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On International Consumption Risk Sharing, Financial Integration and Financial Development[☆]

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Abstract

This paper investigates the empirical link between international consumption risk sharing, financial integration, and financial development for a group of twenty-nine developed and developing countries in the G7, the Euro area and the OECD. We first compute the degree of consumption risk sharing of these countries using an average risk sharing measure. We then relate the average risk sharing measure of these countries to their level of financial integration and financial development. We find that (i) the average consumption risk sharing in the Euro area is higher than those in the G-7 and the OECD, and (ii) a higher degree of international consumption risk sharing is associated with a greater degree of financial integration and a lower level of financial development. Based on these results, we argue that more financially integrated countries with more developed financial markets are better able and less in need to insure themselves against idiosyncratic income shocks. Inclusion of per capita income, output risk and trade openness as additional control variables reduces the effects of financial integration and financial development on consumption risk sharing. Holding financial integration and financial development equal, countries in the Euro area engage in significantly more consumption risk sharing than the ones in the G7 and the OECD.

Keywords: Consumption Risk Sharing, Financial Integration, Financial Development
JEL: E21, F15, F36, G15, O1

1. Introduction

International macroeconomics theory suggests that higher financial integration leads to higher consumption risk sharing among regions and countries, and developed financial markets facilitate this process. One of the widely known benefits of financial integration is that it creates more opportunities for risk sharing and smoothing consumption inter-temporally. Higher degree of consumption risk sharing enables countries to smooth their consumption in response to country-specific income shocks via capital and credit markets. The rise in the set of financial instruments thanks to the financial development and in the cross-ownership of both

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productive and financial assets resulting from financial integration creates new possibilities for diversification of portfolios and sharing idiosyncratic risk across countries. However, Kose et al. (2003) suggest that the median of the volatility of total consumption to that of income has increased from the 1980s to the 1990s in more financially integrated economies, providing some empirical evidence contrary to the notion that a greater degree of financial integration, financial development and risk sharing generates better opportunities to alleviate country-specific shocks. Bekaert et al. (2006) argue that liberalization in equity markets and capital account openness are related to fall in consumption growth volatility implying better risk sharing; but the results are weaker for newly liberalizing emerging economies, suggesting that the degree of financial development is also crucial in explaining consumption risk sharing.

Although a vast body of empirical literature studies international consumption risk sharing, the benefits of financial integration and development, to the best of my knowledge, little research is done on the apparent relationship among them. In this regard, we address two different questions in this paper: (i) do more financially integrated regions or economic blocks engage in a greater degree of consumption risk sharing?, and (ii) do regions or economic blocks with more developed financial markets achieve higher consumption risk sharing? This paper contributes to the literature in two aspects. We first compute the degree of consumption risk sharing of these countries using an average risk sharing measure. We then relate the average risk sharing measure of these countries with the measures of their financial integration and financial development. We find that (i) the average consumption risk sharing in the Euro area is higher than those in the G-7 and the OECD, and (ii) a higher degree of international consumption risk sharing is associated with a greater degree of financial integration and a lower level of financial development. Based on these results, we argue that more financially integrated countries with more developed financial markets are better able and less in need to insure themselves against idiosyncratic income shocks. When per capita income and measures of output risk and trade openness are included as additional state variables, they reduce the effects of financial integration and financial development on consumption risk sharing. Holding the levels of their financial integration and financial development constant, countries in the Euro area engage in significantly more consumption risk sharing than the ones in the G-7 and the OECD.

We follow the methodology developed by Crucini (1999) to measure the average consumption risk sharing of each country in the G-7, the Euro area and the OECD. The risk sharing

measure is constructed in two stages. First, a joint data generating process for aggregate and individual country's income growth is estimated for each country to account for the possibility of the interdependency between these income processes. The first stage estimates are used to construct a time series of innovations to permanent income for each country. The second stage regressions then use these time series of innovations as the second regressor in the each country's consumption equation. In the second stage, the individual country's consumption growth is regressed on the average regional consumption growth and estimates of the unexpected changes in individual country's permanent income computed from the first stage. The coefficient on the average regional consumption growth will be the average risk sharing measure which varies across individual countries.

In order to relate the constructed risk sharing measure with financial integration and financial development, we employ commonly accepted measures of financial integration and financial development. For financial integration, we use the New External Wealth of Nations II dataset assembled by Lane and Milesi-Ferretti (2007). They collect a comprehensive and up-to-date dataset on the foreign assets and liabilities of 145 advanced, emerging and developing countries. We utilize their international financial integration measure given by the ratio of the sum of foreign assets and liabilities of an individual country to its GDP. Regarding financial development, we use the financial development index presented in Financial Development Report (2009) published by the World Economic Forum. Second, we estimate different econometric specifications where we regress the average risk sharing measure on financial integration and financial development indices as well as per capita income, output risk, trade openness and the dummy variables for the economic regions. We employ a cross-sectional OLS rather than a panel estimation since the financial development measure is available only for certain years.

The rest of the paper proceeds as follows: Section 2 briefly summarizes the empirical literature on consumption risk sharing, financial integration and financial development. Section 3 describes the data sources and the methodology used to construct the risk sharing parameters for each country in different groups. Section 4 presents the estimation results and relates the consumption risk sharing rankings with financial integration and development. Section 5 concludes.

2. The Empirical Literature

The current paper is related to two strands of the literature- the international consumption risk sharing literature and the financial integration and development literature. On the international risk sharing side, Lewis (1993) exploits cross-sectional information to examine whether domestic consumption varies with domestic income when world income is included in the regression. Atkeson and Bayoumi (1993) rejected the null hypothesis of full consumption insurance in U.S. and OECD countries. Obstfeld (1994) tests the theory of international risk sharing as a way to understand the completeness of the international financial markets. Kollman (1995) examines the implications of complete and incomplete markets for consumption and the real exchange rate in the short and long run. Canova and Ravn (1996) analyze whether aggregate domestic consumption is completely insured against idiosyncratic real, demographic, fiscal and monetary shocks over short, medium and long cycles. Crucini (1999) produces a parameter that measures the fraction of the annuity value of individual income that nations pool and finds the degrees of risk sharing within the regions of Canada and the U.S. as well as across G-7 countries. The current paper differs from Crucini (1999) in two aspects. First, we calculate the risk sharing measure for the Euro area and the OECD countries. Second, we investigate the relationship among consumption risk sharing, financial integration and financial development, which Crucini (1999) is silent about. Volosovych (2013) empirically investigates which factors could explain cross-country differences in the magnitude of risk sharing from international factor income and finds that an index of investor protection is the most important explanatory variable in predicting the extent of risk sharing.

On the consumption risk sharing at the individual level, using the U.S. Panel Study of Income Dynamics, Cochrane (1991) tests whether consumers are effectively insured against idiosyncratic shocks to income or wealth, either by formal institutions such as charities, private insurance, and government programs or by informal mechanisms such as gifts and loans from relatives, friends and neighbors and found that the distribution of food consumption shifts across individuals who are unemployed more than 100 days due to illness and involuntary job loss, spells of unemployment following an involuntary job loss, loss of work due to strike, or an involuntary move. Using the U.S. Consumer Expenditure Survey, Mace (1991) regresses individual consumption growth on average consumption growth and individual income growth and found that income growth is a significant regressor for some, but not all, categories of

consumption.

The other strand of literature focuses on the financial development and economic growth. Beck, Demirguc-Kunt and Levine (1999) introduces a new database of indicators of financial development and structure across countries and over time. This database unites a variety of indicators that measure the size, activity and efficiency of financial intermediaries and markets. Moreover, World Economic Forum published a new report on financial development (2008), which uses the aforementioned indicators to construct a financial development index. It ranks 52 developed and developing countries in terms of their degree of financial development. Levine and Zervos (1998) empirically investigate whether measures of stock market liquidity, size, volatility, and integration with world capital markets are robustly correlated with current and future rates of economic growth, capital accumulation, productivity improvements, and saving rates using data on 47 countries from 1976 through 1993. They find that stock market liquidity and banking development both positively predict growth and financial markets provide important services for economic growth. Neal and Dewenter (1999) examine the empirical relation between financial market development as measured by the stock market, and gross private savings rates in 16 emerging markets over 1982-1993. They find evidence of a significant positive relation between savings and stock market size and liquidity. On the financial integration side, Lane and Milesi-Ferretti (2007) show the evolution of international financial integration between advanced and developing economies. Kalemli-Ozcan et al. (2003) computes the degree of insurance among the members of a group and an index of industrial specialization for each region within a group. They then investigate whether a higher degree of insurance within a group is associated with high specialization of its regions. Baele et al. (2004) constructs a number of measures to quantify the evolution of financial integration in the euro area to assess the current situation and the pace of financial integration in Euro area countries.

3. Data Description and Methodology

This section first describes the variables and the data sources used in the empirical analysis. We then proceed with the theoretical framework used to extract the average risk sharing parameter for each country. We will mainly follow Crucini (1999) to construct risk sharing measure.

The international data for estimating the income and consumption equations are taken from

OECD's quarterly national accounts. Our sample period is from 2000 to 2009. The data are seasonally and purchasing-power-parity adjusted. We divide nominal GDP by GDP deflator to obtain real GDP. Consumption data is nominal private final consumption expenditure, which is deflated by consumption deflator to obtain real consumption. Since both real GDP and real consumption data is in million of national currency units, they are converted into dollars using real exchange rates. Moreover, for the financial integration index, we use the updated dataset of Lane and Milessi-Ferretti, which covers the period from 1970 to 2009. The index is computed as the ratio of the sum of foreign assets and liabilities of an individual country to its GDP. We first compute the index for each country in our dataset for the period 2000-2009 to make it comparable with risk sharing parameter estimates. We then average along the time dimension to obtain an average measure of financial integration. Finally, for the financial development index, we use the financial development index presented in Financial Development Report (2009) published by the World Economic Forum. The index is based on seven major categories: institutional environment, business environment, financial stability, banks, non-banks, financial markets, size, depth, and access. It ranges from 1-7. These seven pillars are weighted equally as well as most of the subpillars that comprise each of the pillars. Many variables, especially those related to the size and depth of the financial system, are scaled by GDP, which is necessary to control for country size and to allow for more relevant cross country comparisons. The index presents the financial development of the countries included as of the year 2009, therefore we didn't average this index.

The model assumes that there is a group of J countries that engage in consumption risk sharing. Each country in a specific group, call country J, sells a fraction λ_j of her income in return for a claim to the income pool constructed by all J agents in that specific group. λ_j is called as the risk sharing parameter. Each country in the specific group may contribute different fractions of their own income. Hence, the total amount of income in the pool at time t is given by

$$Y_{at} = \frac{1}{\Lambda}\Sigma_{j=1}^{J}\lambda_j Y_{jt} \tag{1}$$

where Y_{jt} is the income of the country j at time t and $\Lambda = \Sigma_{j=1}^{J}\lambda_j$. However, the problem with this expression is that the pooled income depends on the unknown fraction contributed by each country. We solve this problem by assuming that each country in a specific group contribute

the same amount, however these fractions may be different across different groups. Therefore, the countries within a particular group may pool a different fraction of their incomes than the ones within a different group.

The pooled income is a simple average of the income of each country within a specific group and the flow of income after engaging in risk sharing. Hence, the pooled income is defined as the following:

$$\overline{Y_{jt}} = \lambda Y_{at} + (1-\lambda) Y_{jt} \; where \; Y_{at} = \frac{1}{J} \Sigma_{j=1}^{J} Y_{jt} \tag{2}$$

Assume that the real interest rate is fixed and exogenous. The countries borrow and lend at this fixed exogenous real interest rate in order to smooth their consumption. Then, decision rule for the change in consumption is given by

$$\Delta C_{jt} = (1-\beta) \sum_{k=0}^{\infty} \beta^k [E_t \overline{Y}_{jt+k} - E_{t-1} \overline{Y}_{jt+k}] \tag{3}$$

After summing the decision rule above for all the countries in a specific group, we obtain the following expression for the average change in consumption:

$$\Delta C_{at} = \frac{1}{J} \sum_{j=1}^{J} \Delta C_{jt} = (1-\beta) \sum_{k=0}^{\infty} \beta^k [E_t \overline{Y}_{at+k} - E_{t-1} \overline{Y}_{at+k}] \tag{4}$$

Combining equations (3) and (4), we get

$$\Delta C_{jt} = \lambda \Delta C_{at} + (1-\lambda)(1-\beta) \sum_{k=0}^{\infty} \beta^k [E_t \overline{Y}_{jt+k} - E_{t-1} \overline{Y}_{jt+k}] \tag{5}$$

Therefore, an individual country's consumption growth depends on a convex combination of average consumption growth of the particular group that the country is in and the annuity value of the innovations to aggregate income of that particular group and to that country's income.

The first differences of the logarithm of consumption and income will be used while estimating the equation (5) above. From now on, the lowercase letters will denote the logarithm of the level.

Crucini (1999) assumes that an individual country's income growth and aggregate income growth of the specific group that the country is a member are interdependent. This assumption

will give us the ability to capture the effect of individual and aggregate innovations to income on the future values of the individual country's income growth. The specification for this type of interdependence is given by a VAR(1) process:

$$\begin{pmatrix} \Delta y_{at} \\ \Delta y_{jt} \end{pmatrix} = \begin{pmatrix} A_j^{11} & A_j^{12} \\ A_j^{21} & A_j^{22} \end{pmatrix} \begin{pmatrix} \Delta y_{at-1} \\ \Delta y_{jt-1} \end{pmatrix} + \begin{pmatrix} v_{ajt} \\ v_{jt} \end{pmatrix}$$

Hence, the consumption growth will be given by

$$\Delta c_{jt} = \lambda \Delta c_{at} + (1-\lambda)\Delta yp_{jt} \tag{6}$$

where $\Delta yp_{jt} = B_j^{21} v_{ajt} + B_j^{22} v_{jt}$, $B_j^{21} = (I - \beta A_j^{21})^{-1}$, and $B_j^{22} = (I - \beta A_j^{22})^{-1}$.

The reaction of an individual country's consumption growth to the news in aggregate and individual country's income will depend on the dynamic interaction between the two income processes given by VAR(1) system above and the magnitude of the risk sharing. If the risk sharing is perfect ($\lambda = 1$), then the innovation to an individual country's income does not matter since the agents can diversify all the risk. However, if the risk sharing is not perfect ($\lambda < 1$), then the innovation to an individual country's income will be important due to two reasons: (1) it is directly a source of income, and (2) it conveys some information about future aggregate income.

The consumption growth across countries will be positively correlated due to two reasons: (1) individual country's permanent income may be positively correlated across regions. (2) The extent of risk sharing among countries implies a relationship among their income levels, which is a second source of consumption comovements.

Estimation will be performed in two stages. In the first stage, we estimate the income processes for each country in the dataset: G-7 countries, the 13 countries in Euro area and the 29 countries in OECD. Then we use these first-stage estimates to create a time series of "news" to permanent income of each country. In particular, we consider two specifications for the income processes of each country: (1) a joint data-generating process, and (2) an AR(1) process.

$$\begin{pmatrix} \Delta y_{at} \\ \Delta y_{jt} \end{pmatrix} = \begin{pmatrix} A_j^{11} & A_j^{12} \\ A_j^{21} & A_j^{22} \end{pmatrix} \begin{pmatrix} \Delta y_{at-1} \\ \Delta y_{jt-1} \end{pmatrix} + \begin{pmatrix} v_{ajt} \\ v_{jt} \end{pmatrix}$$

$$\Delta y_{jt} = \rho_j \Delta y_{jt-1} + v_{jt} \tag{7}$$

In the second stage, we estimate consumption equations using the time series of innovations as the second regressor. The second-stage regression of the consumption equation is given by

$$\Delta c_{jt} = \lambda_j \Delta c_{at} + (1 - \lambda_j)\Delta \widehat{yp}_{jt} + \epsilon_{jt} \tag{8}$$

where $\Delta \widehat{yp}_{jt} = B_j^{21} v_{ajt} + B_j^{22} v_{jt}$, which is the estimate of unexpected changes in an individual country's permanent income. Mace (1991) interpret the error term, ϵ_{jt}, as a measurement error in an individual country's consumption growth or a taste shock which is uncorrelated with the "news" to permanent income. Each regression is estimated separately and by ordinary least squares.

4. Estimation Results

This section presents the estimation results for income processes and risk sharing parameter estimates. Table 1 displays the number of countries for which a one-sided hypothesis test implies a statistically significant coefficient for individual country's income and aggregate income at 5% and 10% significance levels; the weighting coefficients for innovations to individual country's income and aggregate income denoted as "multipliers", and the R-squared. The multipliers and the R-squared are the averages across all countries within a particular group.

The columns from two to six of Table 1 report the results for the bivariate first-order autoregressive model for an individual country's income growth in a specific group. For the Euro area, at 5% significance level, the number of statistically significant coefficients when estimating the aggregate income equations of the Euro area is considerably higher than that when estimating an individual country's income equation in the Euro area (8 vs. 1). At 10% significance level, the former is slightly higher than the latter (10 vs. 9). The average R-squared of the bivariate specification for the Euro area countries is 0.15. These results show that aggregate income growth in the Euro area is predictable from its past value and the past value of individual country's income growth. Moreover, the high number of insignificant coefficients in the individual country's income growth equation shows that individual country's income growth rate for the Euro area is approximately a random walk.

For the G-7, at 5% significance level, the number of statistically significant coefficients when estimating the aggregate income equations of the G-7 is equal to that when estimating

an individual country's income equation in the G-7 (2 vs. 2). At 10% significance level, the former is bigger than the latter (6 vs. 3). The R-squared of the bivariate specification for the G-7 is 0.18. These results show that at 5% significance level, aggregate income growth and an individual country's income growth in the G-7 is hardly predictable from their past values implying approximately a random walk for both. At the 10% significance level, aggregate income growth is predictable from its past value and the past value of individual country's income growth while individual country's income growth is still approximately a random walk.

For the OECD at 5% significance level, the number of statistically significant coefficients when estimating the aggregate income equations of the OECD is much bigger than that when estimating an individual country's income equation in the OECD (24 vs. 6). At 10% significance level, the former is still bigger than the latter (35 vs. 16). The R-squared of the bivariate specification for the OECD is 0.21. These results show that aggregate income growth rate for the OECD is predictable from the past values of both individual country's and aggregate income growth rates while a typical individual country's income growth rate in the OECD is approximately a random walk.

The last two columns of Table 1 display the findings for the AR(1) specification for an individual country's income growth. For each economic block, nearly all the coefficients are statistically significant at 5% significance level. The R-squared's of the univariate specification for the Euro area, the G-7 and the OECD are 0.10, 0.12 and 0.13, respectively. In general, the bivariate specification performs better than the univariate specification when estimating an individual country's income growth which can be seen from the lower R-squared's in the univariate case.

The third row of each panel displays the multipliers, which are defined as the weighting coefficients for aggregate and an individual country's income innovations. For example, in the Euro area, the average of the estimated multipliers for an individual country's income is equal to 1.44. This number implies that one unit innovation to the current income growth of a typical country in the Euro area increases its permanent income growth by 1.44%. Assuming that the innovation to aggregate income does not change, we predict that an individual country's consumption growth in the Euro area is more volatile than the innovations to that country's income growth. For the G-7, one unit innovation to current income growth of a typical country in the G-7 increases its permanent income growth by 1.53%, implying a more volatile consumption

growth than the "news" to income growth of that country. Finally, for the OECD, one unit innovation to current income growth of a typical country in the OECD increases the permanent income growth of that country by 1.33%, implying a more volatile consumption growth.

The multipliers on A_j^{21} show the impact of a unit innovation to aggregate income of a particular group on an individual country's income growth in that group. These multipliers are 1.13, 1.86 and 0.86 for the Euro area, the G-7, and the OECD respectively. Aggregate income of the G-7 and the Euro area countries have a moderate effect on a typical country's income in the G-7 and the Euro area while that of the OECD countries has a smaller impact on a typical country's income in the OECD.

To sum up, we conclude that aggregate income growth is predictable from both its lagged values and the past values of an individual country's income growth while individual country's income growth can be interpreted as random walk. Although the bivariate specification performs better than the univariate specification in terms of R-squared, the number of statistically significant coefficients is higher in the latter. Since it is not apparent which specification is better to use when estimating risk sharing parameters, we use both specifications and report the results separately.

4.1. Risk-Sharing Parameter Estimates

Table 2 displays the risk-sharing parameter estimates. Each panel presents estimation results for one economic group while each row corresponds to a different income process specification. The table shows the estimated risk-sharing parameters and the standard error of the estimated averages across all countries within a particular group. The table also presents the average R-squared of the regressions for each specific group. The last three columns display the test results for alternative hypothesis about the magnitude of each individual country's risk sharing parameter estimate.

First column indicates that the average risk-sharing in the Euro area is greater than that in the G-7 and the OECD for both bivariate and univariate income specifications. However, if we exclude Japan from the G-7, the average risk-sharing in the G-7 is greater than that in the Euro area and the OECD for bivariate income specification. Although the differences in the average risk-sharing across different economic groups are small for bivariate specification, this is not the case for univariate income process. The average risk-sharing parameter for the Euro area is 0.9, which is much higher than those for the G-7 and the OECD.

The estimated consumption growth equations capture a large fraction of the time-series variation in individual countries' consumption growth rates. The averaged R-squared ranges from 0.93 for the Euro area countries (for both bivariate and univariate income specification) to 0.79 for the OECD countries (for bivariate income specification). Although the importance of aggregate consumption and an individual country's permanent income differs across regressions, the goodness of fit of the consumption growth equations are comparable among the Euro area, the G-7 and the OECD.

The results for hypothesis testing of risk-sharing parameter estimates show that for bivariate income specification, we fail to reject perfect consumption insurance for 1 of the 13 Euro area countries, 4 of the G-7 countries, and 4 of the 29 OECD countries. For univariate income specification, we fail to reject perfect consumption insurance for 10 of the 13 Euro area countries, 2 of the G-7 countries, and 6 of the 29 OECD countries. Moreover, the sixth column shows the number of countries for which 95% confidence interval for the risk sharing parameter λ falls between 0 and 1. Nearly all the countries in each particular block satisfy this condition. Based on these results, we can say that the countries in the Euro area engages in more consumption risk sharing than those in the G-7 and the OECD.

4.2. The Effect of Financial Integration and Development on Risk Sharing

Tables 3 and 4 present the risk-sharing estimates together with financial integration and financial development rankings for each country in our sample using bivariate and univariate income specifications, respectively. In order to read the results more easily, we plot the risk sharing parameter estimates against financial integration and financial development indices.

Figure 1 displays the relationship between risk sharing and financial integration using bivariate and univariate income processes, respectively. The figure indicates that a higher level of financial integration is generally associated with a greater degree of international consumption risk sharing. Considering the fact that the average of the financial integration indices of the Euro area countries is higher than that of the G-7, which is greater than that of the OECD, we expect that the average risk sharing estimates in the Euro area is larger than that of the G-7, which is greater than that of the OECD. Table 2 shows that this is indeed the case.

Figure 2 shows the relationship between risk sharing and financial development using bivariate and univariate income processes, respectively. The figure shows that a higher level of financial development is associated with a lower degree of consumption risk sharing. We argue

that the countries with more developed financial markets might be better able to insure themselves against idiosyncratic income shocks and might be in less need to engage in consumption risk sharing.

We then estimate the following equation for risk sharing estimates coming from bivariate and univariate specifications in order to confirm the observations above:

$$\widehat{\lambda_i} = \beta_0 + \beta_1 finint_i + \beta_2 findev_i + \beta_3 X_i + \beta_4 D_i + \epsilon_i \tag{9}$$

where $\widehat{\lambda_i}$ is the average risk sharing parameter for country i, $finint_i$ is the country i's financial integration level and $findev_i$ is the country i's financial development level. β_1 and β_2 measure the partial change in risk sharing coming from one unit change in the level of financial integration and financial development, respectively. X_i stands for the group of control variables, namely per capital GDP, output risk and trade openness. Output risk is measured by the ratio of the standard deviation of individual-country per-capita GDP growth rate over time to that of the all countries in the sample, which is proposed by Volosovych (2013). Trade openness is the ratio of the sum of individual country's exports and imports to its GDP.

Finally, we include dummy variables for the Euro area and the G-7 to control for the partial effect of being in a particular economic group. In particular, D_i is the matrix of dummy variables, which includes $EuroArea_i$, $G7_i$, and the interaction dummy between the latter two. $EuroArea_i$ is a dummy variable equal to 1 if the country is in the Euro area and zero otherwise; and $G7_i$ is a dummy variable equal to 1 if the country is in the G-7 and zero otherwise. Therefore, the first element of β_4 measures the relative partial change in risk sharing if a country is in the Euro area; its second element measures the relative partial change in risk sharing if a country is in the G-7, and the sum of its three elements measures the relative partial change in risk sharing if a country is in both economic groups. In order not to bias the results, we exclude some outlier observations including those of Luxembourg, Iceland and Japan. Luxembourg has a financial integration index of 196.86, which is more than five standard deviations away from the mean. Iceland and Japan have risk sharing parameter estimates less than zero.

Table 5 shows the estimation results for both average risk sharing parameters estimated using bivariate and univariate income processes. We include the group of control variables one by one starting with the measure of output risk. Then we include per capita GDP and finally, trade openness. Second and third rows of Table 5 show that one unit increase in financial

integration index leads to 1.8% increase in consumption risk sharing whereas one unit increase in financial development index leads to 8.2% to 15.6% decline in consumption risk sharing. The coefficients on the dummy variables for the Euro area and the G-7 in the bivariate case show that being a country in the Euro area increases the consumption risk sharing by 20% compared to the being in the OECD, holding financial integration and financial development constant. In the univariate case, the coefficients on the dummy variables are not statistically significant.

Fourth and fifth rows of Table 5 display the regression results when output risk is included as an additional control variable. In this case, one unit increase in financial integration index raises consumption risk sharing by 1.6% to 2.2% whereas one unit increase in financial development index reduces consumption risk sharing by 14.2%. Similar to the previous specification, the coefficients on the dummy variables for the Euro area and the G-7 in the bivariate case show that being a country in the Euro area increases the consumption risk sharing by 20% compared to the being in the OECD, holding financial integration, financial development and output risk constant. In the univariate case, the coefficients on the dummy variables are not statistically significant. Moreover, in the univariate case, one unit increase in output risk leads to 40% rise in consumption risk sharing, indicating that countries that experience more volatility in their incomes have more incentives to engage in consumption risk sharing. Finally, the coefficient on the financial development is statistically insignificant.

Sixth and seventh rows of Table 5 show the regression results when output risk and per capita GDP are included as additional control variables. In the bivariate case, the coefficients on financial integration index and the dummy variable for the Euro area are still statistically significant while those on financial development index, output risk and per capita GDP are not statistically significant. In the univariate case, the only statistically significant variable is output risk, which is significant at 1%. One unit increase in output risk raises consumption risk sharing by 44%.

The last two rows display the regression results when output risk, per capita GDP and trade openness are included as additional control variables. In the bivariate case, the only statistically significant variable is the Euro area dummy variable while in the univariate case, the only statistically significant variable is output risk. This result might stem from (i) the number of observations is small compared to the number of parameters to be estimated, (ii) the additional control variables included in the regression might be correlated with financial

integration and financial development indices and the OLS is not able to identify separately the effects of control variables on risk sharing from those of financial integration and financial development.

5. Conclusion

This paper empirically studies the link among international consumption risk sharing, financial integration and financial development using data on twenty-nine developed and developing countries in the G7, the Euro area and the OECD. We first compute an average risk sharing parameter for each country following Crucini (1999). We then relate these risk sharing measures to the financial integration and financial development indices by regressing the former on the latter ones, the dummy variables denoting the economic group that the country is in, and a group of control variables. In most of the different specifications, we find that a greater level of international consumption risk sharing is associated with a higher degree of financial integration and a lower degree of financial development. Based on these results, we argue that more financially integrated countries with more developed financial markets are better able and less in need to insure themselves against idiosyncratic income shocks. We also find that inclusion of per capita income, output risk and trade openness as additional control variables into the regression reduces the effects of financial integration and financial development on consumption risk sharing. Holding financial integration and financial integration equal, countries in the Euro area engages in significantly more consumption risk sharing than the ones in the G7 and the OECD.

We should also note two possible shortcomings of the framework used in the current paper. First, this paper assumes that the real interest rate is fixed. A natural extension is to make it time-varying to capture the variation in consumption resulting from intertemporal substitution. Having time-varying real rates might also allow us to capture the differences in consumption across countries due to the inequality of real interest rates around the globe. Second, we use average measures of risk sharing and financial integration. The financial development rankings we use belongs to one specific year, which is due to the lack of data. One might also extend these measures along the time dimension to capture how consumption risk sharing evolves as financial integration and financial development change or to assess how global shocks affect these measures.

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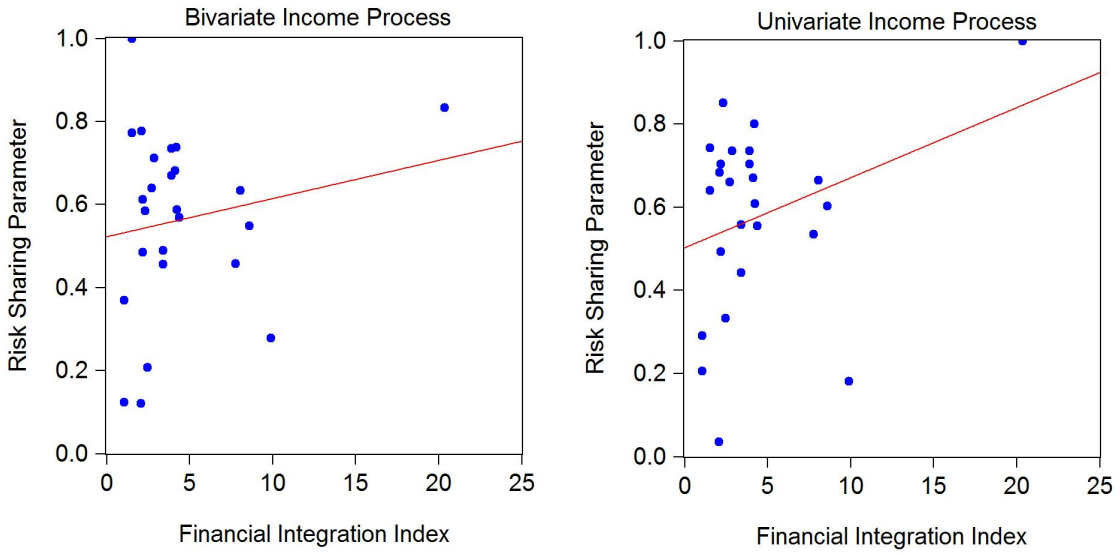

Figure 1: Risk Sharing and Financial Integration

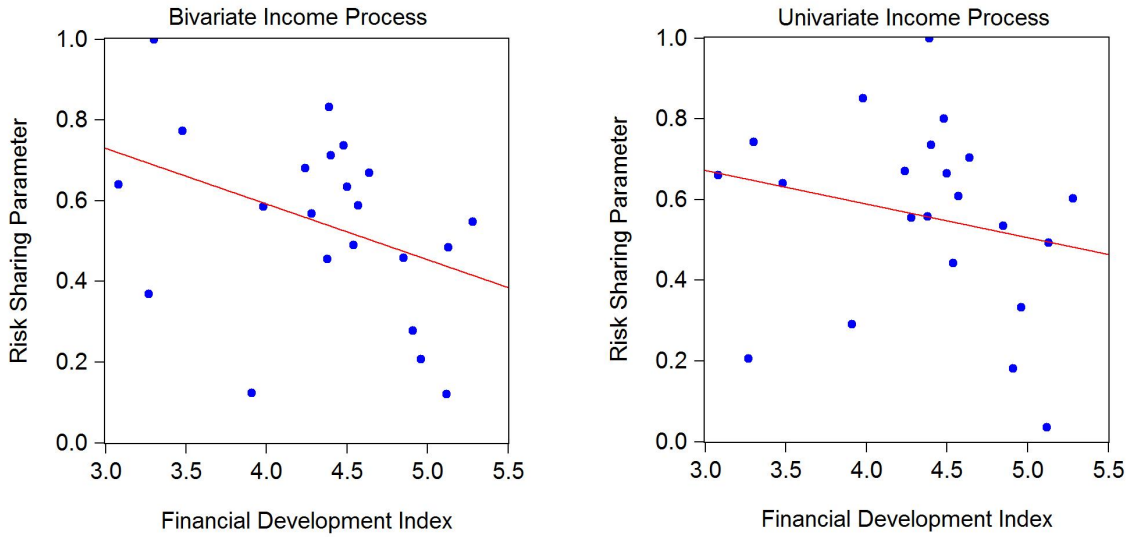

Figure 2: Risk Sharing and Financial Development

Table 1: First-Stage Income Regressions

	Bivariate Specification					Univariate Specification	
	Aggregate Income		Country's Income				
Statistic	A^{11}	A^{12}	A^{21}	A^{22}	R^2	ρ_j	R^2
Results for Euro Area							
Sign Tests (%5)	3	5	0	1	-	13	-
Sign Tests (%10)	4	6	4	5	-	13	-
Multipliers	1.42	1.18	1.13	1.44	0.15	1.60	0.10
Results for G-7							
Sign Tests (%5)	2	0	0	2	-	6	-
Sign Tests (%10)	5	1	1	2	-	6	-
Multipliers	1.92	1.24	1.86	1.53	0.18	1.67	0.12
Results for OECD							
Sign Tests (%5)	13	11	3	2	-	26	-
Sign Tests (%10)	20	15	8	8	-	27	-
Multipliers	5.43	5.51	0.86	1.33	0.21	1.67	0.13

Notes: The first two row entries of each panel display the number of statistically significant coefficients in each particular group at 5% and 10% significance levels, respectively. The second row of entries show the multipliers, $\widehat{B}_{ij}$, the ijth element of $(I - \beta A_j)^{-1}$, which are the weighting coefficients for innovations to income. We use β equal to 0.98. The sample period is 2000.Q3 to 2009.Q1 for the Euro area and the OECD while it is 1998.Q3 to 2009.Q1 for the G-7. The parameter $\widehat{\rho}_j$ is the coefficient on lagged income growth in the univariate specification.

Table 2: Risk Sharing Parameter Estimates

	Mean Statistics			Number of countries for which a 95% Confidence Interval Includes a Risk Sharing Parameter Equal to:		
	$\widehat{\lambda}$	se($\widehat{\lambda}$)	R^2	$\widehat{\lambda} = 1$	$1 > \widehat{\lambda} > 0$	$\widehat{\lambda} = 0$
Income Process			Results for Euro Area			
Bivariate	0.68	0.05	0.93	1	13	0
Univariate	0.90	0.08	0.93	10	13	0
			Results for G-7			
Bivariate	0.43	0.26	0.68	4	6	2
Bivariate (excluding Japan)	0.69	0.25	0.65	4	6	1
Univariate	0.42	0.12	0.79	2	7	2
			Results for OECD			
Bivariate	0.49	0.11	0.80	4	28	5
Univariate	0.54	0.12	0.86	6	29	5

Notes: The risk sharing regressions are estimated by ordinary least squares. The explanatory variables are aggregate consumption growth across individual countries within a particular group and the innovations to permanent income of a specific country calculated from the first-stage regressions reported in table 1.

Table 3: Risk Sharing and Financial Integration & Development Rankings: Bivariate Income Process

	Rank	Risk-Sharing Parameter ($\widehat{\lambda}$)	Financial Development Rankings	Financial Integration Rankings
Euro Area				
Slovak Republic	1	1.000	10	13
Greece	2	0.817	-	12
Finland	3	0.724	8	7
Portugal	4	0.696	-	8
Ireland	5	0.686	6	2
Spain	6	0.653	5	10
France	7	0.650	2	5
Belgium	8	0.630	4	3
Netherlands	9	0.616	1	4
Italy	10	0.609	9	11
Germany	11	0.597	3	9
Austria	12	0.591	7	6
Luxembourg	13	0.573	-	1
G-7				
France	1	1.000	5	2
United Kingdom	2	0.999	1	1
Italy	3	0.912	7	4
Germany	4	0.804	6	3
United States	5	0.338	2	6
Canada	6	0.067	3	5
Japan	7	-1.091	4	7
OECD				
Slovak Republic	1	1.000	21	25
Ireland	2	0.832	14	2
Greece	3	0.776	-	22
Czech Republic	4	0.772	20	24
Sweden	5	0.737	12	9
Portugal	6	0.734	-	12
Spain	7	0.712	13	16
Finland	8	0.680	17	11
Denmark	9	0.669	8	13
Luxembourg	10	0.644	-	1
Hungary	11	0.640	23	21
Belgium	12	0.634	11	4
New Zealand	13	0.611	-	18
France	14	0.587	9	7
Italy	15	0.584	18	17
Austria	16	0.567	16	10
United Kingdom	17	0.548	1	6
Germany	18	0.489	10	14
Australia	19	0.484	2	20
Netherlands	20	0.457	6	5
Norway	21	0.455	13	15
Poland	22	0.368	22	28
Switzerland	23	0.278	5	3
Canada	24	0.207	4	19
Korea	25	0.123	19	27
United States	26	0.120	3	23
Turkey	27	0.065	24	29
Iceland	28	-0.035	-	8
Japan	29	-0.510	7	26

[a] Risk sharing parameters are estimated using the countries' consumption growth equations. We then normalize the risk sharing parameters so that its highest value is equal to 1. Risk-sharing parameter estimate equaling to 1 implies perfect risk sharing.

[b] Financial development rankings are constructed using the Financial Development Report (2009) published by World Economic Forum. Greece, Portugal, Luxembourg, New Zealand and Iceland are not included in these rankings. For financial integration and financial development rankings, 1 shows the most financially integrated and the most financially developed country, respectively.

Table 4: Risk Sharing and Financial Integration & Development Rankings: Univariate Income Process

	Rank	Risk-Sharing Parameter ($\widehat{\lambda}$)	Financial Development Rankings	Financial Integration Rankings
Euro Area				
Greece	1	1	-	12
Finland	2	0.967	8	7
Ireland	3	0.961	6	2
Italy	4	0.942	9	11
Portugal	5	0.934	-	8
France	6	0.892	2	5
Belgium	7	0.891	4	3
Netherlands	8	0.873	1	4
Spain	9	0.865	5	10
Luxembourg	10	0.836	-	1
Austria	11	0.836	7	6
Slovak Republic	12	0.833	10	13
Germany	13	0.815	3	9
G-7				
Italy	1	1	7	4
United Kingdom	2	0.639	1	1
France	3	0.554	5	2
Germany	4	0.468	6	3
Canada	5	0.286	3	5
United States	6	0.069	2	6
Japan	7	-0.049	4	7
OECD				
Ireland	1	1.000	14	12
Luxembourg	2	0.871	-	1
Italy	3	0.850	18	17
Sweden	4	0.799	12	9
Slovak Republic	5	0.742	21	25
Spain	6	0.735	13	16
Portugal	7	0.735	-	12
Denmark	8	0.703	8	13
New Zealand	9	0.703	-	18
Greece	10	0.682	-	22
Finland	11	0.670	17	11
Belgium	12	0.664	11	4
Hungary	13	0.660	23	21
Czech Republic	14	0.640	20	24
France	15	0.608	9	7
United Kingdom	16	0.602	1	6
Norway	17	0.557	15	15
Austria	18	0.555	16	10
Netherlands	19	0.534	6	5
Australia	20	0.493	2	20
Germany	21	0.442	10	14
Canada	22	0.331	4	19
Iceland	23	0.327	-	8
Korea	24	0.290	18	27
Poland	25	0.205	22	28
Switzerland	26	0.181	5	3
Turkey	27	0.141	24	29
United States	28	0.035	3	23
Japan	29	-0.040	7	26

[a] Risk sharing parameters are estimated using the countries' consumption growth equations. We then normalize the risk sharing parameters so that its highest value is equal to 1. Risk-sharing parameter estimate equaling to 1 implies perfect risk sharing.

[b] Financial development rankings are constructed using the Financial Development Report (2009) published by World Economic Forum. Greece, Portugal, Luxembourg, New Zealand and Iceland are not included in these rankings. For financial integration and financial development rankings, 1 shows the most financially integrated and the most financially developed country, respectively.

Table 5: Risk Sharing, Financial Integration and Financial Development

Income Process	(1) Bivariate	(2) Univariate	(3) Bivariate	(4) Univariate	(5) Bivariate	(6) Univariate	(7) Bivariate	(8) Univariate
Dependent: Estimate of Risk Sharing, $\widehat{\lambda}$								
Constant	1.039***	0.785**	0.883**	-0.014	0.757*	0.098	0.489	-0.039
	(0.303)	(0.322)	(0.408)	(0.478)	(0.396)	(0.416)	(0.609)	(0.900)
Financial Integration	0.018*	0.018*	0.022***	0.016**	0.020**	0.012	0.013	0.009
	(0.008)	(0.008)	(0.008)	(0.007)	(0.009)	(0.010)	(0.014)	(0.021)
Financial Development	−0.156**	−0.082*	−0.142*	-0.015	-0.082	-0.084	-0.046	-0.064
	(0.067)	(0.069)	(0.070)	(0.088)	(0.079)	(0.075)	(0.107)	(0.125)
Euro Area	0.209*	0.140	0.201*	0.214	0.220*	0.239	0.224*	0.237
	(0.105)	(0.138)	(0.110)	(0.129)	(0.018)	(0.140)	(0.121)	(0.137)
G-7	0.028	-0.118	0.041	0.019	0.018	0.081	0.053	0.093
	(0.123)	(0.151)	(0.128)	(0.139)	(0.131)	(0.144)	(0.168)	(0.185)
Euro Area*G7	0.124	0.126	-0.122	0.0006	-0.109	-0.067	-0.114	-0.058
	(0.128)	(0.196)	(0.126)	(0.180)	(0.127)	(0.177)	(0.138)	(0.174)
Output Risk	–	–	0.080	0.399***	0.054	0.440***	0.061	0.442***
	–	–	(0.157)	(0.122)	(0.156)	(0.126)	(0.154)	(0.131)
Per Capita GDP	–	–	–	–	-0.001	0.001	-0.001	0.001
	–	–	–	–	(0.001)	(0.001)	(0.001)	(0.002)
Trade Openness	–	–	–	–	–	–	0.241	0.123
	–	–	–	–	–	–	(0.402)	(0.549)
R^2	0.462	0.390	0.468	0.506	0.486	0.528	0.498	0.531

[a] The numbers in parentheses are the heteroskedasticity-autocorrelation corrected standard errors of the respective coefficients.
[b] ***: Significant at 1 percent, **: Significant at 5 percent, and *: Significant at 10 percent.

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