \tag{10}$$

is derived, with ρ standing for the coefficient of relative risk aversion and P representing the price in a common currency. This condition becomes $\Delta c_{it} = \Delta c_{at} + \frac{1}{\rho}\Delta r_{it}$ when expressed in growth rates. Because of this relation the rate of growth of the real exchange rate is added linearly to the baseline regression equations.

In order to test whether consumption in more financially integrated economies shows stronger positive dependence on the growth in the real exchange rate, which would occur if international payments allow countries to take advantage of cheap prices, the coefficient of the real exchange rate is also allowed to depend on financial openness. The risk sharing coefficients are also allowed to depend on the real exchange rate, as suggested by Sorensen in comments appended to Giannone & Reichlin (2005).

3.4 Control Variables

The following variables are included as controls:

1. The levels of the equity and debt openness to net GDP ratios are included since the interaction model would be misspecified in their absence, as explained in Brambor et al (2006) among others. These variables are included in the three baseline specifications, whereas the remaining two control variables are not.

2. The first lag of the dependent variable is included to control for the possible effects of habit formation, as Fuhrer and Klein (2006) show that such a habit process could by itself lead to consumption correlation.

3. Trade openness is included individually and in interaction with net output as it could be a predictor of a country's ability to buffer and smooth against output fluctuations, to the extent that it proxies for a country's creditworthiness. A country that is highly integrated into the world goods market may find it easier to adjust its balance of payments to allow it to borrow in order to stabilise consumption in the face of a domestic output shock. Thus a finding that trade openness leads to decreased dependence on domestic GDP could be partly due to the use of international financial markets to buffer or hedge domestic risk.

4 Data Sources and Empirical Methodology

This paper follows Kose et al (2006) in dividing the period 1970-2004 into 1970-1986 and 1987-2004 (period of high financial integration). The models are estimated via OLS regression. Aggregate values are calculated over the rest-of-OECD21.

4.1 Data Sources

Current price output, consumption (household consumption), investment (gross fixed capital formation) and government consumption are taken from UNSTATS (2007). Aggregate values are calculated by summing over all OECD countries for non-OECD countries and all other OECD countries for OECD countries, then dividing by total (remaining) OECD population. Consumption and net output are made per capita using population data from Penn World Tables 6.2, then deflated to 2000 prices using national consumer price indices, taken from the IMF's International Financial Statistics, then converted to dollars using the 2000 purchasing power parity exchange rate, taken from the Penn World Tables 6.2. This approach follows Sorensen et al (2007).

Data on financial openness are taken from Lane and Milesi-Ferretti's (2007) External Wealth of Nations II (EWN) dataset. Financial openness ratios are calculated based on GDP from the EWN, which is taken from the World Bank's World Development Indicators, rather than UNSTATS. The financial openness data refer to end of year values and so have been lagged by one year. The t subscript in these variables refers to the end of year $t-1$ value, which is appropriate for measuring risk sharing in year t. The financial openness variables have been centred by subtracting their mean values over the relevant (unbalanced) samples.

The regression is also run on international price data, for which consumption, investment and output are taken from the Penn World Tables 6.2. Trade openness is calculated as the sum of imports and exports of goods and services divided by GDP, taken from UNSTATS.

4.2 Price Deflators

Sorensen and Yosha (2002) argue for the use of the CPI to deflate not only consumption but also output (or net output), a practice which is followed here. Deflating output by the output deflator would eliminate changes in the purchasing power of output in terms of consumption goods. This is undesirable since the possible response of consumption to such changes is of interest here. The disadvantage of this approach

is that it does not allow for adjustment to an output shock via a change in the internal terms of trade (Hoffmann, 2007), in other words diverging consumer and producer prices. Not allowing for this channel could lead to an artificially high observed dependence of consumption on output.

Hoffmann (2007) points out that the use of an idiosyncratic price series as the deflator may be inappropriate as it fails to account for international price differentials. He observes that regional risk sharing studies generally deflate consumption and output by a common (national) consumption price deflator, whereas international studies generally deflate the series using an idiosyncratic (also national) price deflator. The first type of regression examines comovement in the values of the series, the second in the quantities. There are arguments in favour of each approach. Deflating by idiosyncratic prices fails to account for the possibility that comovement in idiosyncratic price deflated data could be due to the existence of international price differentials, and not the absence of risk sharing (and vice versa). On the other hand, deflating by a common price series may retain national price differentials that affect the degree of comovement but are not caused by and do not facilitate risk sharing. Hoffmann runs a regression using aggregate prices as the deflator, and finds that the results are closer to those seen among regional regressions. To control for the above considerations, the analysis is run on data from the Penn World Tables 6.2, which uses aggregate price series, as well as national CPI deflated data. The real exchange rate is also added as a control.

5 Empirical Results

There is strong evidence that financial openness leads to risk sharing as measured by the comovement of consumption and net GDP (GDP net of government consumption and investment) in the period 1987-2004 for both OECD and Non-OECD countries. The 21 country subsample of OECD countries are referred to as "the OECD countries". "Non-OECD" refers to the sample excluding the Persian Gulf countries and Overseas Financial Centres. The countries comprising the samples analysed here are listed in Appendix A.

The coefficient of equity holdings in Column 2 of Table 2 implies that an increase in equity holdings equal to 100% of GDP with no accompanying change in debt openness would lead to a 96% decrease in the dependence of idiosyncratic consumption on idiosyncratic GDP. This is a larger effect than is usually found in the literature. Kose et al (2007) find that an increase in equity openness equal to 100% of GDP would decrease the dependence of idiosyncratic consumption on idiosyncratic gross output by 12%, although Sorensen et al (2006) find a much larger effect of equity home bias on consumption risk sharing. Their

Risk Sharing Regression (1), PWT Data

Dependent Variable:	OECD		Non OECD	
$\Delta c_{it} - \Delta c_{at}$	1973-1986	1987-2004	1971-1986	1987-2003
$\Delta ny_{it} - \Delta ny_{at}$	0.258**	0.309***	0.134***	0.220***
	(0.089)	*(0.062)*	*(0.048)*	*(0.080)*
$eo_{it}(\Delta ny_{it} - \Delta ny_{at})$	0.439	-0.298***	0.295	-0.328**
	(0.508)	*(0.102)*	*(0.198)*	*(0.137)*
$do_{it}(\Delta ny_{it} - \Delta ny_{at})$	0.069	0.183***	-0.168	0.026
	(0.126)	*(0.050)*	*(0.185)*	*(0.149)*
eo_{it}	0.016	0.008***	0.008	0.004
	(0.028)	*(0.003)*	*(0.056)*	*(0.021)*
do_{it}	-0.007	-0.006**	-0.030**	0.025***
	(0.005)	*(0.002)*	*(0.014)*	*(0.008)*
Δr_{it}	-0.134**	0.000	-0.104***	-0.047**
	(0.054)	*(0.001)*	*(0.021)*	*(0.022)*
N	285	378	525	833
R^2	0.11	0.16	0.11	0.11

Table 2: The estimated coefficients are based on OLS regressions with country fixed effects. Δny_{it} stands for the growth rate of output net of government consumption expenditure and fixed investment. The a subscript indicates aggregate, calculated over the (rest of) OECD 21 country sample. do_{it} and eo_{it} stand for equity and debt assets plus liabilities as percentages of GDP. Δr_{it} stands for the growth rate of the real exchange rate. ***, ** and * indicate 1%, 5% and 10% significance, respectively. Robust standard errors are in parentheses. All panels are balanced. The four financial openness related variables are jointly significant with a p-value of 0.053 for the OECD 1973-87 sample. The same test for the non-OECD countries over 1971-86 gives a p-value of 0.12. This suggests that over the earlier samples there may be some relationship between consumption risk sharing and financial openness which is obscured by the high collinearity among the variables, however a graphical analysis of the GDP coefficient as a function of financial openness revealed no support for this possibility.

results suggest that a 100% decrease in equity home bias would lead to a greater that proportionate increase in consumption risk sharing. The authors note, however, that the equity home bias coefficient they find may not be applicable to such a large change. The debt coefficient implies that the same increase in debt holdings would lead to a 59% increase in the dependence of idiosyncratic consumption on idiosyncratic GDP. It should be borne in mind that equity and debt openness are correlated, so that a large increase in one while the other remains constant may be unlikely. The four financial openness related variables are jointly significant at the 1% level for both samples over the later period.

The below graphs show the coefficient of idiosyncratic net GDP from Regression 1:

$$\Delta c_{it} - \Delta c_{at} = \alpha_i + (\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it})(\Delta y_{it} - \Delta y_{at}) + \beta_3 eo_{it} + \beta_4 do_{it} + \Gamma Z_{it} + \varepsilon_{it} \tag{11}$$

The values shown are $\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it}$ for levels of equity openness between 200% of GDP below and above the average level, and for debt openness equal to the average ("Debt Openness = 0") and to 100% of GDP above the average ("Debt Openness = 1") over the relevant sample. Under perfect risk sharing, the coefficient should be zero. Under no risk sharing (or buffering), it should be one. The graphs also show confidence intervals of the coefficients. These are equal to plus or minus twice the standard error of the coefficient, calculated as the square root of:

$$\begin{aligned} var(\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it}) = var(\beta_0) + eo_{it}^2 var(\beta_1) + do_{it}^2 var(\beta_2) + \\ 2eo_{it} cov(\beta_0 \beta_1) + 2do_{it} cov(\beta_0 \beta_2) + 2eo_{it} do_{it} cov(\beta_1 \beta_2) \end{aligned} \tag{12}$$

(the coefficient and standard error formulae are adjusted as appropriate for the other regressions (2) and (3), also reported below). This method of analysis follows the suggestions of Brambor et al (2006).

Where the growth rate of the real exchange rate is significant the sign of the estimated coefficient is negative, opposite to that predicted by theory under risk sharing in the presence of non-traded goods. The purchasing power parity exchange rate is taken as the measure of the real exchange rate (RER). An increase in the domestic price level relative to the US level will, ceteris paribus, decrease R_{it}. The definition of RER used is $R_{it} = e_{it} \frac{p_{USt}}{p_{it}}$, where e_{it} is the number of foreign currency units per dollar, p_{USt} is the dollar price level and p_{it} is the foreign price level. Under risk sharing, higher domestic prices should lead to lower consumption, since the marginal benefit of a dollar of consumption is higher in a country with cheaper prices. This result may be driven by the nominal exchange rate. An increase in the nominal exchange rate

could lead to higher import prices, which could affect consumption. The inclusion of financial openness interaction variables with the growth rate of the RER ($eo_{it}R_{it}$ and $do_{it}R_{it}$) does not affect the sign of the RER coefficient.

20 OECD countries, 1973-1986

As seen in Figure 1, for most values of equity and debt openness, the 95% confidence intervals of the estimated coefficient encompass the x-axis. It may be that the biases discussed in Section 3.2 or the lower degree of financial integration over this period make risk sharing difficult to detect.

21 OECD countries, 1987-2004

Figure 2 shows a strong risk sharing effect of equity openness, as predicted by theory. Debt openness shows a weaker, opposing effect, which could be due to the biases discussed above or to debt facilitating increased consumer spending during boom periods. The debt effect depends on Ireland's inclusion in the sample. The implications for individual countries in the year 2003 are presented in Table 6, Appendix D.

35 Non-OECD Countries, 1971-1986

Figure 3 shows that, as in the OECD sample, over the earlier period the confidence intervals of the coefficient encompass the x-axis regardless of the equity and debt openness values considered.

49 Non-OECD Countries, 1987-2003

Figure 4 shows a strong risk sharing effect of equity openness, similar to that found for the OECD countries over the same period. The debt effect is insignificant, possibly due to the various roles debt plays in this sample of countries, as financing expansion during good times, as facilitating buffer saving and lending, and as foreign aid. The implications of these findings for individual countries in 2003 are reported in Table 7, Appendix D.

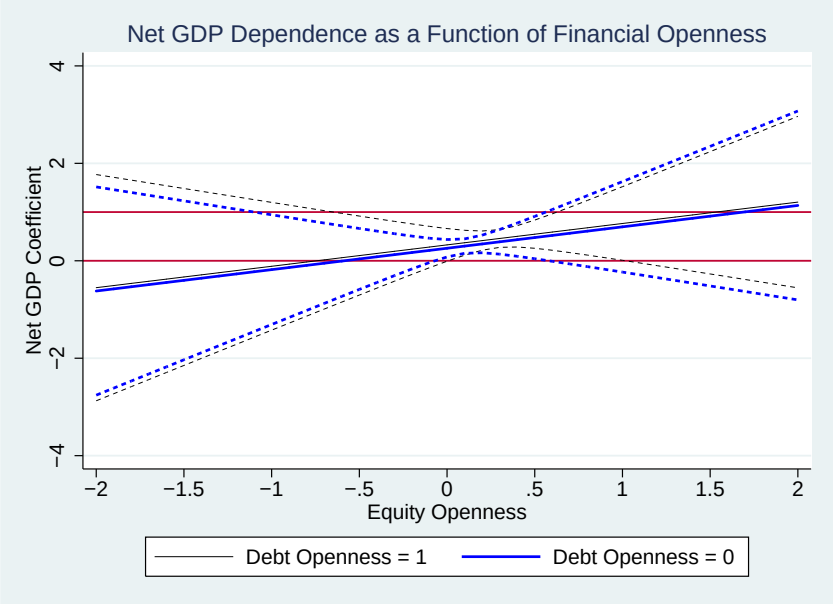

Figure 1: OECD 1973-86 Net GDP Coefficient

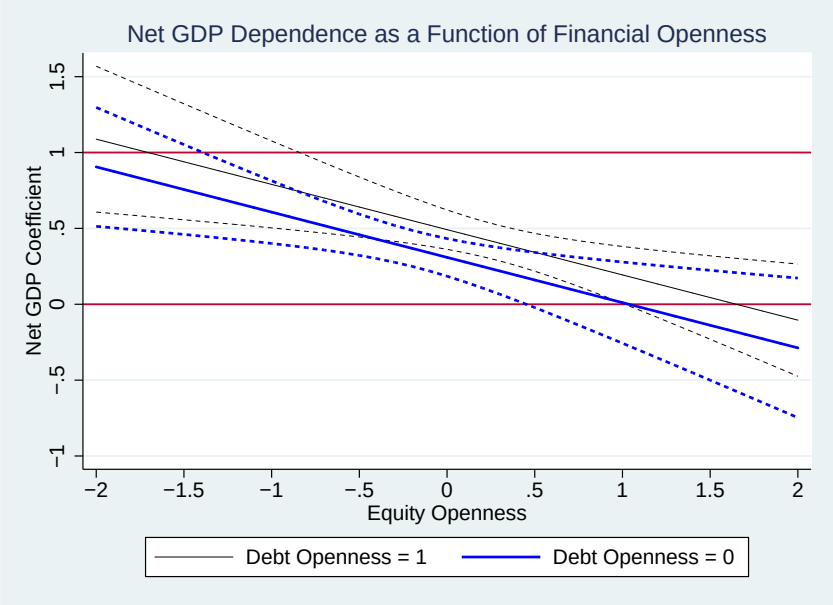

Figure 2: OECD 1987-2004 Net GDP Coefficient

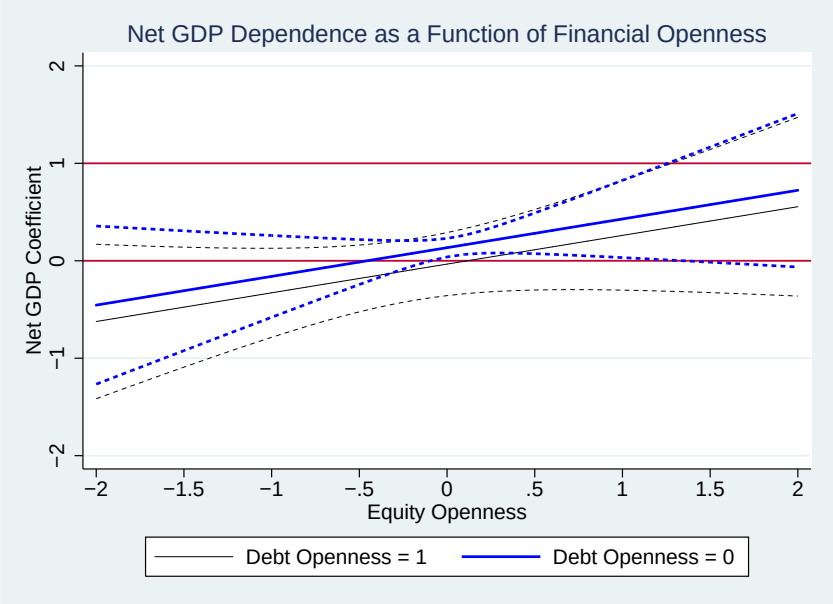

Figure 3: Non-OECD 1971-86 Net GDP Coefficient

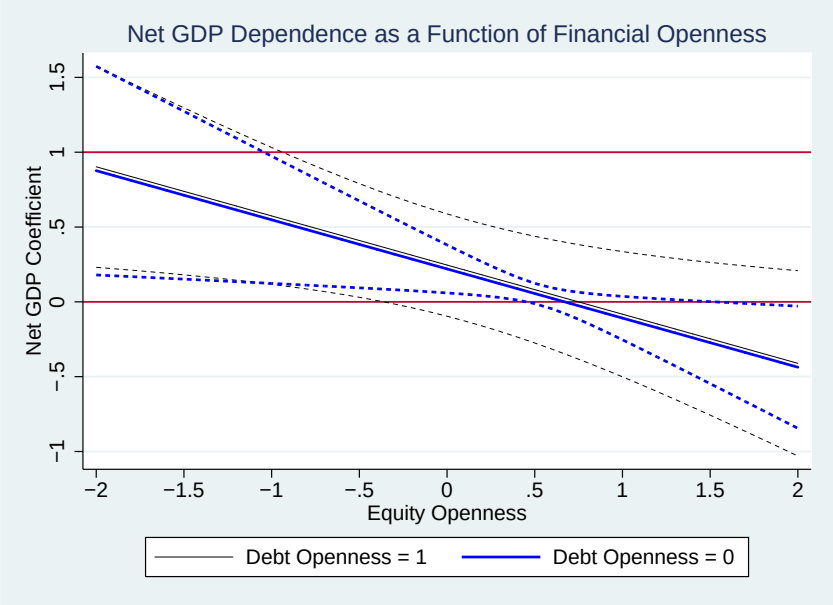

Figure 4: Non-OECD 1987-2003 Net GDP Coefficient

Persian Gulf States and Overseas Financial Centres

Over the period 1971-86 the debt openness interaction variable appears significant (Table 3) and consistent with buffering of output risk, but enters with a very small magnitude (Figure 5). Cross-border financial holdings do not appear to have facilitated risk sharing over the period 1987-2003. The estimation of cross-border financial holdings in these countries may be subject to greater measurement error than is associated with the other two samples studied. The absence of any risk sharing effect is clearly seen in the two graphs. The confidence intervals in Figure 5 quickly blow up, while in Figure 6 the resource coefficient as a function of equity openness is essentially a straight line.

5.1 CPI-Deflated Data

The results using CPI-deflated data are similar to those using the PWT data, however the CPI-deflated data show evidence of debt being used to buffer risk by non-OECD countries over 1971-86 and of debt increasing consumption dependence on net GDP among the same countries over 1987-2004, similar to the effect seen among OECD countries over this period. Figure 7 shows the much stronger debt affect seen in CPI-deflated data for the non-OECD 1987-2004 sample, in comparison to the PWT results (Figure 4).

The results for Overseas Financial Centres and Gulf States (not shown) are very similar to those using the PWT data. The similarity in the estimated coefficients across data sources suggests that international price differentials do not significantly affect risk sharing, although the inclusion of the growth rate in the real exchange rate as a control variable plays some role in explaining this similarity, as it tends to be significant mainly on the international price data.

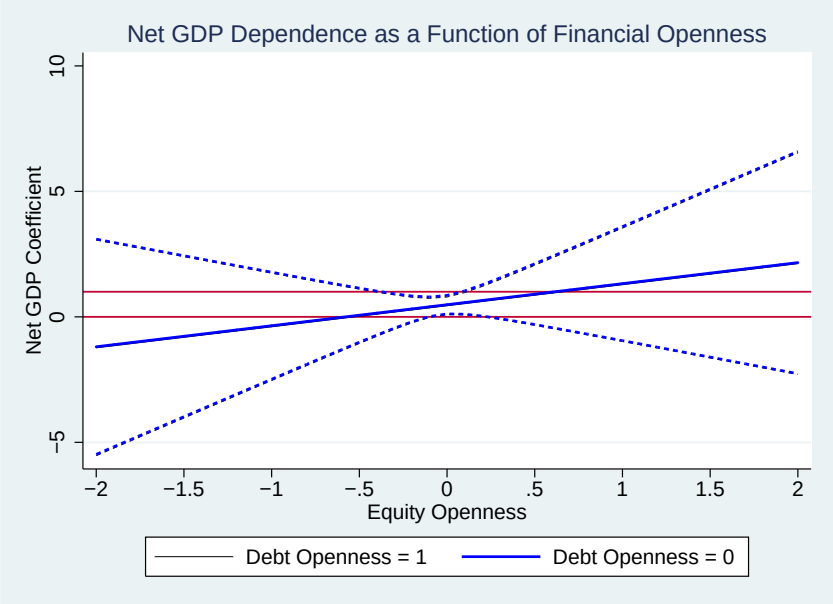

Figure 5: Net GDP Coefficient for Persian Gulf Countries and OFCs 1971-86

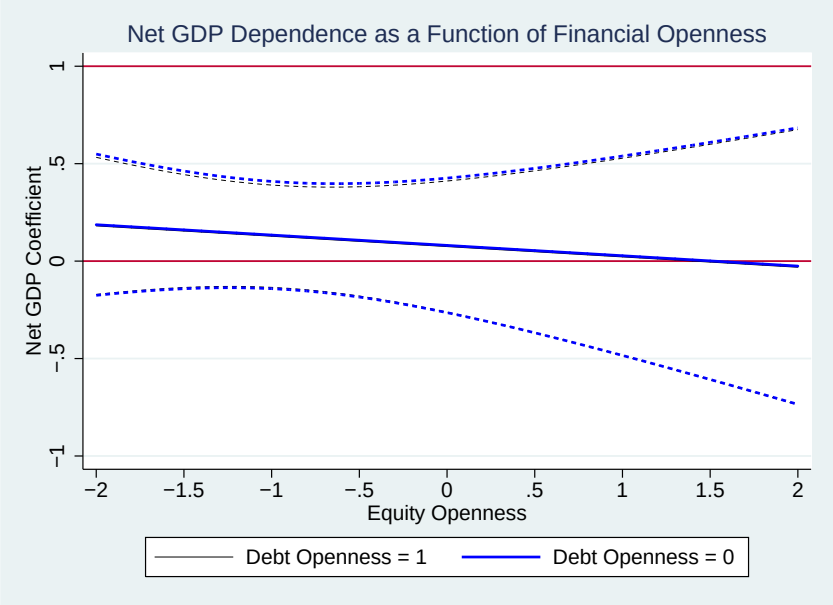

Figure 6: Net GDP Coefficient for Persian Gulf Countries and OFCs 1987-2004

Risk Sharing Regression (1), OFCs and Gulf States

Dependent Variable: $\Delta c_{it} - \Delta c_{at}$	1970-1986	1987-2003
$\Delta ny_{it} - \Delta ny_{at}$	0.486**	0.081
	(0.184)	*(0.173)*
$eo_{it}(\Delta ny_{it} - \Delta ny_{at})$	0.838	-0.053
	(1.086)	*(0.111)*
$do_{it}(\Delta ny_{it} - \Delta ny_{at})$	-0.043***	-0.006
	(0.011)	*(0.007)*
eo_{it}	0.009	-0.010**
	(0.056)	*(0.004)*
do_{it}	-0.006***	-0.001
	(0.000)	*(0.001)*
Δr_{it}	-0.037**	0.022
	(0.014)	*(0.058)*
N	128	255
R^2	0.43	0.05

Table 3: Δny_{it} stands for the growth rate of output net of government consumption expenditure and fixed investment. The a subscript indicates aggregate, calculated over the (rest of) OECD 21 country sample. do_{it} and eo_{it} stand for equity and debt assets plus liabilities as percentages of GDP. r_{it} stands for the growth rate of the real exchange rate. ***, ** and * indicate 1%, 5% and 10% significance, respectively.

Risk Sharing Regression (1), CPI-Deflated Data

Dependent Variable:	OECD		Non OECD	
$\Delta c_{it} - \Delta c_{at}$	1973-1986	1987-2004	1971-1986	1987-2003
$\Delta ny_{it} - \Delta ny_{at}$	0.232***	0.290***	0.336**	0.413***
	(0.072)	*(0.059)*	*(0.122)*	*(0.120)*
$eo_{it}(\Delta ny_{it} - \Delta ny_{at})$	0.615	-0.316**	-0.187	-0.829**
	(0.401)	*(0.132)*	*(0.421)*	*(0.386)*
$do_{it}(\Delta ny_{it} - \Delta ny_{at})$	-0.305	0.210**	-0.455*	0.371***
	(0.203)	*(0.079)*	*(0.225)*	*(0.079)*
eo_{it}	-0.027	0.011***	-0.046	0.008
	(0.023)	*(0.003)*	*(0.069)*	*(0.024)*
do_{it}	-0.007	-0.008***	-0.058**	0.014
	(0.006)	*(0.002)*	*(0.022)*	*(0.011)*
Δr_{it}	-0.137**	0.001	-0.005	-0.003
	(0.060)	*(0.001)*	*(0.041)*	*(0.018)*
N	285	378	525	833
R^2	0.15	0.24	0.32	0.30

Table 4: The results for CPI-deflated data are similar to those using PWT data (Table 2). ***, ** and * indicate 1%, 5% and 10% significance, respectively. All panels are balanced.

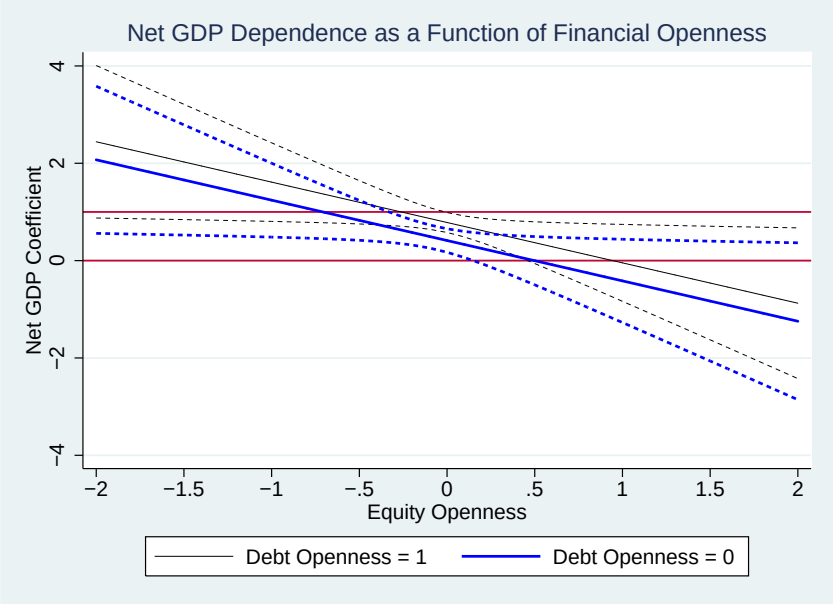

Figure 7: Net GDP Coefficient for Non-OECD Countries 1987-2004, CPI-Deflated Data

5.2 Regression (2): Equity/Debt Interaction

Allowing the risk sharing effect of equity holdings to depend on the level of debt holdings (this variable could of course also be interpreted as the converse):

$$\begin{aligned}\Delta c_{it} - \Delta c_{at} = \alpha_i + (\beta_0 + \beta_1 eo_{it} + \beta_1 do_{it} + \beta_3 eo_{it} do_{it})(\Delta y_{it} - \Delta y_{at}) \\ + \beta_3 eo_{it} + \beta_4 do_{it} + \beta_5 eo_{it} do_{it} + \Gamma Z_{it} + \varepsilon_{it}\end{aligned} \tag{13}$$

does not appear to offer further insights into consumption risk sharing. The debt/equity interaction term is marginally significant at the 10% level in the Non-OECD 1987-2003 sample using CPI data but not PWT data, although the two regression results give a similar picture for the dependence of the coefficient on financial openness (the relevant figures are available on request). These figures are consistent with the view that introducing this term merely introduces more noise into the estimation. The average-debt line appears to be the same as that of the Regression (1) estimation, whereas the line for above average-debt openness countries shows no clear relationship between the risk sharing coefficient and equity openness.

5.3 Regression (3): Non-Idiosyncratic Variables

This regression relaxes the assumption of an equal and opposite effect of financial openness on the dependence of consumption on domestic and aggregate GDP:

$$\begin{aligned}\Delta c_{it} = \alpha_i + (\gamma_0 + \gamma_1 eo_{it} + \gamma_2 do_{it})\Delta y_{it} + (\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it})\Delta y_{at} \\ +\beta_3 eo_{it} + \beta_4 do_{it} + \Gamma Z_{it} + \varepsilon_{it}\end{aligned} \tag{14}$$

Financial openness does not affect the level of comovement of domestic consumption with aggregate net GDP for any of the four samples. The high correlation of domestic and aggregate net GDP among OECD countries (the Pearson correlation coefficient is 0.35 over 1987-2004 and 0.43 over 1973-86, both significant at the 1% level) may be primarily due to factors not directly dependent on financial integration, such as the common effects of an oil price shock on demand in these countries. The corresponding correlation coefficients for the non-OECD countries are 0.11 (p-value 0.01) over 1971-1987 and 0.04 (not significant) over 1987-2004. The assumption that financial openness increases the dependence on aggregate GDP to the same extent to which it decreases dependence on domestic GDP appears unwarranted, however it does not interfere significantly with the results. The p-value of the equity interaction term for the non-OECD countries over 1987-2004 decreases from 0.021 (using Regression (1)) to 0.016 (using Regression (3)). Thus, dropping the unnecessary assumption that the aggregate resource movements are always reflected in the domestic resource movements may make risk sharing slightly easier to detect, however the difference is quite trivial. The similarity of the results with and without subtracting aggregate values from domestic values reflects the fact that the aggregate series are more stable than the domestic series.

Figure 8 shows that among non-OECD countries financial integration is concentrated on the liability side, which would not give domestic investors claims on aggregate net output (the graph shows average (uncentred) debt openness, but the same pattern is seen in equity openness). This may help to explain the fact that aggregate net output is not a significant predictor of domestic consumption for non-OECD countries.

5.4 Robustness Checks

All regressions are based on the OLS estimator with country fixed effects and robust standard errors. Although the financial openness variables appear to have unit roots, the errors from the regressions are sta-

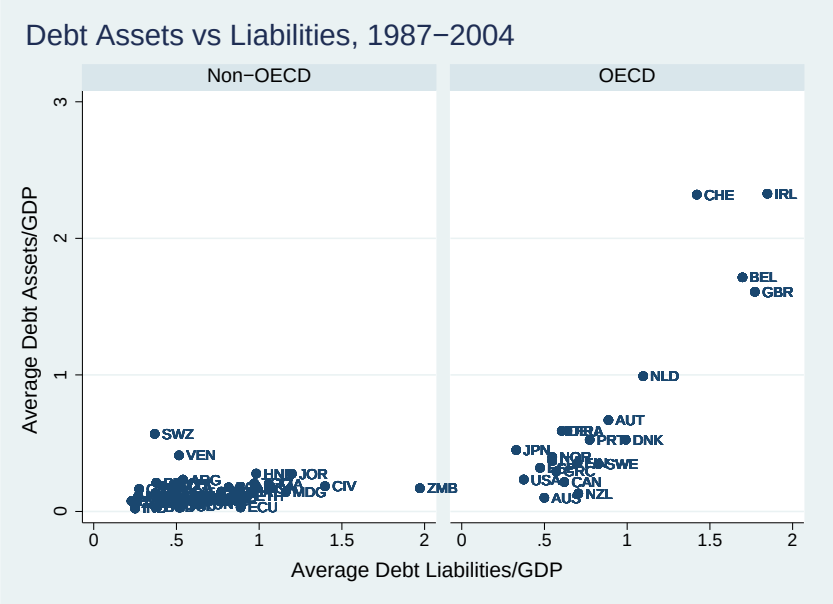

Figure 8: Debt Assets vs Liabilities by Sample

tionary.[1] All standard errors are robust to clustering of errors within countries (following Kose et al, 2006).

The risk sharing findings are not affected by the introduction of the lagged dependent variable, lagged trade openness (both separately and in interaction with idiosyncratic GDP), real exchange rate interaction variables or (in the case idiosyncratic variable regressions) year dummies. The lagged dependent variable is significant only in the OECD sample, where it alters the coefficients of significant variables very little. Including it leads to a higher dependence of consumption on net output in the steady state, but very nearly the same relative effect of equity and debt openness (since their coefficients and those of net output are inflated by the same factor), which are the variables of primary interest in this paper.

The results are generally unaffected by the exclusion of individual countries. The exclusion of Ireland renders the debt interaction variable marginally insignificant, but does not affect the significance or magnitude of the equity interaction variable. The exclusion of Chad from the non-OECD 1987-2003 sample leads to an increase in the p-value of the F-test for the joint significance of the interaction variables using Regres-

[1]Referring to the results for the OECD, 1987-2004, and PWT data, the panel unit root test of Levin, Lin and Chu (2002) rejects the null of non stationarity under any plausible specification, for example with two lags and trend the t-star statistic is -7.19. The test of Im et al (2003) also strongly rejects the null hypothesis that all series are non-stationary, with a W[t-bar] statistic of -2.72 allowing two lags in the residual from the error process. The residuals from other regressions are similarly stationary, details are not reported.

sion (2) from .001 to .031. The dependence of the aggregate resource coefficient on financial openness when Chad is excluded (figure not shown) remains similar to that based on the results including Chad (Figure 4). Excluding Zambia gives a larger debt effect with a negative coefficient consistent with the possibility that debt provides some buffering of output risk. The influence of Chad on the results appears to stem from FDI liabilities associated with the recently completed Doba basin oil project. Chad may represent an example of risk sharing through equity holdings, since a significant portion of the price risk of future oil earnings is taken on by foreign investors.

6 Conclusions

Integration into the international equity and debt markets appears to have facilitated risk sharing for both OECD and non-OECD countries over the period 1987-2003/4. The finding that non-OECD countries use financial markets for risk sharing runs counter to previous empirical findings, and may have significant policy implications for countries considering their level of engagement in financial trade. In the case of the 1987-2003/4 period, the findings are robust to both the data source and the method used to deflate current price series. There appears to be strong support for the use of a general framework to measure consumption risk sharing which allows for separate effects of equity and debt openness.

Aanalysing idiosyncratic consumption and net output series (domestic growth rates net of the global growth rate) is not necessary if the aggregate (OECD) movements are accounted for independently, and may make it marginally more difficult to detect risk sharing. This suggests the possibility of a market for trading aggregate risk, which is generally assumed to be uninsurable in the literature. Examining the nature of macroeconomic risk that is common across non-OECD countries, if such risk exists, could shed further light on risk sharing by these countries.

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A Country Samples

A.1 21 Country OECD Sample

This sample of wealthy countries is the same as that used in Kose et al (2003).

Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Ireland (IRL), Italy (ITA), Japan (JPN), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), and United States (USA).

For regressions over the period 1973-86, Greece is excluded due to missing equity data.

A.2 49 Country Non-OECD Sample

This sample includes all Non-OECD21 countries for which all data (from both the Penn World Tables 6.2 and the CPI deflated data) were available for all years from 1987-2003 (inclusive), excluding Persian Gulf states and countries that are designated by the IMF as Overseas Financial Centres.

Argentina (ARG), Burkina Faso (BFA), Bangladesh (BGD), Bolivia (BOL), Botswana (BWA), Chile (CHL), Cote d'Ivoire (CIV), Cameroon (CMR), Colombia (COL), Dominican Republic (DOM), Algeria (DZA), Ecuador (ECU), Egypt (EGY), Ethiopia (ETH), Gabon (GAB), Ghana (GHA), Guatemala (GTM), Honduras (HND), Hungary (HUN), Indonesia (IDN), India (IND), Iceland (ISL), Jamaica (JAM), Jordan (JOR), Kenya (KEN), Korea (KOR), Sri Lanka (LKA), Madagascar (MDG), Mexico (MEX), Malaysia (MYS), Nigeria (NGA), Nepal (NPL), Pakistan (PAK), Papua New Guinea (PNG), Poland (POL), Paraguay (PRY), Senegal (SEN), El Salvador (SLV), Swaziland (SWZ), Chad (TCD), Togo (TGO), Trinidad and Tobago (TTO), Tunisia (TUN), Turkey (TUR), Tanzania (TZA), Uganda (UGA), Venezuela, Rep. Bol. (VEN), South Africa (ZAF), Zambia (ZMB).

A.3 35 Country Non-OECD Sample

This sample includes all Non-OECD21 countries for which all data (from both the Penn World Tables 6.2 and the CPI deflated data) were available for all years from 1971-1986 (inclusive), excluding Persian Gulf states and countries that are designated by the IMF as Overseas Financial Centres.

Chile (CHL), Cote d'Ivoire (CIV), Cameroon (CMR), Colombia (COL), Dominican Republic (DOM), Algeria (DZA), Ecuador (ECU), Egypt (EGY), Ethiopia (ETH), Gabon (GAB), Ghana (GHA), Guatemala

(GTM), Honduras (HND), India (IND), Iceland (ISL), Jamaica (JAM), Jordan (JOR), Kenya (KEN), Korea (KOR), Sri Lanka (LKA), Madagascar (MDG), Malaysia (MYS), Nigeria (NGA), Nepal (NPL), Pakistan (PAK), Paraguay (PRY), Senegal (SEN), El Salvador (SLV), Swaziland (SWZ), Togo (TGO), Trinidad and Tobago (TTO), Turkey (TUR), Tanzania (TZA), Venezuela, Rep. Bol. (VEN), South Africa (ZAF).

A.4 Persian Gulf States and Overseas Financial Centres

This sample is not exclusive of countries in the other two samples. It consists of all Persian Gulf states and countries that are designated by the IMF as Overseas Financial Centres for which all data were available over the relevant period. The 1987-2003 balanced sample consists of: Bahrain (BHR), Switzerland (CHE), Costa Rica (CRI), Cyprus (CYP), Hong Kong S.A.R. of China (HKG), Israel (ISR), Japan (JPN), Mauritius (MUS), Panama (PAN), Philippines (PHL), Qatar (QAT), Saudi Arabia (SAU), Singapore (SGP), Thailand (THA), Uruguay (URY).

The balanced sample from 1971-1986 consists of: Bahrain (BHR), Switzerland (CHE), Costa Rica (CRI), Israel (ISR), Japan (JPN), Mauritius (MUS), Singapore (SGP), Thailand (THA).

B The "Adding Up" Constraint

If consumption were regressed on aggregate consumption instead of aggregate net output in Regression (2), an adding up constraint would apply to the estimated coefficients. Since aggregate consumption and aggregate net output are highly correlated, the constraint may still be relevant. By construction of aggregate consumption, within the OECD subsample, if one country's consumption growth exceeds the average, another country's growth must fall short. Thus in a panel regression:

$$\Delta c_{it} = \alpha_i + \gamma \Delta y_{it} + \beta \Delta c_{at} + \eta \Delta y_{at} + \varepsilon_{it} \tag{15}$$

the coefficient of aggregate consumption must be one. If the coefficient varies by country:

$$\Delta c_{it} = \cdots + \beta_i \Delta c_{at} + \cdots \tag{16}$$

its average must be one.

If it is a function of financial integration,

$$\Delta c_{it} = \cdots + (\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it})\Delta c_{at} + \cdots \tag{17}$$

again its average must be one.

In the absence of an adding up constraint, the interaction variables in Equation (17) would explain deviations from β_0, which is common across countries. This remains true in the presence of the adding up constraint, but now the coefficients are constrained by $\beta_0 + \beta_1 \overline{eo}_{it} + \beta_2 \overline{do}_{it} = 1$, in other words they now explain deviations from one. As long as this interpretation is noted, the constraint poses no problem.

C Average Financial Openness Values

	Observations	Equity Avg.	Debt Avg.
OECD 1973-86	336	0.19	0.66
OECD 1987-2004	378	0.82	1.57
Non-OECD 1971-1986	1664	0.12	0.46
Non-OECD 1987-2003	1872	0.25	0.93
OFCs and Gulf States 1971-1986	352	0.18	2.18
OFCs and Gulf States 1987-2003	396	1.79	4.13

Table 5: Average equity and debt to GDP ratios by sample. These values were subtracted from equity and debt to GDP ratios in order to aid the interpretation of the regression coefficients.

D Net GDP Coefficients by Country

The below graph and tables show the coefficient of net output from Regression (1):

$$\Delta c_{it} - \Delta c_{at} = \alpha_i + (\beta_0 + \beta_1 eo_{it} + \beta_2 do_{it})(\Delta y_{it} - \Delta y_{at}) + \beta_3 eo_{it} + \beta_4 do_{it} + \Gamma Z_{it} + \varepsilon_{it} \tag{18}$$

after accounting for the effects of equity and debt openness in 2003 based on the results in Table 2.

Risk Sharing Coefficients with Standard Errors, OECD 2003

COUNTRY	β	se(β)	H0: β=0	H0: β=1
Sweden	0.03	0.13	F	R
Canada	0.09	0.10	F	R
Finland	0.11	0.11	F	R
Australia	0.12	0.10	F	R
Netherlands	0.13	0.14	F	R
New Zealand	0.21	0.08	R	R
Denmark	0.23	0.08	R	R
United States	0.23	0.07	R	R
France	0.24	0.08	R	R
Spain	0.27	0.07	R	R
Switzerland	0.29	0.13	R	R
Ireland	0.29	0.23	F	R
Norway	0.31	0.06	R	R
Japan	0.35	0.06	R	R
Belgium	0.37	0.09	R	R
Italy	0.37	0.06	R	R
Germany	0.39	0.06	R	R
Greece	0.46	0.07	R	R
Portugal	0.55	0.08	R	R
Austria	0.57	0.08	R	R
United Kingdom	0.62	0.08	R	R

Table 6: Column (1) reproduces the coefficients from Figure 9 (β refers to $\beta_0 + \beta_1 eo_{i,2003} + \beta_2 do_{i,2003}$ - consumption dependence on idiosyncratic GDP), with standard errors in Column 2. Column 3 shows the results of testing the null hypothess H0: $\beta_0 + \beta_1 eo_{i,2003} + \beta_2 do_{i,2003} = 0$ (perfect risk sharing). F stands for Fail to reject, R stands for Reject. Column 3 shows the results of testing the null hypothess H0: $\beta_0 + \beta_1 eo_{i,2003} + \beta_2 do_{i,2003} = 1$ (no risk sharing). All countries fall into two categories - the risk sharing coefficient is either statistically insignificantly different from zero (at the 5% level) and significantly different from one, or strictly between zero and one. The high standard error of Ireland's coefficient is worth noting.

Risk Sharing Coefficients with Standard Errors, Non-OECD 2003

COUNTRY	β	se(β)	COUNTRY	β	se(β)
Trinidad and Tobago	-0.08	0.04	Poland	0.20	0.10
South Africa	-0.05	0.04	Ethiopia	0.20	0.07
Chad	-0.04	0.02	Egypt	0.20	0.09
Chile	-0.03	0.03	Colombia	0.20	0.09
Papua New Guinea	-0.03	0.08	Cote d'Ivoire	0.20	0.10
Malaysia	0.01	0.02	Senegal	0.21	0.08
Jamaica	0.03	0.04	Honduras	0.21	0.08
Bolivia	0.03	0.02	Tanzania	0.22	0.08
Tunisia	0.07	0.02	Jordan	0.22	0.09
Swaziland	0.07	0.10	Uganda	0.23	0.08
Hungary	0.08	0.03	Guatemala	0.23	0.13
Nigeria	0.09	0.03	Paraguay	0.24	0.09
Zambia	0.10	0.12	Cameroon	0.24	0.10
Argentina	0.13	0.24	India	0.24	0.14
Togo	0.13	0.08	Sri Lanka	0.25	0.10
Iceland	0.15	0.11	Pakistan	0.25	0.11
Ghana	0.15	0.09	Algeria	0.25	0.12
Venezuela	0.15	0.06	Gabon	0.26	0.10
Botswana	0.16	0.10	Kenya	0.26	0.11
Ecuador	0.16	0.06	Turkey	0.26	0.10
Mexico	0.17	0.11	Indonesia	0.26	0.10
Dominican Republic	0.17	0.10	Madagascar	0.27	0.10
El Salvador	0.18	0.08	Bangladesh	0.27	0.14
Korea, Republic of	0.19	0.11	Burkina Faso	0.27	0.12
Poland	0.20	0.10			

Table 7: β refers to $\beta_0 + \beta_1 eo_{i,2003} + \beta_2 do_{i,2003}$ - consumption dependence on idiosyncratic GDP. The coefficients are taken from Table 2, Column 4, and β is calculated using 2003 equity and debt openness values. Standard errors are shown in Column 2. The null hypothesis H0: $\beta_0 + \beta_1 eo_{i,2003} + \beta_2 do_{i,2003} = 1$ is rejected at the 5% level for all countries. The null hypothesis H0: $\beta_0 + \beta_1 eo_{i,2003} + \beta_2 do_{i,2003} = 0$ is not rejected at the 5% level for 20 of the 49 countries. It appears that financial openness explains a considerable amount of cross-sectional variation in risk sharing in 2003. The high standard error of Argentina's coefficient (coefficient 0.13, standard error 0.24) is worth noting.

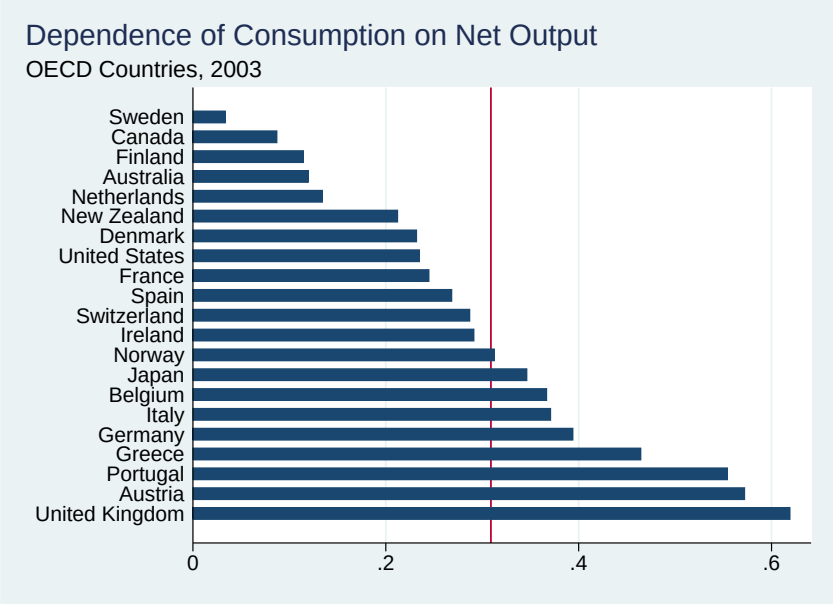

Figure 9: Dependence of Idiosyncratic Consumption on Idiosyncratic GDP by Country, OECD. The dependence measure was calculated as $\beta_0 + \beta_1 eo_{i,2003} + \beta_2 do_{i,2003}$, with the coefficients taken from Table 2, Column (2). The red line shows the coefficient of idiosyncratic GDP for a country with average equity and debt openness.

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