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Financial Frictions and Asymmetric International Risk Sharing

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Pierfederico Asdrubali, Soyoung Kim and Haerang Park

Abstract

International risk sharing in OECD countries weakens during domestic recessions, when its role is most needed. Instead, no significant changes emerge during boom periods or in relation to the global business cycle. The asymmetry in the risk sharing response to cyclical fluctuations is driven mainly by dis-smoothing effects in the capital market channel and the credit market channel. Specifically, interest payments to abroad and credit constraints of households increase during domestic recessions, limiting the smoothing role of risk sharing channels. However, countries with more internationally integrated financial markets and corporate disclosure can mitigate the dis-smoothing effects of these two channels and thus the asymmetry in international risk sharing. These findings contribute to rationalise heterogeneous results in the literature on the impact of globalisation and of financial frictions on international risk sharing. From an analytical viewpoint, they caution against assessments of international risk sharing over time which do not take the business cycle into account. From a policy perspective, they establish that, contrary to part of the literature on financial frictions, financial integration and corporate disclosure do affect international risk sharing during recessions. Since our results carry over to EU countries, they support the pursuit of the Capital Markets Union and further elimination of financial barriers to the completion of the Single Market. They also call for a more active role of counter-cyclical fiscal policy: during a recession, when a negative (positive) output shock hits, net government savings should fall (rise) along with net private savings, in order to preserve consumption stability.

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1. INTRODUCTION

The empirical literature testing the effects of financial frictions (or their removal) on risk sharing among developed countries has yielded mixed results. For example, Kollmann (1996), Heathcote and Perti (2002), and Sørensen et al. (2007) document strong effects, while Lewis (1996), Bai and Zhang (2012) and Fitzgerald (2012) find negligible effects. However, when a country's degree of international risk sharing is dependent on the business cycle, its consumption can be more volatile, deviating from the level achievable in the absence of cyclicalities. If international financial markets are incomplete or imperfect, for example due to financial frictions, credit conditions can deteriorate during recessions, making economic agents in the country more credit constrained. They may have to pay higher risk premia to investors or may be unable to borrow enough from credit markets. Such hurdles would prevent countries from effectively smoothing negative output shocks through international financial markets, weakening the role of international risk sharing during recessions and letting a higher fraction of the shocks pass through to consumption. The empirical macroeconomic literature has long established that international risk sharing, at least among advanced economies, varies markedly over time (e.g., Rangvid et al., 2016). In this study we argue that the business cycle, particularly through its interaction with financial frictions, plays a significant role in this context.

International risk sharing has long been the subject of both theoretical and empirical studies. Theoretically, countries can fully insure against their output shocks in the Arrow-Debreu framework of complete international markets (Obstfeld and Rogoff, 1996). Under full risk sharing, country consumption growth should be independent of country output growth, conditional on world aggregate growth. Some initial studies, including Obstfeld (1994) and Crucini (1999), have tested the null hypothesis of full risk sharing and others, starting from Sørensen and Yosha (1998), have examined the extent of international risk sharing achieved by different mechanisms (called channels of risk sharing). These studies do not explore the relation between the degree of risk sharing and the (global and local) business cycle, although they consider risk sharing variations over time and allow for the possibility that, under incomplete risk sharing, country macro-variables may affect consumption. More recently, few studies document changes in the degree of risk sharing focusing only on economic crises (e.g., Kalemli-Ozcan et al., 2014; Rangvid et al., 2016) but have not obtained consistent results. A paper by Furceri and Zdzienicka (2015) analyses how risk sharing in the euro area is affected by local business cycles, but disregards the role of global business cycles.¹

By relaxing the assumption of a business-cycle-invariant degree of risk sharing and employing additional cyclical measures separately for domestic and global business cycles, our analysis provides a more comprehensive picture of business cycle effects on international risk sharing. First, we present empirical evidence of the asymmetry between recessions and non-recession times and between domestic and global business cycles. Using data from 21 OECD countries from 1970 to 2018, we measure the extent of international risk sharing and test for the presence of cyclicalities. In times of non-domestic recessions, 55.9% of a unit idiosyncratic output growth shock is absorbed internationally and the remaining 44.1% is translated into a change in consumption growth. However, international risk sharing becomes smaller during domestic recessions (33.4%), leaving consumption more affected by the output shock (66.6%). On the contrary, such patterns are not apparent during booms and in relation to the global business cycle.

Second, to deepen the investigation on the previous result, we build upon the variance decomposition method of Asdrubali et al. (1996) to account for the effect of recessions in each international risk sharing channel. The capital market channel, through which countries can buffer their consumption against output shocks via income flows from investments in international capital markets (portfolio diversification), turns out to be dis-smoothing during recessions, playing a major role in lowering the degree of international risk sharing. Countries face higher risk premia and depreciating exchange rates with the outbreak of negative domestic shocks and thus increased interest payments to foreign

¹ Other relevant papers focus either on U.S. states (Hoffmann and Shcherbakova-Stewen 2011) or on U.S. micro-data (Storesletten et al. 2004), while still others (e.g., Pierucci and Ventura 2010) define the business cycle by simply distinguishing between positive and negative output shocks.

investors, resulting in net income outflows and reversing the effect of the net foreign factor income channel. In addition, the credit market channel takes a part in lowering the degree of international risk sharing as households face greater credit constraints during recessions. Countries can counter consumption reduction by lowering savings or borrowing capital from domestic and international credit markets. However, households find rolling over or incurring debt more challenging than firms, a phenomenon which has intensified since the global financial crisis period with the collapse of housing prices.

Third, digging deeper on the financial imperfections which could drive the dis-smoothing role of the financial channels, we study whether financial frictions amplify the asymmetry of international risk sharing. Previous studies have documented that credit availability is constrained by financial frictions more in recessions than in booms (e.g., Bernanke and Gertler, 1989; Gertler and Gilchrist, 1994). Therefore, the observed asymmetric behavior in international risk sharing suggests financial frictions as the potential driving factor behind its cyclical nature. By employing index measures of financial integration, corporate disclosure, and capital flow restriction as proxies, we test for the interaction of financial frictions with the cyclical nature in international risk sharing. The results show that countries with more internationally integrated financial markets and lower information asymmetry between firms and investors experience international risk sharing patterns less dependent on the business cycle. These results imply that policies aimed to mitigate financial frictions can also help reduce international risk sharing asymmetry and improve stability in consumption.

Our findings improve upon previous studies by providing more generalised evidence on the asymmetry of international risk sharing. Using data from European countries, Furceri and Zdzienicka (2015) document a drop in risk sharing during economic downturns, while Kalemli-Ozcan et al. (2014) report a rise in risk sharing during the financial crisis of 2008–2009 and a subsequent drop after the European debt crisis of 2010. Rangvid et al. (2016) separate domestic and global financial crises and show that the degree of international risk sharing does not change in domestic crises but increases in global crises.² By distinguishing between negative and positive shocks both domestically and globally over 43 years, we document a full picture of cyclical fluctuations in international risk sharing, and we also identify driving factors behind the cyclical nature. In the extended analysis by subperiod, we find that the fluctuations in international risk sharing around domestic business cycles has intensified recently, a phenomenon which could not be captured fully in Rangvid et al. (2016) with earlier time series.³

Furthermore, our findings shed light on the interplay between financial frictions and the business cycle. The literature has established that the propagation of negative shocks damages balance sheets of economic agents (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997) and lending ability of banks (Bernanke and Blinder, 1988; Stein, 1998). Such propagation also considers the presence of financial frictions in the mechanism that makes external funding more costly, resulting in spending reduction. Previous studies have shown the impact of financial frictions on fluctuations in employment (Sharpe, 1994), investments (Oliner and Rudebusch, 1996), and borrowings (Bernanke et al., 1996; Gertler and Gilchrist, 1994) during recessions. Our results extend the role of financial frictions in recessions to the asymmetric functioning of international risk sharing. By focusing on cyclical nature in risk sharing at the international level, we provide evidence that financial frictions amplify domestic consumption fluctuations around the business cycle.

The remainder of the paper is structured as follows. Section 2 describes the data and the empirical framework. Section 3 discusses the empirical results on cyclical nature of international risk sharing, its channels and relation with financial frictions. Section 4 presents additional analyses using subsample periods and alternative business cycle measures. Section 5 concludes.

² Rangvid et al. (2016) argue that relatively little idiosyncratic risk during global financial crises makes international risk sharing appear greater.

³ Rangvid et al. (2016) employ country fixed effects in their regressions. In the literature on international risk sharing, it is standard not to use the country fixed effects because they blur the cross-sectional nature of international risk sharing (e.g., Asdrubali et al., 1996; Sørensen and Yosha, 1998). In fact, the inclusion of the country fixed effect absorbs the time-invariant component of idiosyncratic output, and thus overstates the degree of risk sharing and reduces the overall variance. This results in smaller drops in international risk sharing during domestic recessions and in more significant changes during global recessions (Park, 2021).

2. DATA AND EMPIRICAL METHOD

In this section, we provide an empirical framework to study if and how international consumption risk sharing varies over the business cycle. We extend the existing approach widely used in the international risk sharing literature (e.g., Asdrubali et al., 1996; Sørensen and Yosha, 1998; Crucini and Hess, 1999) by explicitly allowing for cyclical components in the degree of international risk sharing. We start from the basic test of the risk sharing proposition introduced by Cochrane (1991) and Obstfeld (1994):

$$\tilde{c}_{it} = \beta \tilde{y}_{it} + \varepsilon_{it}, \quad (1)$$

where \tilde{c}_{it} is the annual growth rate of real consumption per capita minus the cross-sectional average counterpart and \tilde{y}_{it} is the annual growth rate of real output (GDP) per capita minus the cross-sectional average counterpart for country i and time t . We compute cross-country average growth rates using time-varying weights of countries set as relative shares in the total values measured in USD.⁴ Our data are taken from the Annual National Accounts of the OECD Statistics database. The main sample consists of 966 country-year observations for 21 traditional OECD countries and 46 years from 1973 to 2018⁵ The set of countries includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the U.K., and the U.S..⁶ Table 1 presents a few descriptive statistics of key variables.

Table 1. **Descriptive Statistics**

| Countries | GDP Growth | Consumption Growth |
|-----------|-----------------|--------------------|
| OECD | 0.0172 (0.0159) | 0.0169 (0.0102) |
| Australia | 0.0166 (0.0156) | 0.0185 (0.0121) |
| Austria | 0.0182 (0.0174) | 0.0165 (0.0154) |
| Belgium | 0.0169 (0.0171) | 0.0151 (0.0127) |
| Canada | 0.0148 (0.0204) | 0.0151 (0.0134) |
| Denmark | 0.0150 (0.0202) | 0.0136 (0.0176) |
| Finland | 0.0194 (0.0305) | 0.0190 (0.0205) |
| France | 0.0152 (0.0157) | 0.0159 (0.0113) |
| Germany | 0.0176 (0.0191) | 0.0166 (0.0121) |
| Greece | 0.0087 (0.0370) | 0.0156 (0.0317) |
| Ireland | 0.0374 (0.0437) | 0.0214 (0.0285) |

⁴ The weights are calculated using country-wide figures instead of per-capita terms for large countries (e.g., United States) to take a greater share in the world GDP aggregates than small countries with high per-capita GDP (e.g., Luxembourg).

⁵ We use GDP data from 1970 to 2018 to identify domestic recessions. The first 3 years are used to construct a reliable trend and excluded in the estimation of international risk sharing.

⁶ For easy comparison with past studies, we use the same set of countries widely used in the international risk sharing literature (e.g., Asdrubali et al., 2023).

| | | |
|----------------|-----------------|-----------------|
| Italy | 0.0141 (0.0235) | 0.0139 (0.0197) |
| Japan | 0.0185 (0.0219) | 0.0188 (0.0158) |
| Netherlands | 0.0169 (0.0179) | 0.0144 (0.0147) |
| New Zealand | 0.0131 (0.0233) | 0.0134 (0.0147) |
| Norway | 0.0208 (0.0190) | 0.0220 (0.0166) |
| Portugal | 0.0190 (0.0317) | 0.0198 (0.0305) |
| Spain | 0.0173 (0.0221) | 0.0183 (0.0226) |
| Sweden | 0.0164 (0.0212) | 0.0134 (0.0131) |
| Switzerland | 0.0094 (0.0197) | 0.0088 (0.0095) |
| United Kingdom | 0.0177 (0.0213) | 0.0189 (0.0179) |
| United States | 0.0174 (0.0193) | 0.0166 (0.0135) |

Note: This table reports the means and standard deviations (in parentheses) of real per capita GDP growths and consumption growths of our sample OECD countries from 1973 to 2018. The OECD aggregate denotes cross-country average growth rates using time-varying weights of countries set as relative shares in the total output values measured in USD.

2.1. TESTING AND MEASURING FOR CYCLICALITY IN INTERNATIONAL RISK SHARING

The baseline model specification for the first step is given as follows:

$$\tilde{c}_{it} = \beta \tilde{y}_{it} + \varepsilon_{it}, \quad (2)$$

$$\beta = \beta_1 + \beta_k \mathbf{Cycle}_k$$

where \tilde{c}_{it} is the annual growth rate of real consumption per capita minus the cross-sectional average counterpart and \tilde{y}_{it} is the annual growth rate of real output (GDP) per capita minus the cross-sectional average counterpart for country i and time t . \mathbf{Cycle} is a (possibly full) vector of K domestic and global business cycle indicators: *Recession*, *Boom*, *Global Recession*, *Global Boom*. For example, *Recession* is a country-specific recession indicator, which equals 1 if the country experiences a recession and 0 otherwise.

We test for cyclicity in international risk sharing by estimating the coefficients on the interaction terms between the idiosyncratic output growth and the cycle dummies, starting with the recession indicator, in Equation (2). The conventional model in the international risk sharing literature neglects the exploration of differing degrees of international risk sharing depending on the state of the economy; thus, β_k is set to zero. Under this assumption, traditional studies (e.g., Obstfeld, 1994; Crucini, 1999; Asdrubali et al., 1996; Sørensen and Yosha, 1998) have focused only on β_1 , which reflects how much of an idiosyncratic output shock is on average transmitted to idiosyncratic consumption, and thus $1 - \beta_1$ indicates the average degree of international risk sharing (i.e., the fraction of an idiosyncratic output shock shared internationally). In this study, we generalise the model to allow for cyclical fluctuations in international risk sharing. If we reject the null hypothesis, $\beta_k = \mathbf{0}$, we can validate the presence of cyclicity in international risk sharing. The sign and magnitude of the cyclical parameters, β_k , determine how the degree of international risk sharing would change, e.g. in recession periods. In our model, the degree of international risk sharing becomes $1 - \beta_1 - \beta_2$ during recessions. The cyclical parameter can be either positive or negative, depending on the direction of fluctuations around the business cycle. A positive (negative) cyclical parameter for the interaction term implies that the degree of international risk sharing decreases (increases) in recession periods.

We first assess changes in the degree of international risk sharing between recessions and non-recession times using the baseline model. Then, we analyse a potential asymmetry between recessions and booms as well as domestic and global business cycles. We separate time periods further into recessions, booms, and normal times at both the domestic and global levels and extend the baseline model by additionally employing associated cyclical terms. The fullest version of the degree of international risk sharing is $1 - \beta_1 - \beta_2 \text{Recession} - \beta_3 \text{Boom} - \beta_4 \text{Global Recession} - \beta_5 \text{Global Boom}$. Following Sørensen and Yosha (1998), we adopt generalised least squares estimation to address potential heteroskedasticity by weighting observations with the inverse of the country-specific variance of residuals calculated from the first-stage ordinary least squares regressions.⁷

2.2. IDENTIFYING BUSINESS CYCLES

To identify recessions, we follow the conventional peak-to-trough criterion.⁸ Thereby, for each country, we define a recession as the period from a peak of economic activity to its subsequent trough. We take cyclical GDP as a proxy for the overall economic state, computed as the difference between the logarithm of real GDP in local currency and its trend level. Specifically, following Braun and Larrain (2005), troughs are identified as years when cyclical GDP falls by more than one standard deviation below zero.⁹ For each trough, we find a local peak, which is identified as the closest preceding year with a positive cyclical GDP higher than in years before and after the local peak. As a result, a recession indicator equals one for the years after the local peak and to the trough.

Regarding booms, we take the same approach as in Braun and Larrain (2005), but in the opposite direction. Peaks are identified as years when cyclical GDP rises by more than one standard deviation above zero. For each peak, we find a local trough, which is the closest preceding year with a negative cyclical GDP lower than the years before and after the local trough.¹⁰

For global recessions and booms, we use the 30% rule of Braun and Larrain (2005). We define years as global recessions (booms) when the share of countries in the world experiencing recessions (booms) is above 30%.¹¹

2.3. CHANNELS DECOMPOSITION

Based on the methodology pioneered by Asdrubali et al. (1996) and Sørensen and Yosha (1998), we can decompose the overall degree of international risk sharing $1 - \beta$ in Equation (1) into three channels of risk sharing: (1) the net foreign factor income channel, (2) the international transfer channel, and (3) the credit market channel. Idiosyncratic output growth can be rewritten as follows:

$$\tilde{y} = (\tilde{y} - \tilde{g}\tilde{n}i) + (\tilde{g}\tilde{n}i - \tilde{g}\tilde{d}i) + (\tilde{g}\tilde{d}i - \tilde{c}) + \tilde{c}, \quad (3)$$

where $\tilde{\cdot}$ indicates the deviation from cross-country aggregates (i.e., idiosyncratic part), y is real per-capita output (GDP) growth, gni is real per-capita gross national income (GNI) growth, gdi is real per-

⁷ In an alternative specification, we also control for time-specific unobservables with time fixed effects. We find that the results are similar to those without time fixed effects.

⁸ The peak-trough criterion to identify recessions has been used by the NBER's Business Cycle Dating Committee as well as in many previous studies (e.g., Braun and Larrain, 2005; Kroszner et al., 2007; Dell'Ariccia et al., 2008; Beck et al., 2016).

⁹ We calculate trend values using the Hodrick-Prescott filter with a smoothing parameter of 6.25 (Ravn and Uhlig, 2002).

¹⁰ The local troughs used to identify domestic booms are not the same as the troughs used to identify domestic recessions. When we consider the boom indicator, we further separate non-recession periods into booms and normal times.

¹¹ To identify global business cycle, we use data from 212 countries in the world including the 21 OECD countries in our main sample. Data on non-OECD countries are from the National Accounts Main Aggregates Database of the UN. The global recession periods include 1974, 1975, 1982, 1983, 1991, 1992, 1993, and 2009.

capita gross disposable income (GDI) growth, and c is real per-capita consumption growth. Here, we omit subscripts for country i and time t for simplicity.

According to the national account definition, GNI equals the sum of GDP and net foreign factor income (NFI), which is net income flow from abroad accruing to the residents in a country because of their international asset holdings (debt, equity, and foreign direct investments – FDI – which we label “capital market”), plus net cross-border labor compensations ($GDP + NFI = GNI$). GDI equals the sum of GNI and net international transfers from non-economic counterparts such as governments or international organisations (NIT) ($GNI + NIT = GDI$). Finally, consumption equals GDI minus net savings (S), where national savings include private savings by households and firms and public savings by the government ($GDI - S = C$). Therefore, the three terms on the right-hand side of Equation (3) are related to NFI, NIT, and net savings, respectively.

Multiplying both sides of Equation (3) by the idiosyncratic output growth (\tilde{y}) and taking expectations, we obtain the following variance decomposition:

$$\begin{aligned} Var(\tilde{y}) = & Cov(\tilde{y}, (\tilde{y} - \tilde{g}\tilde{n}_i)) + Cov(\tilde{y}, (\tilde{g}\tilde{n}_i - \tilde{g}\tilde{d}_i)) + Cov(\tilde{y}, (\tilde{g}\tilde{d}_i - \tilde{c})) \\ & + Cov(\tilde{y}, \tilde{c}). \end{aligned} \quad (4)$$

After dividing both sides of Equation (4) by $Var(\tilde{y})$ and rearranging, we obtain the following breakdown of international risk sharing:

$$\beta^I + \beta^T + \beta^C = 1 - \beta, \quad (5)$$

where $\beta^I (= \frac{Cov(\tilde{y}, (\tilde{y} - \tilde{g}\tilde{n}_i))}{V(\tilde{y})})$ is the net foreign factor income channel parameter, $\beta^T (= \frac{Cov(\tilde{y}, (\tilde{g}\tilde{n}_i - \tilde{g}\tilde{d}_i))}{V(\tilde{y})})$ is the international transfer channel parameter, $\beta^C (= \frac{Cov(\tilde{y}, (\tilde{g}\tilde{d}_i - \tilde{c}))}{V(\tilde{y})})$ is the credit market channel parameter, and $\beta (= \frac{Cov(\tilde{y}, \tilde{c})}{V(\tilde{y})})$ is the amount of unshared idiosyncratic output shock.

The net foreign factor income channel parameter (β^I) captures the extent to which net foreign factor income flows from abroad, e.g., interest and dividend receipts from foreign debt and equity holdings and reinvested earnings from FDI – together with net labor compensation – buffer domestic consumption against output shocks. The international transfer channel parameter (β^T) reflects the additional smoothing achieved by international transfers, and the credit market channel parameter (β^C) shows smoothing with savings adjustments via domestic and international credit markets.

This framework is normally used to decompose the overall risk sharing parameter in Equation (1), but it can also be applied to our augmented model in Equation (2).¹² In the main case with a country-specific recession indicator,¹³ the three channel parameters ($\beta^I, \beta^T, \beta^C$) can be estimated from the following set of regressions, which also account for cyclical components:

NFI channel (factor income):

$$\tilde{y}_{it} - \tilde{g}\tilde{n}_{it} = (\beta_1^I + \beta_2^I \text{Recession}_{it})\tilde{y}_{it} + \varepsilon_{it}^I, \quad (6)$$

NIT channel (transfer):

$$\tilde{g}\tilde{n}_{it} - \tilde{g}\tilde{d}_{it} = (\beta_1^T + \beta_2^T \text{Recession}_{it})\tilde{y}_{it} + \varepsilon_{it}^T,$$

Credit market channel (credit):

$$\tilde{g}\tilde{d}_{it} - \tilde{c}_{it} = (\beta_1^C + \beta_2^C \text{Recession}_{it})\tilde{y}_{it} + \varepsilon_{it}^C,$$

where the coefficients on the interaction terms between the idiosyncratic output growth and the recession indicator characterise cyclical patterns in the three channels of international risk sharing. Therefore, the percentage of an idiosyncratic shock smoothed via the net foreign factor income channel

¹² Note that the β coefficients in regressions (5) maintain the property of summing up to unity, as required by the decomposition in (4). In fact, it is straightforward to show that since the set of covariates is homogeneous across equations, the β 's sum in regressions (5) corresponds to the sum of the β s in simple regressions where each variable is replaced by the residual of its projection onto the covariates. In other words, we are recasting the variance decomposition in (4) in terms of the “netted-out” variables.

¹³ The general case features the $Cycle_k$ vector in place of the Recession indicator.

(β^I) is $\beta_1^I + \beta_2^I \text{Recession}_{it}$, that of the international transfer channel (β^T) is $\beta_1^T + \beta_2^T \text{Recession}_{it}$, and that of the credit market channel (β^C) is $\beta_1^C + \beta_2^C \text{Recession}_{it}$. The amount of unshared risk (β) is equal to $\beta_1 + \beta_2 \text{Recession}_{it}$ in our baseline model, which is estimated from the regression model of Equation (2).

To investigate deeper the nature of the asymmetry, we further decompose the net foreign factor income and credit market channels into their components. Net foreign factor income comprises net interest receipts (interest receipts and payments), net dividend receipts (dividend receipts and payments), net reinvested FDI earnings receipts, and net cross-border labor compensation receipts. Net savings comprise net corporate savings, net government savings, and net household savings. We take the same regression approach illustrated in Equation (6) to measure the degree of international risk sharing contributed by each of the channel components.

Detailed NFI channel (factor income):

$$\tilde{y}_{it} - (y_{it} + \widetilde{nft}_{it}^I) = (\beta_1^{Ij} + \beta_2^{Ij} \text{Recession}_{it}) \tilde{y}_{it} + \varepsilon_{it}^{Ij}, \quad (7)$$

$j = [\text{net interest receipt, net dividend receipt, net FDI receipts, net wage receipts}],$

Detailed credit market channel (credit):

$$\tilde{y}_{it} - (y_{it} - \widetilde{s}_{it}^h) = (\beta_1^{Ch} + \beta_2^{Ch} \text{Recession}_{it}) \tilde{y}_{it} + \varepsilon_{it}^{Ch},$$

$h = [\text{net corporate savings, net government savings, net household savings}].$

2.4. FINANCIAL FRICTIONS

To examine whether financial frictions actually amplify the cyclical nature of international risk sharing, we augment the regression model of Equation (2) by including additional interaction terms representing financial frictions:

$$\tilde{c}_{it} = (\beta_1^F + \beta_2^F \text{Recession}_{it} + \beta_3^F \text{Friction}_{it} \text{Recession}_{it}) \tilde{y}_{it} + \varepsilon_{it}^F, \quad (8)$$

where the friction parameter (β_3) is interpreted as the extent to which financial frictions drive cyclical patterns in international risk sharing. If it is significantly estimated with the same sign of the cyclical parameter (β_2), we can argue that financial frictions intensify cyclical nature in international risk sharing and its impact on consumption.

We capture different aspects of financial frictions by employing various measures of financial integration, corporate disclosure, and capital flow restriction. Following the international economics literature (e.g., Demirgüç-Kunt and Levine, 2001; Mendoza et al., 2009; Kalemli-Ozcan et al., 2014), we measure the degree of financial integration as the ratio of foreign assets and liabilities to GDP. As for corporate disclosure, we use the business extent of disclosure index developed by the World Bank since 2005, which measures how investors are protected through the disclosure of ownership and financial information. The disclosure index ranges from 0 to 10, with higher values indicating more disclosure. Furthermore, we consider frictions to international capital flows using the capital control indicator provided by Fernández et al. (2016) since 1997. The capital control indicator measures the prevalence of restrictions for outflows for 10 different asset categories, including money market instruments, bonds, and equities. The restriction index ranges from 0 to 1, with higher values indicating more capital controls. For ease of interpretation, we take negative values of financial integration and corporate disclosure.

3. RESULTS

3.1. CYCLICALITY IN INTERNATIONAL RISK SHARING

The average proportion of an idiosyncratic output shock unshared internationally is 53.4% for the 21 OECD countries (see Table 2). However, this result from the conventional international risk sharing model in Equation (1), masks variations around business cycles.

Table 2. **International Risk Sharing**

| | (1) Unshared | (2) Factor Income | (3) Transfers | (4) Credit |
|--------------------|-----------------------|----------------------|--------------------|-----------------------|
| \tilde{y} | 0.5339*** (0.0612) | 0.0720** (0.0319) | 0.0015 (0.0083) | 0.3926*** (0.0571) |
| adj-R ² | 0.4277 | 0.0092 | 0.0001 | 0.1638 |
| observations | 966 | 966 | 966 | 966 |

Note: This table reports the results from panel regressions of (1) \tilde{c} , (2) $\tilde{y} - \tilde{g}\tilde{n}_i$, (3) $\tilde{g}\tilde{n}_i - \tilde{g}\tilde{a}_i$, and (4) $\tilde{g}\tilde{a}_i - \tilde{c}$ on idiosyncratic GDP growth (\tilde{y}). Standard errors are in parentheses. ***, ** denote coefficients that are statistically significant at 1% and 5%, respectively.

By extending the conventional model with cyclical terms, we discover substantial asymmetries in international risk sharing, particularly during recessions. Table 3 shows the results from our regression in Equation (2), where each specification implements a different dimension of the \mathbf{Cycle}_K vector. In Column (1) of Table 3, the coefficient on idiosyncratic output growth (\tilde{y}) is estimated to be 44.1%, which means that, in non-recession times, 44.1% per unit idiosyncratic risk is not shared internationally and leads to a decline in idiosyncratic consumption (\tilde{c}). Therefore, the degree of international risk sharing for the OECD countries is 55.9% in non-recession times. However, during recessions, the degree of international risk sharing gets much lower than the non-recession time level. The coefficient on the interaction term between the idiosyncratic output growth and the recession indicator ($Recession \times \tilde{y}$) is estimated to be 22.5%. This indicates that the proportion of idiosyncratic risk left unshared internationally rises by 22.5% during recessions compared to normal times. Accordingly, the degree of international risk sharing decreases from 55.9% to 33.4% in recessions.

Table 3. **International Risk Sharing over Business Cycles**

| | Δc | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| \tilde{y} | 0.4411*** (0.0854) | 0.5183*** (0.0344) | 0.5576*** (0.0484) | 0.4953*** (0.0422) | 0.4915*** (0.0473) | 0.4885*** (0.0525) |
| $Recession \times \tilde{y}$ | 0.2245** (0.1006) | 0.1430*** (0.0515) | | 0.1426*** (0.0521) | 0.1537** (0.0625) | 0.1680** (0.0772) |
| $Boom \times \tilde{y}$ | | 0.0323 (0.0733) | | 0.0101 (0.0816) | 0.0117 (0.0804) | 0.0097 (0.0856) |
| $Global\ Recession \times \tilde{y}$ | | | 0.0439 (0.0614) | 0.0225 (0.0614) | 0.0357 (0.0786) | 0.0398 (0.0873) |
| $Global\ Boom \times \tilde{y}$ | | | 0.0772 (0.0688) | 0.0945 (0.0794) | 0.0946 (0.0800) | 0.1078 (0.1066) |
| $Recession \times Global\ Recession \times \tilde{y}$ | | | | | -0.0288 (0.1014) | -0.0463 (0.1202) |
| $Recession \times Global\ Boom \times \tilde{y}$ | | | | | | -0.0481 (0.1529) |
| adj-R ² | 0.4395 | 0.4853 | 0.4842 | 0.4872 | 0.4876 | 0.4881 |
| Observations | 966 | 966 | 966 | 966 | 966 | 966 |

Note: This table shows the results from panel regressions of idiosyncratic consumption growth (\tilde{c} ; i.e., deviation from real per-capita world aggregate consumption growth) on idiosyncratic GDP growth (\tilde{y} ; i.e., deviation from real per-capita world aggregate GDP growth) and additional interaction terms with domestic recession (Recession), domestic boom (Boom), global recession (Global Recession), and global boom (Global Boom) indicators. Standard errors are in parentheses. ***, ** denote coefficients that are statistically significant at 1% and 5%, respectively.

The significant drop in international risk sharing during recessions is robust to a more detailed decomposition of business cycles. We include the interaction terms between idiosyncratic output growth and the boom indicator ($Boom \times \tilde{y}$) in Column (2) and global recession and boom indicators, ($Global\ Recession \times \tilde{y}$) and ($Global\ Boom \times \tilde{y}$) in Columns (3) and (4) of Table 3, respectively. However, the associated coefficients are small in magnitude and statistically insignificant. We further control for both domestic and global business cycles simultaneously in Column (5) of Table 3 and check that weakened international risk sharing during domestic recessions is not driven by times when global economy also contracts and cannot smooth out negative domestic shocks. In any alternative model specifications, the degree of international risk sharing is down to around 35% in domestic recessions, with an incremental decrease of 14.3% to 22.5% compared to non-recession times.¹⁴

The results suggest that international risk sharing does not function well particularly when it is most needed. The primary role of international risk sharing is to buffer against an idiosyncratic output shock and mitigate its negative impact on domestic consumption. Because of international risk sharing, a drop in domestic GDP given constant global GDP growth does not translate fully into a decrease in domestic consumption. The idiosyncratic shock is partially shared internationally with income from abroad or borrowings from the international credit market. Only the remaining unshared shock does affect domestic consumption. According to the estimate from our baseline model in Column (1) of Table 3, the idiosyncratic consumption growth should be -0.44% in response to an idiosyncratic output growth shock of -1% in the case of the OECD countries. However, as the role of international risk sharing weakens during recessions, the pass-through gets stronger, resulting in idiosyncratic consumption growth of -0.66%. If a country cannot mitigate these cyclical fluctuations, it will achieve a lower degree of consumption smoothing.

Our findings complement previous studies by providing more detailed evidence on the cyclicity of international risk sharing. Kalemli-Ozcan et al. (2014) show that international risk sharing was lower in the European debt crisis of 2010. Rangvid et al. (2016) separate domestic and global crises and show that the degree of international risk sharing does not change in domestic crises but increases in global crises. They argue that relatively little idiosyncratic risk during global crises makes international risk sharing appear greater. By distinguishing between negative and positive shocks, both domestically and globally, over 43 years, we document a full picture of cyclical fluctuations in international risk sharing. In the extended analysis in Section 4.1, we document that the cyclicity in international risk sharing has intensified recently, a phenomenon which could not be fully captured in Rangvid et al. (2016) with earlier time series.

3.2. CHANNELS OF CYCLICAL INTERNATIONAL RISK SHARING

Using the method illustrated in Section 2.3, we investigate three channels of cyclical international risk sharing: the foreign factor income channel, the international transfer channel, and the credit market channel. Table 4 provides the results from the regressions of Equation (6) on the channel decomposition. Column (1) of Table 4 presents the same results from our baseline model, tabulated in Column (1) of Table 3. The unshared proportion of an idiosyncratic output shock in Column (1) can be compared with those smoothed out internationally through the foreign factor income channel in Column (2), the international transfer channel in Column (3), and the credit market channel in Column (4) of Table 4. In normal times, 55.9% of idiosyncratic risk is shared mainly through the credit market channel (41.6%). In response to a negative output shock, economic agents can reduce savings or borrow from domestic and international credit markets to maintain their consumption levels. The rest of international risk sharing is

¹⁴ International risk sharing could be further affected during domestic recessions when the rest of the world is experiencing a boom or a recession. To address these cases, we augment our specifications by additionally including triple interaction terms with domestic recession and global boom/recession indicators.

carried out by the net foreign factor income channel (13.8%), which helps further cushion consumption with net factor income flows from abroad. Risk sharing via the international transfer channel (0.9%) is both statistically and economically insignificant.

Table 4. **Channels of Cyclical International Risk Sharing**

| | (1) Unshared | (2) Factor Income | (3) Transfer | (4) Credit |
|--------------------------------|-----------------------|-----------------------|---------------------|-----------------------|
| \tilde{y} | 0.4411*** (0.0854) | 0.1377*** (0.0441) | 0.0094 (0.0094) | 0.4164*** (0.0917) |
| <i>Recession</i> × \tilde{y} | 0.2245** (0.1006) | -0.1450** (0.0590) | -0.0151 (0.0161) | -0.0643 (0.1106) |
| adj-R ² | 0.4395 | 0.0171 | 0.0016 | 0.1637 |
| observations | 966 | 966 | 966 | 966 |

Note: This table shows the results from panel regressions of (1) \tilde{c} , (2) $\tilde{y} - \tilde{g}\tilde{n}_i$, (3) $\tilde{g}\tilde{n}_i - \tilde{g}\tilde{d}_i$, and (4) $\tilde{g}\tilde{d}_i - \tilde{c}$ on idiosyncratic GDP growth (\tilde{y}) and additional interaction terms with domestic recession (*Recession*) indicator in each column, respectively. Standard errors are in parentheses. ***, **, * denote coefficients that are statistically significant at 1%, 5%, and 10%, respectively.

We find that cyclical fluctuations of international risk sharing are driven mainly by the foreign factor income channel and the credit market channel. A dis-smoothing effect of -14.5% occurs during recessions in the foreign factor income channel, completely neutralising its role in international risk sharing. Another dis-smoothing effect of 6.4% comes from the credit market channel, reducing its role in international risk sharing to 35.2% during recessions. The results on the foreign factor income channel are similar to those of Balli et al. (2013), who focus solely on the role of the income channel and find it dis-smoothing before the global financial crisis and smoothing in the post-crisis period. As further discussed in Section 4.1, the dis-smoothing effect of the income channel in our analysis is driven mostly by the period before the global financial crisis, and becomes insignificant after the crisis. Regarding the credit market channel, its dis-smoothing effect is insignificant in Table 4 for recessions but becomes more dominant in recent periods after the crisis, as discussed also in Section 4.1. Consistently with the literature, the international transfer channel does not play a relevant role.

A more detailed decomposition of the foreign factor income channel indicates that the main source of the dis-smoothing effect during recessions is an increase in interest payments to foreign investors. In Table 5, we separate the net foreign factor income into net interest receipts in Column (2), net dividend receipts in Column (3), and net reinvested earnings from foreign direct investments (FDI) in Column (4). Due to data availability, we conduct the analysis using a subsample without missing observations. The results show that net interest income outflows during recessions are only partly offset by net income flows from dividends and FDI reinvested earnings. We further decompose the net interest and dividend income flows in Columns (5) to (8) of Table 5. The channel breakdown shows that there are smoothing effects of dividend income receipts from abroad during recessions, which are overridden by increased interest payments to abroad. These effects may seem in contrast with the intuition that both inward receipts and, according to Balli et al. (2010,2013), especially outward payments should exert a stronger income smoothing effect during domestic recessions. In fact, however, recessions are all about changes in credit spreads (Cochrane, 2011). Interest payments by borrowers increase during recessions and more intensely during financial crises (Muir, 2017). Global capital markets are likely to consider a recession as an additional risk factor that raises the possibility of financial distress and alters the perception of a country-specific risk. In a consumption-based asset pricing model, Campbell and Cochrane (1999) argue that risk aversion is reinforced by recession risks, which makes risk premia countercyclical. Accordingly, interest rates and exchange rates increase during recessions, leading to higher interest payments for foreign ownership of domestic assets. As for dividends, our results seem to unveil the practice of dividend smoothing (Lintner, 1956; Brav et al., 2005) – carried out mostly by corporation managers – which leads to a similar dividend policy both during recessions and during normal times. In addition to this financial analysis, we check the role of the net compensation of employees from abroad, the remaining item of the net foreign factor income, in the untabulated analysis. Using the subsample with

available observations, we find that the total value of net employee compensation is small and its role in international risk sharing is also small in magnitude and statistically insignificant.¹⁵

Table 5. Detailed Decomposition of Foreign Factor Income Channel

| | (1) Factor Income | (2) Interest | (3) Dividend | (4) FDI Reinvested Earnings |
|--------------------------------|-------------------------|-------------------------|-------------------------|--------------------------------------|
| \tilde{y} | 0.1440*** (0.0515) | 0.3542*** (0.0913) | -0.0438 (0.0307) | -0.1664*** (0.0631) |
| <i>Recession</i> × \tilde{y} | -0.1362* (0.0709) | -0.4483*** (0.1210) | 0.1743*** (0.0535) | 0.1377** (0.0695) |
| adj-R ² | 0.0179 | 0.0526 | 0.0163 | 0.0379 |
| Observations | 624 | 624 | 624 | 624 |
| | (5) Interest Receipt | (6) Interest Payment | (7) Dividend Receipt | (8) Dividend Payment |
| \tilde{y} | 0.0049 (0.0528) | 0.3493*** (0.0745) | -0.0363 (0.0323) | -0.0075 (0.0226) |
| <i>Recession</i> × \tilde{y} | 0.0560 (0.0662) | -0.5042*** (0.1155) | 0.1586*** (0.0537) | 0.0157 (0.0273) |
| adj-R ² | 0.0079 | 0.0487 | 0.0171 | 0.0003 |
| observations | 624 | 624 | 624 | 624 |

Note: This table shows the results on the net foreign factor income channel in Column (1), and its specific components including net interest, dividend, and FDI reinvested earnings in Columns (2) to (8) using subsample with available observations. Standard errors are in parentheses. ***, **, * denote coefficients that are statistically significant at 1%, 5%, and 10%, respectively.

As for the credit market channel, the dis-smoothing effect during recessions is driven by net savings of households. Financial institutions become reluctant to roll over debt in recessions, and economic agents face more significant financial constraints. Under this unstable state, economic agents cannot decrease savings or increase borrowings much to counteract consumption reduction. Net savings are categorised into three types of economic agents: corporate, government, and household. We present a more detailed decomposition of the credit market channel in Table 6, using subsample with available observations. A significantly large dis-smoothing effect occurs in net savings of households, which is offset partially by the smoothing effect by corporate net savings. This suggests that households become more credit constrained than other savers and their consumptions are most affected by a recession. As further discussed in Section 4.1, this dis-smoothing effect is more apparent after the global financial crisis when balance sheets and credit availability of households weakened as housing collateral values decreased (Cloyne et al., 2019).

Table 6. Detailed Decomposition of Credit Market Channel

| | (1) Credit (Net Saving) | (2) Corporate | (3) Government | (4) Household |
|--------------------------------|----------------------------|----------------------|-----------------------|------------------------|
| \tilde{y} | 0.4756*** (0.0533) | 0.0724 (0.0587) | 0.2774*** (0.0383) | -0.0019 (0.0609) |
| <i>Recession</i> × \tilde{y} | -0.1568** (0.0762) | 0.2446** (0.0969) | 0.0601 (0.0687) | -0.3313*** (0.0998) |
| adj-R ² | 0.1825 | 0.0489 | 0.1694 | 0.0548 |
| observations | 619 | 619 | 619 | 619 |

Note: This table shows the results on the credit market channel in Column (1) and its specific components including corporate, government, and household net savings in Columns (2) to (4) using subsample with available observations. Standard errors are in parentheses. ***, ** denote coefficients that are statistically significant at 1% and 5%, respectively.

¹⁵ This result is also in line with the analysis conducted in a different time interval by Balli et al. (2011).

The policy implication of our findings calls for a more active role of counter-cyclical fiscal policy. During a recession, when a negative (positive) output shock hits, net government savings should fall (rise) along with net private savings, in order to maintain consumption stability.

3.3. FINANCIAL FRICTIONS AND CYCLICAL INTERNATIONAL RISK SHARING

In this section, we analyse the role of financial frictions in the cyclical risk sharing. In frictionless markets, the cost of external finance is the same as the opportunity cost of internal finance. However, when information asymmetry between borrowers and lenders as well as costly enforcement of loan contracts arise, rational investors impose limits to the terms of lending, dependent on the size of balance sheets of borrowers. This makes raising funds externally more expensive than using internal funds (Bernanke and Gertler, 1989).¹⁶ Upon a negative output shock, balance sheets of households and nonfinancial firms weaken, constraining their ability to provide collateral to external finance. Recent recessions including the global financial crisis associate more with banking distress, in which banks face bank run risk and decide not to roll over existing debts (Gertler et al., 2017). Moreover, risk aversion is reinforced by recession risks, which in turn induces higher risk premium and thus interest payments during downturns (Campbell and Cochrane, 1999). These mechanisms are more potent in recessions than in booms, and this asymmetric behavior has been documented in previous studies (e.g., Bernanke and Gertler, 1989; Gertler and Gilchrist, 1994).

Given the asymmetry between recessions and booms as well as cyclical changes in the capital market and credit market channels, cyclical risk sharing is likely to be associated with financial frictions. Countries faced with more financial frictions would experience more cyclical fluctuations in international risk sharing. When financial markets are more internationally integrated, foreign financial institutions unaffected by the domestic output shock can cushion a sharp decline in credit availability during recessions, which would be reflected in the credit market channel. In addition, corporate disclosure helps reducing information asymmetry between borrowers and investors,¹⁷ lowering risk premium and interest payments considered in the foreign factor income channel. To test the hypothesis on the association between financial frictions and cyclical risk sharing, we extend the main model as in Equation (8) by employing additional interactions terms with financial frictions proxied by financial integration, corporate disclosure, and capital flow restriction.

Overall, financial frictions amplify cyclical patterns in international risk sharing. Table 7 presents the results on the effects of financial integration on cyclical risk sharing in Panel A, those of corporate disclosure in Panel B, and those of capital flow restriction in Panel C. Each column represents different channels of international risk sharing along with the size of unshared risk. For comparability, we take negative values of financial integration and corporate disclosure.

Table 7. **Financial Frictions and Cyclical International Risk Sharing**

| | (1) Unshared | (2) Factor Income | (3) Transfer | (4) Credit |
|--|--------------|-------------------|--------------|------------|
| Panel A. -Integration | | | | |
| \hat{y} | 0.3820*** | 0.0878* | 0.0053 | 0.5249*** |
| | (0.1231) | (0.0479) | (0.0123) | (0.1036) |
| <i>Recession</i> × \hat{y} | 0.3689*** | -0.1041 | 0.0027 | -0.2676** |
| | (0.1339) | (0.0699) | (0.0164) | (0.1282) |
| <i>Friction</i> × <i>Recession</i> × \hat{y} | 0.0107*** | -0.0037 | 0.0015*** | -0.0085*** |
| | (0.0037) | (0.0035) | (0.0004) | (0.0021) |
| adj-R ² | 0.4657 | 0.0071 | 0.0033 | 0.1858 |
| Observations | 652 | 652 | 652 | 652 |
| Panel B. -Disclosure | | | | |
| \hat{y} | 0.2371* | 0.1585*** | -0.0137 | 0.6181*** |
| | (0.1251) | (0.0429) | (0.0093) | (0.1164) |

¹⁶ Bernanke and Gertler (1989) call "external finance premium" the difference between the costs of external and internal finance.

¹⁷ See Healy and Palepu (2001) for a review of the literature on corporate disclosure and information asymmetry.

| | | | | |
|--|-----------|-----------|----------|-----------|
| <i>Recession</i> × \tilde{y} | 0.6198*** | -0.2144** | -0.0071 | -0.3978** |
| | (0.1482) | (0.0885) | (0.0157) | (0.1826) |
| <i>Friction</i> × <i>Recession</i> × \tilde{y} | 0.0407** | -0.0304* | -0.0009 | -0.0095 |
| | (0.0201) | (0.0155) | (0.0035) | (0.0255) |
| adj-R ² | 0.4532 | 0.0301 | 0.0088 | 0.2525 |
| Observations | 294 | 294 | 294 | 294 |
| Panel C. Restriction | | | | |
| \tilde{y} | 0.4681*** | 0.0649 | -0.0018 | 0.4827*** |
| | (0.0487) | (0.0410) | (0.0062) | (0.0621) |
| <i>Recession</i> × \tilde{y} | 0.2096* | -0.0324 | -0.0182 | -0.2506** |
| | (0.1091) | (0.0684) | (0.0152) | (0.1113) |
| <i>Friction</i> × <i>Recession</i> × \tilde{y} | 0.3314 | 0.2305 | 0.0173 | -0.1646 |
| | (0.7989) | (0.0155) | (0.2259) | (0.8976) |
| adj-R ² | 0.4469 | 0.0081 | 0.0051 | 0.1571 |
| Observations | 483 | 483 | 483 | 483 |

Note: This table shows the results from panel regressions of (1) \tilde{c} , (2) $\tilde{y} - \tilde{g}\tilde{n}_i$, (3) $\tilde{g}\tilde{n}_i - \tilde{g}\tilde{d}_i$, and (4) $\tilde{g}\tilde{d}_i - \tilde{c}$ on idiosyncratic GDP growth (\tilde{y}) and additional interaction terms with financial friction measures as well as the domestic recession indicator (*Recession*) in each column, respectively. Integration, Disclosure, and Restriction indicate financial market integration, corporate information disclosure, and capital flow restriction, measured as indicated in section 2.4. Note that for comparability, we take negative values of financial integration and corporate disclosure. Standard errors are in parentheses. ***, **, * denote coefficients that are statistically significant at 1%, 5%, and 10%, respectively.

We find that countries with less internationally integrated financial markets and more corporate information opacity have much lower international risk sharing during recessions. Economic agents have better access to credit if domestic financial markets are more integrated into greater global markets where foreign investors independent of domestic shocks can provide sustainable credit. In fact, financial market integration enhances international risk sharing mainly through the credit market channel (Column (4) in Panel A of Table 7). Financial reporting quality helps mitigate information asymmetry between borrowers and lenders but also between informed and uninformed investors (Wittenberg-Moerman, 2008) and allows better lending arrangements during financial distress (Holmstrom and Tirole, 1997). The results also show that corporate disclosure improves the smoothing effect of the foreign factor income channel during recessions (Column (2) in Panel B of Table 7). Capital flow restrictions seem to weaken the credit market channel of international risk sharing during recessions (Column (4) in Panel C of Table 7); however, they lack statistical significance, possibly due to limited variation in the capital control index for the sub-sample of countries.

Our findings emphasise the macroeconomic implications of financial frictions for consumption stability. Economic agents use credit markets to insure against a negative shock. During recessions with tightened credit conditions, economic agents are likely to have a difficulty in raising funds and pay extra risk premiums, which leads to increased interest payments and limited cushioning from savings and borrowings. These outcomes lead to a weakened smoothing role of the foreign income and credit market channels during recessions as observed in Section 3.2. These outcomes would be more apparent if a country were not equipped with well-functioning and internationally integrated financial markets. Information asymmetry between firms and investors as well as restrictions to capital flows across countries further generate a burden to a country in need of credit. Therefore, financial frictions worsen already tightened credit conditions during recessions and contribute to cyclical risk sharing and consumption volatility.

Furthermore, our findings expand the literature on financial frictions and the business cycle by shedding more light on the role of financial frictions in the cyclical risk sharing. The financial literature has established that the propagation of negative shocks damages the balance sheets of economic agents (Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997) and the lending ability of banks (Bernanke and Blinder, 1988; Stein, 1998). Such propagation also considers the presence of financial frictions in the mechanism that makes external funding more costly, resulting in spending reduction. Previous studies have shown the impact of financial frictions on fluctuations in employment (Sharpe, 1994), investments (Oliner and Rudebusch, 1996), and borrowings (Bernanke et al., 1996; Gertler and Gilchrist, 1994) around recessions. In terms of risk sharing, Hoffmann and Shcherbakova-Stewen (2011) argue that banking deregulation mitigates cyclical risk sharing because it is likely to improve access to credit markets for small businesses. By focusing on cyclical risk

sharing at the international level, we provide evidence that financial frictions do amplify domestic consumption fluctuations around the business cycle. Since our results carry over to EU countries (see Section 4.3), their policy implication is a support to the pursuit of the Capital Markets Union and to the further elimination of financial barriers to the completion of the Single Market.

4. EXTENDED ANALYSIS

4.1. CYCLICAL INTERNATIONAL RISK SHARING IN SUB-PERIODS

To examine how cyclical patterns of international risk sharing have evolved over the period under exam, we divide the sample period into three subperiods: (1) 1973 to 1990, (2) 1991 to 2007, and (3) 2008 to 2018. The first period covers the 1970s and the 1980s before the collapse of former communist countries and the German reunification. The second period ranges from the 1990s to the period before the global financial crisis. The third period covers the years including the global financial crisis and its aftermaths. We re-estimate our baseline model of Equation (2) for each of the subperiods.

We find that the cyclical nature of international risk sharing exhibits slightly different patterns across subperiods, with more fluctuations in recent periods. The results are in Panel A of Table 8 for the first period, Panel B for the second period, and Panel C for the third period. There are three main findings. First, cyclical nature of international risk sharing is not apparent before the 1990s. Although we observe a dis-smoothing effect of 10.2% in the foreign factor income channel (Column (2) of Panel A), it is not statistically significant and is mostly offset by a smoothing effect of 8.8% via the credit market channel (Column (4) of Panel A), resulting in a relatively small rise in unshared risk (4.3%, Column (1) of Panel A) during recessions. This result is probably due to the effectively scarce impact of recessions on factor incomes, in a period of administrative capital market restrictions throughout the OECD. Second, the cyclical nature of international risk sharing in the second subperiod is predominantly driven by the foreign factor income channel. The dis-smoothing effect of 28.0% in the foreign factor income channel (Column (2) of Panel B) is only partially offset by a smoothing effect of 9.1% in the credit market channel (Column (4) of Panel B), which leads to an increase in the unshared risk by 18.9% (Column (1) of Panel B) during recessions.

Table 8. **Cyclical International Risk Sharing in Subperiods**

| | (1) Unshared | (2) Factor Income | (3) Transfer | (4) Credit |
|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Panel A. 1973-1990 | | | | |
| \tilde{y} | 0.5591*** (0.0690) | 0.0817 (0.0844) | 0.0085 (0.0184) | 0.3507*** (0.0975) |
| <i>Recession</i> × \tilde{y} | 0.0426 (0.0956) | -0.1021 (0.0989) | -0.0290 (0.0295) | 0.0885 (0.1213) |
| adj-R ² | 0.4370 | 0.0086 | 0.0035 | 0.1916 |
| Observations | 378 | 378 | 378 | 378 |
| Panel B. 1991-2007 | | | | |
| \tilde{y} | 0.5520*** (0.0473) | 0.1827** (0.0902) | 0.0123 (0.0198) | 0.2530** (0.0905) |
| <i>Recession</i> × \tilde{y} | 0.1888* (0.1066) | -0.2796** (0.1254) | 0.0002 (0.0263) | 0.0905 (0.1414) |
| adj-R ² | 0.5034 | 0.0223 | 0.0052 | 0.0743 |
| Observations | 357 | 357 | 357 | 357 |
| Panel C. 2008-2018 | | | | |
| \tilde{y} | 0.3775*** (0.0797) | 0.1156** (0.0518) | -0.0098** (0.0038) | 0.5351*** (0.1011) |
| <i>Recession</i> × \tilde{y} | 0.4085*** (0.1011) | -0.0711 (0.0818) | -0.0199* (0.0114) | -0.2986** (0.1394) |
| adj-R ² | 0.6003 | 0.0237 | 0.0399 | 0.2365 |
| Observations | 231 | 231 | 231 | 231 |

Note: This table shows the results from panel regressions of idiosyncratic consumption growth (\tilde{c} ; i.e., deviation from real per-capita world aggregate consumption growth) on idiosyncratic GDP growth (\tilde{y} ; i.e., deviation from real per-capita world

aggregate GDP growth) and additional interaction terms with domestic recession (Recession) indicator for subsample periods in each panel. Standard errors are in parentheses. ***, ** denote coefficients that are statistically significant at 1% and 5%, respectively.

Third, the degree of international risk sharing overall increases in the third period but fluctuates more severely around the business cycle, largely due to a dis-smoothing effect in the credit market channel. The dis-smoothing effect via the foreign factor income channel in recessions diminishes to 7.1% (Column (2) of Panel C). However, a dis-smoothing effect of 29.9% occurs in the credit market channel, limiting its contribution to international risk sharing from 53.5% in non-recession times to 23.7% in recessions (Column (4) of Panel C). Accordingly, the proportion of unshared risk increases from 37.8% in non-recession times to 78.6% in recessions (Column (1) of Panel C). An unprecedented monetary easing with almost zero interest rates may have helped reduce interest payments to foreign investors during recessions in this subperiod, weakening the dis-smoothing effect of the foreign factor income channel. Conversely, liquidity shocks combined with the collapse of housing prices in recessions of the period may have facilitated a dis-smoothing effect in the credit market channel, because these factors deteriorate credit availability, particularly for households who mostly borrow against home equity as collateral. The dis-smoothing response of the credit market to the financial crisis appears to have been mostly driven by the retrenchment in cross-border interbank flows in the eurozone, not compensated by direct banking integration, by the scarce equity market integration and by the limited role of bond market integration (Hoffmann et al. 2019).

4.2. ALTERNATIVE BUSINESS CYCLE MEASURE

To check the robustness of our main findings on cyclical international risk sharing in Section 3.1, we employ an alternative measure of business cycles. Recessions are identified as the years when a country-level real per-capita GDP growth rate falls below its average level ($y < \bar{y}$) and the output deviation relative to its world aggregate is negative ($\tilde{y} < 0$).

Table 9 presents the results using the alternative measure of domestic business cycles, which are qualitatively consistent with those in Section 3.1.¹⁸ In Table 9, the coefficient on the interaction term with the alternative recession indicator is approximately 19.0%, again suggesting lower international risk sharing in recessions. 10.3 percentage points of the decrease is owed to a dis-smoothing effect of the foreign factor income channel.

Table 9. **Alternative Business Cycle Measure**

| | (1) Unshared | (2) Factor Income | (3) Transfer | (4) Credit |
|---|-----------------------|-----------------------|---------------------|-----------------------|
| \tilde{y} | 0.4480*** (0.0896) | 0.1187*** (0.0394) | 0.0038 (0.0109) | 0.4294*** (0.0895) |
| $1_{\tilde{y} < 0, y < \bar{y}} \times \tilde{y}$ | 0.1895* (0.0997) | -0.1031* (0.0608) | -0.0051 (0.0167) | -0.0814 (0.1034) |
| adj-R ² | 0.4410 | 0.0139 | 0.0002 | 0.1655 |
| Observations | 966 | 966 | 966 | 966 |

Note: This table shows the results from panel regressions of idiosyncratic consumption growth (\tilde{c} ; i.e., deviation from real per-capita world aggregate consumption growth) on idiosyncratic GDP growth (\tilde{y} ; i.e., deviation from real per-capita world aggregate GDP growth) and interaction terms of idiosyncratic GDP growth with alternative business cycle measure. ***, * denote coefficients that are statistically significant at 1% and 10%, respectively.

¹⁸ Using the alternative measure of domestic business cycles, we also find similar results for the detailed decomposition of the foreign factor income channel as in Table 5, where its dissmoothing effects during domestic recessions are mainly driven by increased net interest payments abroad.

4.3. CYCLICAL INTERNATIONAL RISK SHARING IN THE EU SUB-SAMPLE

To check whether geographical or institutional factors influence our main result, we run the regressions in system (6) on the sub-sample of OECD countries which belong to the European Union. As Table 10 shows, the results are again consistent with those in our main analysis using the full sample.

Table 10. **Cyclical International Risk Sharing in the EU Subsample**

| | (1) Unshared | (2) Factor Income | (3) Transfer | (4) Credit |
|--------------------------------|-----------------------|-----------------------|---------------------|-----------------------|
| \tilde{y} | 0.3915*** (0.1045) | 0.1256*** (0.0428) | 0.0005 (0.0098) | 0.4823*** (0.1007) |
| <i>Recession</i> × \tilde{y} | 0.2735** (0.1154) | -0.1203** (0.0545) | -0.0098 (0.0172) | -0.1435 (0.1173) |
| adj-R ² | 0.4339 | 0.0227 | 0.0015 | 0.2405 |
| observations | 598 | 598 | 598 | 598 |

Note: This table shows the results from panel regressions of (1) \tilde{c} , (2) $\tilde{y} - \tilde{g}\tilde{n}_i$, (3) $\tilde{g}\tilde{n}_i - \tilde{g}\tilde{d}_i$, and (4) $\tilde{g}\tilde{d}_i - \tilde{c}$ on idiosyncratic GDP growth (\tilde{y}) and additional interaction terms with domestic recession (*Recession*) indicator in each column, respectively, using the subsample of EU countries. Standard errors are in parentheses. ***, **, * denote coefficients that are statistically significant at 1%, 5%, and 10%, respectively.

5. CONCLUSION

The economic literature has long established that international risk sharing varies both cross-sectionally and over time. In this study, we provide evidence that international risk sharing in the OECD countries is highly dependent on the business cycle, which makes consumption smoothing less effective. International risk sharing weakens during domestic recessions when its role is most needed to counteract a negative impact on consumption. However, it maintains almost the same size during booms and around global business cycles. By breaking down the degree of international risk sharing into three channels, we document that the cyclicity is driven mainly by dis-smoothing effects in the capital market channel and in the credit market channel. In particular, increased interest payments to foreign investors and constrained credit availability for households contribute largely to the dis-smoothing of the channels. These cyclical fluctuations—almost absent in the period prior to financial globalisation—have surfaced afterwards and become more intense since the global financial crisis of 2008 when liquidity shocks, combined with the collapse of housing prices, have deteriorated credit conditions of households. We also show that financial frictions are related to the cyclicity. Indeed, financial market integration and corporate disclosure mitigate potential dis-smoothing effects from the foreign factor income channel and the credit market channel, respectively.

Our results are robust to different business cycle definitions, to different specifications, and to different institutional settings. Our findings help explain the conflicting results of studies on the effect of (financial) globalisation on risk sharing. To the extent that financial integration occurs during booms or normal times, its impact on international risk sharing may be negligible, so as to make estimations which do not take the domestic cycle into account statistically insignificant. Furthermore, our findings help rationalise why the literature on financial frictions and risk sharing reached different results, in the absence of business cycle controls. Indeed, they establish that, contrary to part of the literature on financial frictions, financial integration and corporate disclosure do affect international risk sharing during recessions. Since our results carry over to EU countries, they support the pursuit of the Capital Markets Union and further elimination of financial barriers to the completion of the Single Market.

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