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Risk sharing in Europe

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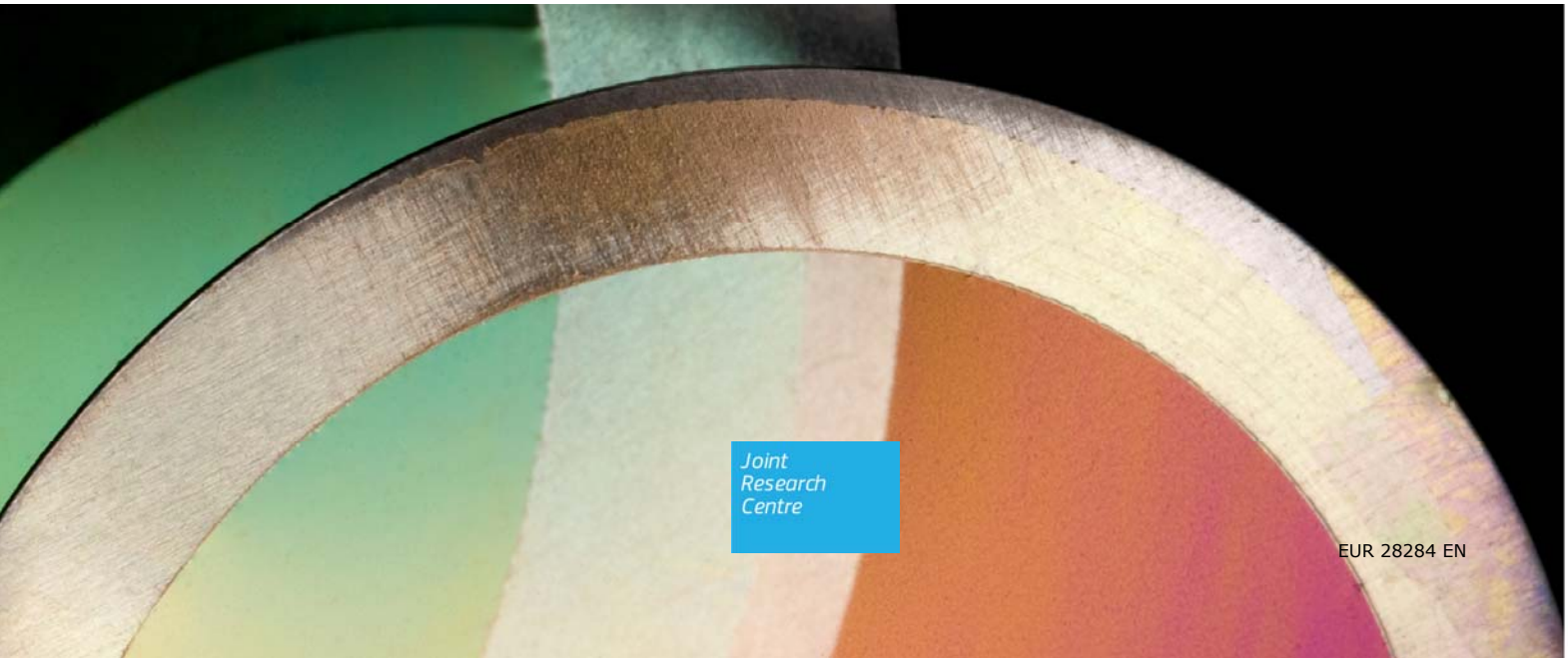

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Title Risk sharing in Europe

Abstract

We analyse if consumption can be internationally detached from GDP domestic shocks due to cross border risk sharing mechanisms. We update the measurement of risk sharing for industrialized OECD countries and for several subsets of European ones. We use panel VAR models to capture the dynamic behaviour of cross border consumption smoothing through the capital markets, government and credit market channels. We also check for the substitutability among channels. Finally, we track the evolution of risk sharing over time for each channel.

- *The bulk of risk sharing is achieved through the credit markets of savings channel.*
- *Risk sharing through international transfers is almost non-existent, while the capital markets channel started to smoothly take off after the introduction of the euro.*
- *The dynamic behaviour of the channels is different. While in the capital markets channel smoothing takes place mostly on impact, in the credit channel the initial impact effect is partially compensated by dis-smoothing in the following years.*
- *The channels do not act independently as we detect some substitutability among them.*
- *Risk sharing has not been constant over time. The credit channel, which was the main channel for cross border smoothing in Europe, has dried during the last recession and subsequent debt crisis.*

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Executive summary

International risk sharing focuses on the cross border channels which are at work in **smoothing** disposable income and consumption when a country is hit by a negative output shock. Indeed, in an ideal world of perfect risk sharing, countries are completely insured against bad events, and domestic **consumption** growth will be orthogonal to domestic GDP growth. In practice this is rarely the case. Even in well-functioning monetary unions like the US, evidence suggests that one quarter of shocks to per capita GDP of individual states remains unsmoothed (Asdrubali et al., 1996). We find instead that more than **80% of GDP idiosyncratic shocks can remain unsmoothed** in the Euro Area and the European Union.

The capability of a system of countries to share risks not only depends on the cross border mechanisms which attenuate fluctuations of disposable income, such as for example international asset holdings or international transfers, but also on the domestic pattern of savings that can be influenced by domestic fiscal policies. Cross border smoothing in hard times is important, as it allows reducing the drop in consumption prompted by crisis, sustaining production and growth and insuring the welfare of citizens. The policy relevance of the issue of risk sharing has been recently confirmed by the growing attention of both the literature and the policy making. In June 2015 the Five President's Report claimed that enhancing risk sharing is indeed a way to mitigate the effect of negative output shocks.

In our model we follow the relevant literature and decompose risk sharing in three **channels:** (1) the capital markets channel based on the net factor income, (2) the government channel, based on international transfers, and (3) the credit markets channel that includes savings. This decomposition is motivated by the current harmonised structure of national accounts. We use a variety of empirical techniques to measure risk sharing among the set of industrialized OECD countries and several subsets including the main countries in Europe, the European Union and the Euro Area. This enables us to see the differences steaming from being member of the European Union or the Euro Area. The period analysed goes from 1960 to 2014, although we also divide our sample in the pre- and post-euro ones to check the effects of the introduction of the common currency.

We find that:

- The **bulk** of risk sharing takes place through the **credit markets or the saving** channel.
- Risk sharing **through international transfers** is almost **non-existent**, both before and after the introduction of the euro.
- **Capital** markets risk sharing seems to be slowly **taking off** after the introduction of the euro.

Results suggest the existence of room for enhancing the capital market channel via policy action.

Since international consumption smoothing has not only a cross-border dimension but also a temporal one, we check the dynamic or intertemporal behaviour of cross-border consumption smoothing through the three channels. We not only take into account the possible dynamic effect of GDP shocks, but also the feedbacks and the interlinkages among the channels.

We find that not taking into account the dynamic profile of the channels can substantially bias our measures of risk sharing. More importantly, we show that the **dynamic behaviour of the channels is different**. While the absorption of a GDP shock through the capital markets channel takes place mostly during the same year of the shock, the credit channel suffers some dis-smoothing 2 years after a positive shock hitting idiosyncratic GDP. As a result, risk sharing through the credit channel might be overestimated. For instance, if the inflow of money due to international borrowing through

the credit markets channel has a positive effect in a given year, it will instead decrease the smoothing capabilities of that channel when the loans have to be paid back.

We also track the evolution of risk sharing along time confirming that it has not been constant in our sample. In particular, the **last great recession and the subsequent sovereign debt crisis** has **dried** the **credit markets** channel in the Euro Area and the European Union.

Finally, we do not analyse the channels in isolation, but consider them as a system. Within this setup, we are able to check for the relation among the **channels** and found that they behave as **substitutes** rather than complements. In this sense, if a policy measure is foreseen to enhance one of the channels, it might have some negative effect in other channels, partially shrinking them.

1. Introduction

Since the seminal paper by Asdrubali, Sorensen and Yosha (1996), ASY from now on, a branch of the literature has focused on measuring the degree of risk sharing. One of the main contributions of ASY consisted in providing a variance decomposition scheme which allows to separate the overall degree of risk sharing into different channels (capital markets, credit markets and international transfers) for a set of economies. Within this framework, the interest focuses on the idiosyncratic components or shocks that are given by the growth rate of the macroeconomic variable of interest (consumption, GDP, income,…) minus the average growth relative to the group of economies included in the analysis. They conclude that for the US, markets provide more income and consumption risk sharing than the federal government for the period 1963-1990. Recent reviews of the literature of risk sharing can be found in Ahrend, Arnold and Moeser (2011), who point out the need to develop collective risk sharing mechanisms, and Pierucci (2014) that reviews the empirical literature about risk sharing and the effects of economic and financial integration on risk sharing.

As Kose, Prasad and Terrones (2009) point out, the recent literature presents conflicting results, even for advanced economies. While some studies suggest that risk sharing has increased during the recent globalization period (see, for instance, Sorensen, Wu, Yosha and Zhu, 2007, and Giannone and Reichlin, 2006), some others found little evidence of increased risk sharing (Moser, Pointner and Scharler, 2004, and Bai and Zhang, 2012). Moreover, as Balli, Basher and Balli (2013) point out, most findings relate to particular periods of time (mostly to an era of financial upturn). For a deeper insight into the mechanisms of risk sharing and also in order to explain these conflicting results, Balli, Basher and Balli (2013) split the returns from the net foreign holdings into receipts (inflows) and payments (outflows) for the set of OECD industrialized countries and found that the factor income flow exhibited a remarkable resilience for income risk sharing during the last crisis. Hoffman and Sørensen (2015) relate the lack of increased risk sharing in Europe to the dependence of the countries from domestic banking sectors. Other authors focus on government behavior to explain the results found in the literature. For instance, Kalemli-Ozcan, Luttini and Sørensen (2014) relate the recent collapse in risk sharing of peripheral EU countries (namely, Portugal, Italy, Ireland, Greece and Spain) to the fact that their governments did not save during the expansionary phases of the business cycle and were not able to borrow on the international markets during the crisis due to the high levels of debt. The last recession and subsequent debt crisis in Europe led to an asymmetric behavior of the different member countries of the European Union. In order to mitigate the negative effects of the negative output shocks, The Five President's Report (Juncker et al, 2015) points out the need of more integrated financial markets that would lead to an increase in private risk sharing as well as the need of a mechanism of fiscal stabilization for the euro area as a whole in order to enhance public risk sharing. The European Central Bank (2016) suggests that the quality of risk sharing is also important, being foreign direct investment and longer maturity debt more resilient to negative GDP shocks and, therefore, more suitable mechanisms to increase consumption smoothing.

The very basic empirical strategy to assess risk sharing within a particular channel (for instance, the net factor income, alias capital markets channel) consists in regressing idiosyncratic Net Factor Income shocks, over the idiosyncratic GDP growth. A number between 0 and 1 is interpreted as the percentage of risk sharing that is provided by the capital market or Net Factor Income channel. The exercise can be repeated for the remaining channels as in ASY. The difference between 1 and the sum of the estimated parameters for the three channels (net factor income, international transfers and savings) is the amount of unsmoothed shocks. If some of the estimated coefficients are negative, this means that the channel more than offsets the shock to GDP, while if some parameters are greater than 1, this means that the channel amplifies rather than reduces the impact of a shock. However, within this approach, dynamic aspects are not taken into account and the regressions are run for each particular year or over short panels. Even though

GDP shocks were considered exogenous, this would lead to inefficient estimates which can explain the heterogeneity of the results obtained. The evolution of risk sharing over time is measured as the evolution of the estimated betas, many times, smoothed via kernel estimates or other techniques. Cavalieri, Fanelli and Gardini (2008) conclude that the lack of European risk sharing found in previous studies could be due to the rich dynamic structure underlying European consumption streams. As Valiante (2016) points out, risk sharing has not only a cross sectional dimension but a time dimension as well.

Asdrubali and Kim (2004) introduce panel Vector Auto Regressions (VAR) in the analysis of risk sharing and consumption smoothing channels, and found that the dynamic properties of the different smoothing channels were heterogeneous. This type of models is particularly convenient since they allow to make output endogenous, as well as to take into account dynamics and feedbacks among the variables in the model. In this way, we are able to check the resilience of consumption to GDP shocks and measure how long does it take to absorb a shock. Additionally, within this methodology we are able to answer policy issues regarding as whether the different channels have acted as substitutes or complements. To capture the possible evolutionary patterns of risk sharing we will estimate the models using a rolling window and track the time-varying behavior of the different smoothing channels.

In summary, in this report we focus on several points: First, we update the measurement of risk sharing for a group of industrialized countries commonly used in the empirical analysis and for several subsets of European ones through a variety of approaches available in the literature. Second, we also use panel VAR models in order to check the dynamic or intertemporal behavior of consumption smoothing through the different channels identified in the seminal paper by ASY. As a by-product, we are able to make output endogenous. Third, we are able to check the extent of substitutability among channels. And, finally, we track the evolution of risk sharing along time for each channel.

The rest of the report is structured as follows. In section 2, we briefly introduce the main channels for risk sharing and review the literature on risk sharing within the European Union. In section 3, we introduce the channels for risk sharing and present the models used for our data analysis. In section 4, we describe what goes inside each channel. In section 5, we present our empirical results. Finally, in section 6, we present some conclusions and policy recommendations.

2. Risk sharing in the EU

In this section, we review the literature related to international risk sharing in Europe in order to place our results within the previous empirical evidence.

Sorensen and Yosha (1998), who also decompose risk sharing into the channels proposed by ASY, conclude, using the same econometric techniques, that risk sharing was low in all channels for several groups of countries of the EU. However, Kalemli-Ozcan, Sorensen and Yosha (2004), again using the same empirical strategy, conclude that risk sharing within the EU improved over the 90's due to increased cross-border ownership of assets.

Demyanyk, Ostergaard and Sorensen (2008) use panel regressions for the subsamples 1995-1999 and 2000-2006 for different groups of EU countries. Following Melitz and Zumer (1999) and Sorensen et al. (2007), they allow the beta coefficients to be time-varying and country-specific. In particular, the betas are modelled as the sum of 3 terms: a constant, a time trend and a term that depends on the amount of foreign assets held by each country over the aggregate. They find that income risk sharing has been higher in the 5 years following the introduction of the euro, but consumption smoothing has generally decreased with the only exception of the countries member of the EMU.

Kalemli-Ozcan, Luttini and Sorensen (2014) use the approach of ASY, and implement a further decomposition of the channels in order to identify the importance of government and private savings in overall risk sharing, finding that risk sharing collapsed in Greece, Ireland, Italy, Portugal and Spain in 2010 since positive government saving induced dis-smoothing, i.e. negative smoothing.

Furceri and Zdzienicka (2015), again following the empirical approach of ASY look at risk sharing in 15 countries of the Euro Area for the period 1979-2010 and found that 66% of the shocks in the EA are not smoothed, and that smoothing is mainly achieved via private saving (around 22%). They also simulate the theoretical effect of a supranational fiscal mechanism of risk sharing.

Kalemli-Ozcan (2016) stresses that the Eurozone crisis caused a dry up in external financing sources provided by capital flows in several countries. For a fast recovery she points out that the Eurozone needs a banking union and a broader financial union based on equity ownership rather than on debt.

The Quarterly Report on the Euro Area (European Commission, 2016) compares risk sharing estimates in the EU to those for the US, and concludes that the Eurozone lags behind the US and that there is room for increasing shock smoothing, especially through the capital market channel. Moreover, the report estimates that the direct impact of output shocks on consumption is almost four times bigger in the Eurozone than it is in the US. Buti, Leandro and Nikolov (2016) highlight that there is space for improving international risk sharing in the Eurozone and Carnot, Evans, Fatica and Mourre (2015) design several hypothetical macroeconomic insurance schemes that could improve risk sharing in the euro area.

All in all, the literature dealing with risk sharing in the Euro Area points out that its extent is much lower than that estimated for the US, especially regarding private risk sharing. Moreover, it collapsed during the financial and sovereign debt crisis in peripheral European countries.

3. Channels and models for risk sharing

Following the structure in the System of National Accounts, ASY identified three channels for risk sharing: capital market channel, the fiscal channel and the credit market channel. Recall that in national accounts the Net Factor Income (NFI) is given by the gross national income minus the gross domestic product, the Net International Transfers (NIT) are given by gross disposable income minus gross national income and Savings (S) are measured as gross disposable income minus consumption. Taking into account the previous structure in national accounts, ASY consider the following identity as the starting point to identify the channels for risk sharing

$$GDP = \frac{GDP}{GNI}\frac{GNI}{GDI}\frac{GDI}{C}C$$

where GDP stands for Gross Domestic Product, GNI for Gross National Income, GDI for Gross Disposable Income and C for Consumption. Taking logs and first differences, subtracting the cross-sectional average, multiplying both sides by Δlog(GDP) (minus its mean) and after taking expectations, we can decompose the cross sectional variance of GDP growth rates into different components: First, the covariance between Δlog(GDP) - Δlog(GNI) and Δlog(GDP). Second, the covariance between Δlog(GNI) - Δlog(GDI) and Δlog(GDP), that is cross-border fiscal redistribution. Third, the covariance between savings growth rates and Δlog(GDP). Lastly, dividing both sides of the variance decomposition by the variance of the idiosyncratic GDP growth rates, we end up with the following identity:

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

where β_K is interpreted as the amount of risk-sharing (in percentage to 1) that takes place through the Net Factor Income or capital markets channel, β_F is the amount of smoothing achieved through international transfers or the government channel, β_C is the amount of risk sharing achieved through savings or the credit market channel and β_U is the amount of shocks that remains unsmoothed. The names of the channels are those given in the seminal paper by ASY and we do not pretend to change them here. However, in Section 4, we will clarify what goes inside each channel.

The previous coefficients can be estimated through the following regressions where all the variables but the error terms are considered shocks measured as deviations from the aggregate.

$$\Delta\log(\mathrm{GDP}) - \Delta\log(\mathrm{GNI}) = \beta_{0,K} + \beta_K \Delta\log(\mathrm{GDP}) + u_K \quad (1)$$

$$\Delta\log(\mathrm{GNI}) - \Delta\log(\mathrm{GDI}) = \beta_{0,F} + \beta_F \Delta\log(\mathrm{GDP}) + u_F \quad (2)$$

$$\Delta\log(\mathrm{GDI}) - \Delta\log(\mathrm{C}) = \beta_{0,C} + \beta_C \Delta\log(\mathrm{GDP}) + u_C \quad (3)$$

$$\Delta\log(\mathrm{C}) = \beta_{0,U} + \beta_U \Delta\log(\mathrm{GDP}) + u_U \quad (4)$$

If $\beta_U = 0$, there is full risk sharing. On the contrary, if $\beta_U > 0$, GDP shocks are, at least, partially passed to consumption. In the extreme case of $\beta_U > 1$, GDP shocks are amplified rather than smoothed. As mentioned before, the amount of unsmoothed output shocks is estimated as $1 - \beta_K - \beta_F - \beta_C$. Further decompositions of the basic channels can be achieved if we go beyond in the System of National Accounts; see, for instance, Balli, Pericoli and Pierucci (2014) for the decomposition of the net factor income channel into interests, dividends and retained earnings or Kalemli-Ozcan, Luttini and Sorensen (2014) for decomposing savings into private and public savings. In our analysis, and in order to compare our results to other analysis available in the literature, we will continue to work with the standard decomposition into three channels of risk sharing.

In order to capture the serial correlation that might be present in the data, and following the usual practice in the literature, we allow for an AR(1) process in the error term. However, there are additional issues not contemplated in the previous models. First, we would like to consider GDP endogenous as the dependent variable (i.e., consumption in

equation 4) is a component of the explanatory variable (GDP) itself, which might imply biased estimates of the smoothing parameters as well as for the degree of risk sharing that remains unsmoothed, due to simultaneity bias.[1] Second, the previous setup estimates risk sharing in an isolated way not contemplating any possible link among the channels. Third, the different dynamic behavior of the channels was characterized by Asdrubali and Kim (2004), who differentiate between risk sharing channels that provide ex-ante insurance (as capital channel through asset markets) and channels that provide intertemporal smoothing ex-post via credit markets. Government smoothing, or fiscal stabilizers, can work both as ex-ante or ex-post smoothing channel. Through a panel VAR, we can make output endogenous, characterize the dynamic role of each smoothing channel and interrelate them.

Within this dynamic panel approach our basic model is

$$X_{i,t} = A_{0,i} + A_1 X_{i,t-1} + A_2 X_{i,t-2} + \cdots + A_p X_{i,t-p} + U_{i,t}$$

where for each country and each time period $X_{i,t}$ is the 4×1 vector

$X_{i,t}$=($\Delta\mathrm{logGDP}_{i,t}$, $\Delta\mathrm{logGDP}_{i,t} - \Delta\mathrm{logGNI}_{i,t}, \Delta\mathrm{logGNI}_{i,t} - \Delta\mathrm{logGDI}_{i,t}, \Delta\mathrm{logGDI}_{i,t} - \Delta\mathrm{logC}_{i,t}$)' ,

$A_{0,i}$ is the 4x1 vector of intercepts that can be country specific, A_j, j=1,…,p are 4×4 matrices of coefficients and $U_{i,t}$ is multivariate white noise. The coefficient matrices are the same for all countries included in the panel so we can pool all the information to get more precise estimates. The inclusion of as many lags as needed to clean the residuals can make the noise free from serial correlation. We also assume stationarity since all the variables are measured as deviations from the aggregate in growth rates. This is a reduced form model free from any issue regarding endogeneity. We contemplate two different specifications and consider a common intercept (in this case $A_{0,i} = A_0$ for all countries) and, alternatively, specific intercepts for each country.

In this setup, a shock is meant to the whole channel and we can compute its dynamic effect through impulse response functions. Additionally, we can check how a shock in one channel affects the remaining ones.

[1] As we will see in the empirical section, in our analysis this leads to an underestimation of the overall degree of unsmoothed shocks.

4. What's inside each channel?

In this report we maintain the names of the channels introduced in the seminal paper by ASY, as it is done in the literature, so they can be compared with those found in other analyses. However, in what follows, we will describe what goes into each channel for a better understanding of the mechanism of risk-sharing thorough each one of them. The data we are using come from the System of National Accounts and the channels are matched with its structure. What follows is not intended to give an exhaustive description of the System of National Accounts and the Balance of Payments but to give further insight of how the difference channels might work knowing what is inside each one of them.

The **capital markets channel** comprises the net factor income (NFI). This channel is made out of two types of transactions between residents and non-residents of a particular country. On the one hand, compensations to employees that are non-residents and, on the other hand, investment income receipts and payments on external financial assets and liabilities. The compensations to employees exclude migrants, that is, those that live in the foreign country more than one year and as the Quarterly Report on the Euro Area (2016) reveals cross border labour compensation accounts for a very small fraction of consumption smoothing in the Euro Area, being even negative for some subsets of countries. So the bulk of risk sharing within this channel is realized through investment income. The latter comprises income from foreign direct investment, portfolio investment income and other investment income. The two most important sources of investment income are: payments on debt securities (interests) and on equity securities (dividends). Notice that capital gains and losses do not go onto this channel since they are classified as part of the value of the investments.

The so called **fiscal or government channel** (or public risk-sharing) includes transfers made by a resident entity to a non-resident entity without an economic counterpart. Included in this channel are general government transfers and current transfers between other sectors. The first one comprises transfers between governments and international cooperation. Examples of entries that go into this channel are cash transfers between governments in order to finance current expenditures; gifts of food, international aid for earthquakes or natural disasters; gifts on certain military equipment and regular contributions paid by member governments to international organizations and vice versa. Included here are also transfers between governments and non-residents other than governments and international organizations. For instance, current taxes on income or social security contributions between a government and the non-resident are included here. International transfers made between other sectors include workers' remittances by migrants (staying in the foreign country for more than one year) and international transfers between private entities aimed to alleviate poverty and the consequences of natural disasters.

The third channel in risk sharing is the so called **credit channel** or gross savings which is the balancing item in the system of national accounts between disposable income and final consumption, which comprises not only household savings, but also corporate and government savings. Notice that this channel has also a domestic connotation since agents can smooth consumption by borrowing and lending not only in international markets but also in domestic ones or by investing less.

5. Empirical results

5.1. Data set

We have taken annual data from National Accounts that cover the timespan 1960-2014. For comparisons with the available literature, the set of OECD countries included in the analysis are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. In this way, we cover the industrialized countries and can also form subsets that comprise the main economies in Europe, the European Union and the Euro Area. Just the aggregated GDP of Germany, Italy, France and Spain accounts for 2/3 of the Euro Area GDP. The main sources of data for this analysis are AMECO, the annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN), and the database OECD Statistics. We prefer to use the AMECO database since it provides harmonized statistics on all of the variables required to perform the analysis and for the whole sample 1960-2014, leaving some missing information only in a very limited number of cases.

The nominal variables Gross Domestic Product (GDP), Net Factor Income (NFI), Gross National Income (GNI), Net International Transfers (NIT), Gross Disposable Income, (GDI) and Consumption (C) have been taken from AMECO. Then, they have been deflated by the CPI, (base year 2010=100) and computed in per-capita terms by dividing the real aggregates by the population. The series have been made stationary by computing their logged differences, which gives the annual growth rates of the real per-capita variables.

To build the idiosyncratic shocks of each variable we have computed the difference between each variable and the cross-country weighted average. In order to construct the averages, we have used exchange rates, following the weighting procedure described in Beyer et al. (2001), where the aggregation is performed directly on growth rates but using time-varying weights of countries that are given by their relative share in the real GDP in EUR-ECU. In order to express real GDPs in a common EUR-ECU currency, the real series have been divided by the exchange rate series provided also by AMECO.

We have also built a second database where the macro aggregates are transformed into Purchasing Power Standard (PPS) units by dividing the nominal aggregates for the appropriate PPS exchange rate reported by AMECO. We have transformed them into real per-capita idiosyncratic shocks to growth rates making the necessary computations.

Full details of how we build the databases as well as the treatment of missing data are given in Appendix 1.

5.2. Estimation Strategy

Given the long timespan of our sample, we estimate the models for the whole sample as well as for two subsamples 1960-1998 and 1999-2014 in order to check the effect of the introduction of the euro. Our estimated parameters can be interpreted as the average risk sharing that took place over the years covered in each subsample.

Moreover, we analyse how the extent of international risk sharing has evolved over time in the same spirit as Kose et al. (2009). We will use a rolling window of 20 years to estimate the panel VAR model. In this way, we can check, for instance, how the last recession and sovereign debt crisis in Europe has affected the level of risk sharing. For comparison purposes, we add the cross country regressions run year by year as in Kose et al. (2009).

We would like to comment the following econometric issues: first, we view risk sharing as a problem regarding the specific shocks, that is short or mid-term fluctuations of idiosyncratic variables, so we do not need to take into account any cointegration issues, as we are working with time series which are all $I(0)$. Second, regarding the assumption of exogeneity of output shocks that it is taken in the literature, we notice that violations of this assumption might come from several sources (estimation error in the dependent variables, simultaneity bias …). Even though our regression equations are considered just as linear projections of the dependent variables onto the regressors, we prefer to check the robustness of our results moving to a fully simultaneous and dynamic panel VAR framework in order to consider output as an endogenous variable. Within the panel VAR we can also take into account the dynamic interactions among the different channels and the dynamic profile of how each shock is disseminated through the different channels. As an overall effect of risk sharing we use the accumulated impulse response function. Third, when needed we use robust standard errors for heteroscedasticity and serial correlation for inference. Alternatively, we take into account the possible serial correlation in the static or contemporaneous models allowing for AR(1) residuals and heteroscedasticity using 2-steps Generalized Least Squares (GLS) when estimating equations (1) to (4) in the regression framework. We also contemplate fixed time effects. We have also checked the possibility of cross sectional fixed effects. However, the estimated betas hardly change because our variables are already computed as deviations from the aggregate in first differences

We estimate the results for 4 sets of countries: (i) the whole data set named hereinafter ALL, (ii) the European countries denoted by Europe, (iii) the set of countries that belong to the European Union, EU, and (iv) the countries that belong to the Euro Area, denoted by EA.

5.3. Empirical results

For brevity, and given that the results are qualitatively the same, in this section we only show them for the database built in terms of PPS, but full results are available from the authors upon request. Table 1 shows the results from three estimation methods: Univariate panel estimation, simultaneous panel estimation and panel VAR. The estimation was performed for the whole sample as well as for the two subsamples of interest mentioned in the previous section in order to compare them among themselves and with those available in the literature. By rows, we can see the degree of risk sharing achieved through the capital markets channel (KAP), from international transfers or the so called government channel (GOV) and from the credit markets channel (CRE). The row named as UNS represents the amount of unsmoothed shocks. The final row N represents the number of data points within each sample (full sample, pre-euro and post-euro). By columns, the table should be read as follows: for each sample, the first column, denoted as univariate panel (univariate panel) shows the results of the estimation of each channel separately using 2 steps GLS with time and fixed effects and autocorrelated AR(1) errors. The second column, denoted as SURE (Seemingly Unrelated Regression Equations), shows the results of the simultaneous estimation of the three channels, again with country and time fixed effects and AR(1) errors. Finally, the 3rd and 4th columns show the estimation results from the panel VAR. The 3rd column shows risk sharing on impact or contemporaneous smoothing while the 4th column shows the accumulated effect over time. In order to compare the results across different methodologies, we have followed Asdrubali and Kim (2004), normalizing the accumulated impact of a GDP shock to GDP as 100 and reported the fraction passed out through the channels, on impact and accumulated over time. Within each channel, each cell has two numbers: our estimate of the degree of risk sharing (as a share of 1) and in parenthesis its standard deviation. For example, in the overall sample, the number 0.7488 that appears under the column Panel VAR impact in the cell corresponding to the unsmoothed shocks (UNS) means that on impact, the same

year that the shock takes places, during the sample that goes from 1960 to 2014, on average, around 75% of GDP shocks were not smoothed and, therefore, passed into consumption.

Table 1: Risk sharing estimates for the sample of 21 OECD countries. The set of countries comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. KAP stands for the capital markets channel, GOV for the government channel and CRE from the credit markets channel; UNS is the degree (as a share of 1) of unsmoothed shocks.

	Sample: 21 OECD Member States											
	1960-2014				1960-1998				1999-2014			
	Univ. panel	Sure	Panel VAR Impact	Panel VAR accum	Univ panel	Sure	Panel VAR impact	Panel VAR Accumu	Univ panel	Sure	Panel VAR impact	Panel VAR accum
KAP	.0041 (.0042)	.0094 (.0099)	.0051 (.0069)	.0208 (.0076)	-.0053 (.0027)	-.0067 (.0062)	-.0105 (.0052)	.0019 (.0075)	.0376 (.0091)	.0551 (.0283)	.0395 (.0185)	.0875 (.0318)
GOV	-.0011 (.0017)	-.0016 (.0037)	-.0008 (.0025)	.0107 (.0059)	.0059 (.0015)	.0083 (.0041)	.0017 (.0034)	.0105 (.0075)	-.0034 (.0023)	-.0016 (.0049)	-.0049 (.0032)	.0096 (.0300)
CRE	.3137 (.0161)	.3363 (.0212)	.2469 (.0154)	.1916 (.0157)	.3603 (.0152)	.3561 (.0198)	.2510 (.0185)	.2074 (.0187)	.3743 (.0196)	.3436 (.0405)	.2399 (.0283)	.1291 (.0321)
UNS	.6833	.6559	.7488	.7768	.6391	.6423	.7578	.7802	.5911	.7131	.7256	.7738
N	1,134	1,134	1,134	1,134	1,134	798	798	798	336	336	336	336

Several conclusions can be drawn from Table 1:

(i) All the estimates point out that risk sharing through international transfers has been almost non-existent, both before and after the introduction of the euro.

(ii) Capital markets risk sharing seems to be higher in the post-EMU sample. Not taking into account the endogeneity and dynamics seem to bias the estimates downward.

(iii) The credit market channel estimations from the panel VAR are, in general, lower than those from the static panel models. This might reflect the fact that loans have to be repaid and following a contemporaneous positive smoothing, it comes certain dis-smoothing due to this payment back.

(iv) The fraction of unsmoothed shocks seems to be underestimated around 10 points when not taking into account properly dynamics and the endogeneity of output.

Tables 2, 3 and 4 in Appendix 2 present equivalent results for the subset of European countries (Table 2), the subset of European Union countries (Table 3) and the subset of countries of the Euro Area (Table 4).

We can draw the same conclusions for the set of European countries. However, although the same conclusions can be drawn for the subsets of EU and EA countries, the degree of unsmoothed shocks seems to be higher in the second part of the sample. More precisely, the credit channel dried out in the post euro sample, probably due to the recent great recession and subsequent debt crisis.

To check the dynamic behaviour of each of the channels, we plot in Figure 1 the impulse response functions of the three channels to a GDP shock. Recall that in order to compare the results across different methodologies, we have followed Asdrubali and Kim (2004), normalizing the accumulated impact of a GDP shock to GDP as 100 and computed the fraction passed out through the channels along time. The analysis of the picture reveals no action in the capital markets and government channels. The figure also shows that the credit market smooths more than 20% of the shock on impact, but after 2 years we found a significant negative contribution showing some dis-smoothing. The same analysis can be found in Appendix 3 for the sets of countries in the sample within Europe, the EU and the Euro Area. We see a similar dynamic behaviour of the channels in all the subsets analysed.

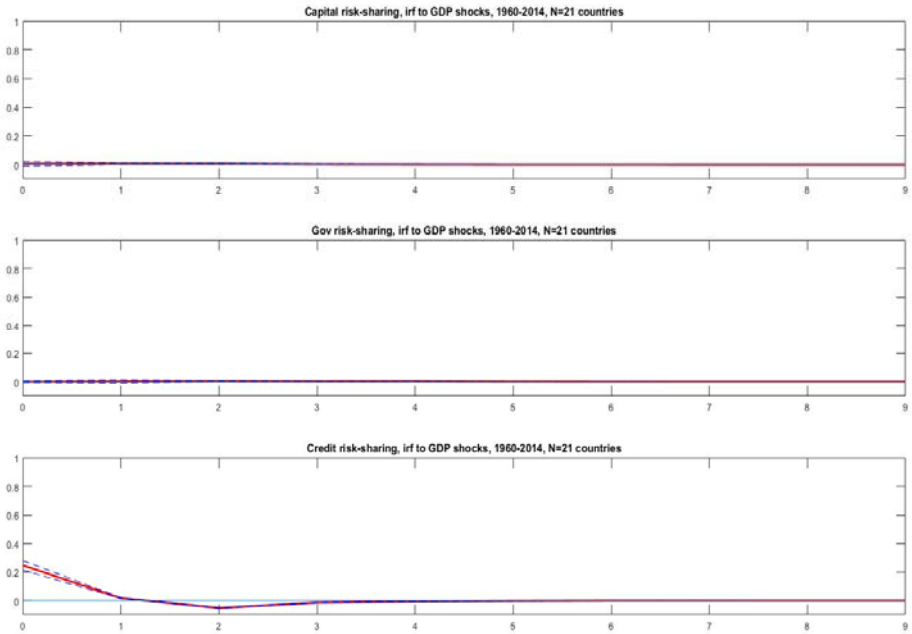

Figure 1: Impulse response functions of the capital markets (top panel), government (government panel) and credit channel (bottom panel) to a GDP shock. The red line reflects the point estimates and the blue dotted lines are 95% confidence bands. The set of countries comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. Sample 1960-2014.

The impulse response analysis of the different channels to a shock in each one of them is useful to check if the channels act as substitutes or complements. Figure 2 shows the impulse response functions for the set of industrialized OECD countries. Equivalent figures can be found in Appendix 3 for the remaining sets of countries in our analysis. We can conclude that the channels act as substitutes rather than complements and that following a positive shock to one of the channels might come some dis-smoothing through an alternative channel. This should be kept in mind when trying to enhance a particular channel through some policy measure, since it might induce some undesired effect in another channel.

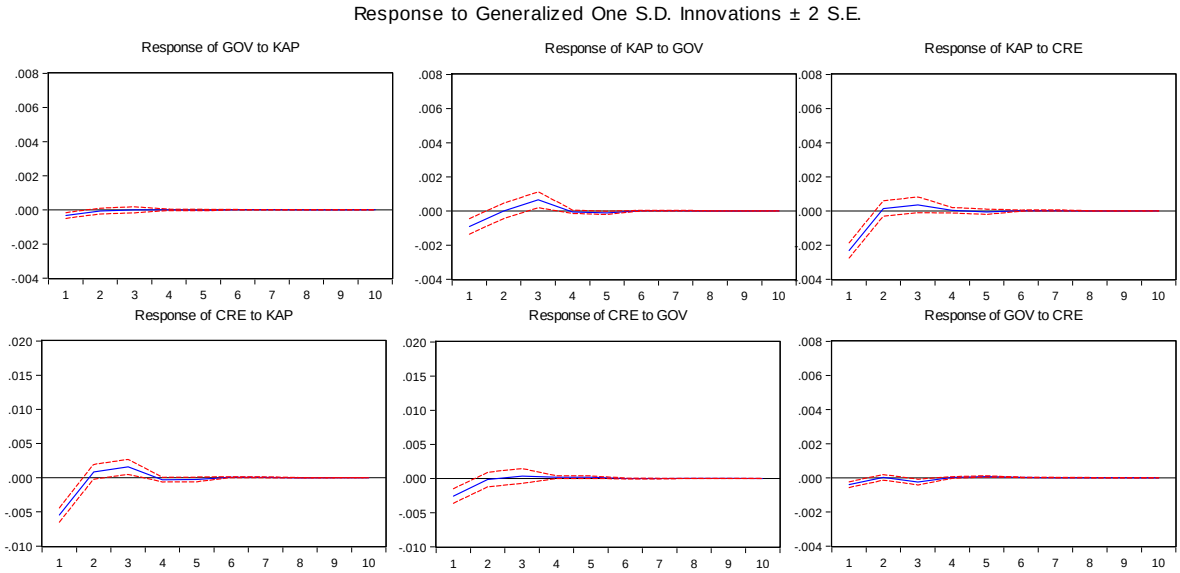

Figure 2: Impulse response functions of each channel to a shock in the alternative channels. The red line reflects the point estimates and the blue dotted lines are 95% confidence bands. The set of countries comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. Sample 1960-2014.

5.4 Evolution of risk sharing over time

For a further insight on how the last great recession and subsequent sovereign debt crisis has affected risk sharing and to check if the main results are maintained over time or depend on the particular sample analysed, we use a rolling window of 20 years to estimate the panel VAR model being the first sample 1961-1980 and the last sample 1995-2014 and check for the evolution along time of our estimations in the four sets of countries we are analyzing, representing the main countries in the OECD, Europe, EU and Euro Area. In order to compare our results, we also add the cross country yearly regressions in the same spirit of Kose et al. (2009). In this way, we can check, for instance, how the last recession and sovereign debt crisis in Europe has affected the level of risk sharing.

Figure 3 shows the results for risk sharing for the three channels given by the cross section regressions repeated year by year. We also plot 95% confidence bands computed using standard errors robust to autocorrelation and heteroscedasticity.

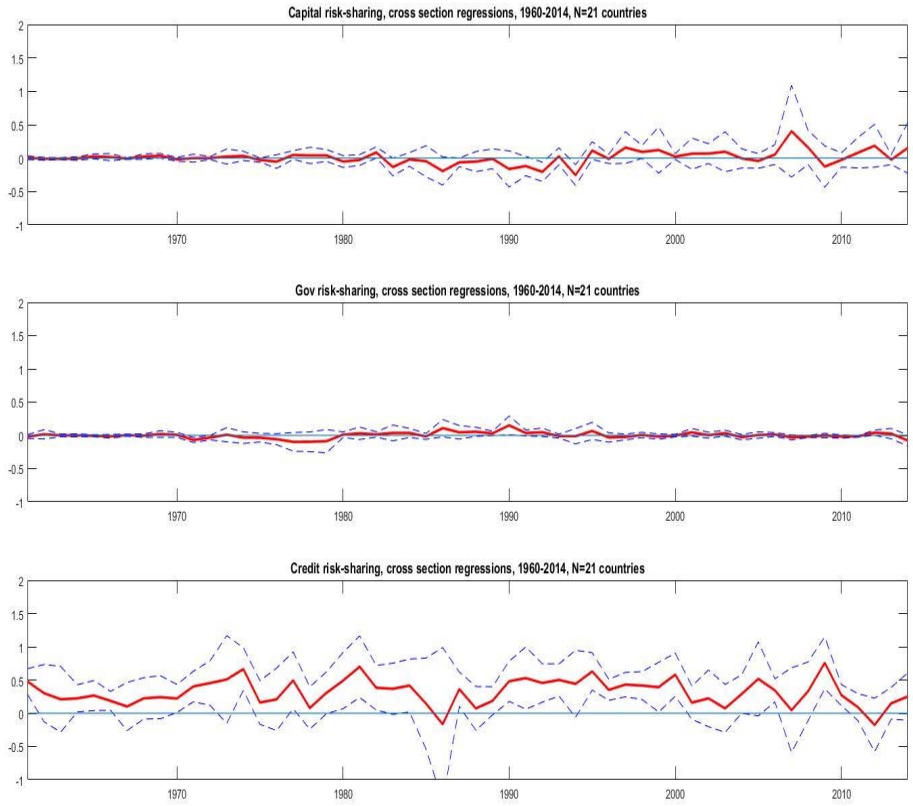

Figure 3: Estimated betas from year by year cross section regressions; top panel: capital markets, middle panel: public risk sharing, bottom panel: credit and savings risk sharing. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States. The time span goes from 1960 to 2014.

The main conclusions that can be drawn from the picture are: (i) first, risk sharing through capital markets is very low, hardly different from zero (statistically significant in very few years). Recently, it also seems more volatile; (ii) second, public risk sharing has been almost non-existent and even caused dis-smoothing in the last years; and (iii) the bulk of risk sharing takes place through savings, alias credit markets channel. The picture also shows the effect of the last recession and subsequent debt crisis drying out this last channel.

The same analysis was performed for the subsets of European countries, the subset of countries within the EU and the subset of countries that belong to the euro area and is shown in Appendix 3. The results are qualitatively the same although the estimations become more volatile and confidence bands widen as we have less data points to compute our estimates.

Figures 4 and 5 show the results for the sample of industrialized OECD countries from the panel VAR estimation. Figure 4 shows the effect on impact and Figure 5 the accumulated or overall effect over a period of 10 years. Given that this model takes into account dynamics and uses a rolling window of 20 years and, therefore two consecutive samples of 20 years only differ in 1 data point, the estimates exhibit a large degree of smoothness.

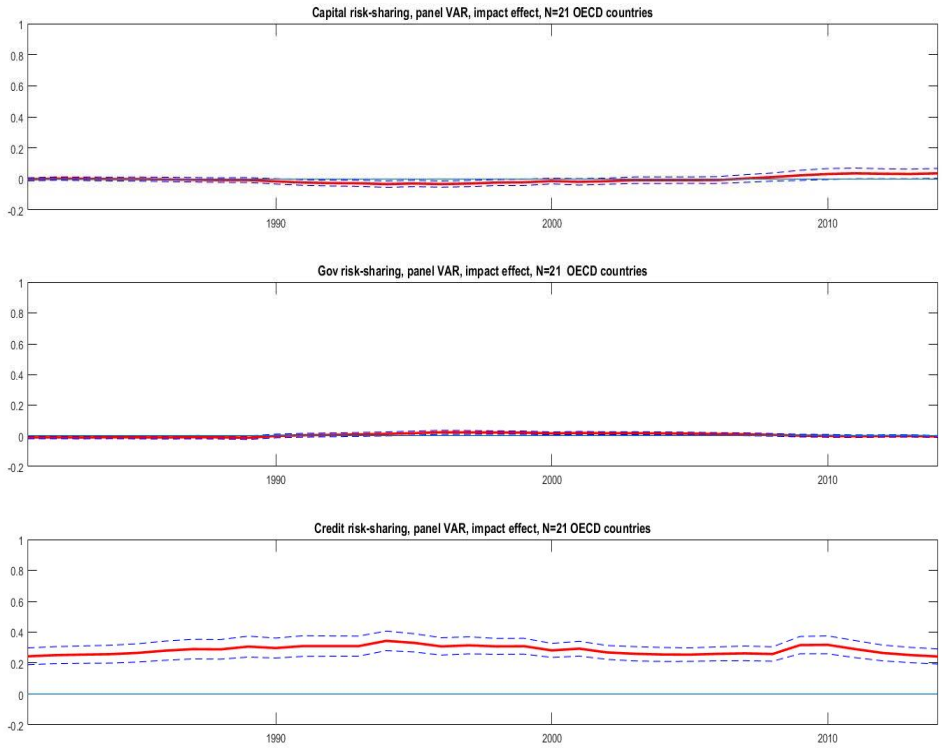

Figure 4: Estimated risk-sharing on impact from panel VAR models using a rolling window of 20 years; top panel: capital markets, middle panel: public risk sharing, bottom panel: credit and savings risk sharing. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

We can draw the following conclusions: the main channel for risk sharing is again the credit channel, although, in general, we can see that the accumulated effect is smaller than the effect on impact. Therefore, following some smoothing through this channel on impact, there is some dis-smoothing the following years. The dis-smoothing effect is not observed in the other two channels: capital markets and international transfers. The second channel for achieving consumption smoothing seems to be the capital markets channel. Contrary to other studies, we find that this channel is growing since the introduction of the euro, although it still remains at lower values than the credit market. Finally, as regards international transfers, smoothing through this channel is non-existent.

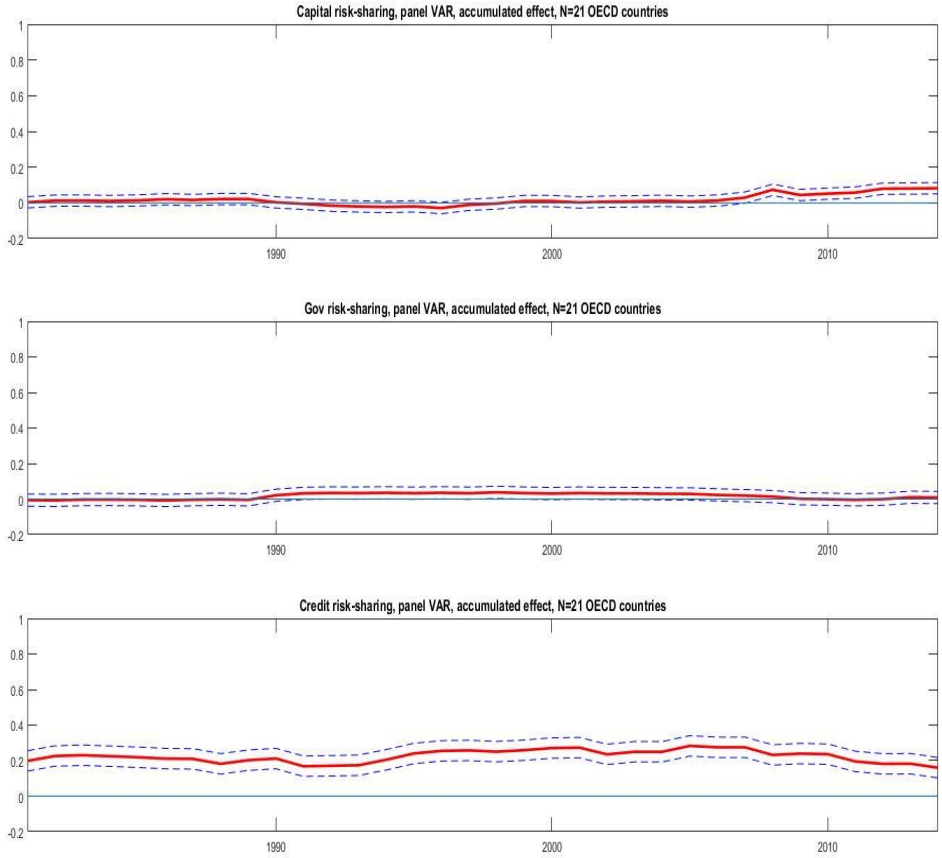

Figure 5: Accumulated risk-sharing from panel VAR models using a rolling window of 20 years; top panel: capital markets channel, middle panel: government channel, bottom panel: credit channel. N=21 OECD industrialized countries. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

Again, the same analysis was performed for the subsets of European countries, EU countries and those that belong to the euro area and is shown in Appendix 3. The results are qualitatively the same although we can see that the effect of the crisis is much more severe, especially in the euro area countries.

6. Conclusions and policy recommendations

We have estimated the degree of risk sharing among a group of OECD countries, and several subsets within Europe, the EU and the EA using panel VAR models that can cope with the issue of endogeneity of output and appropriately take into account dynamics and feedback among the channels and the channels and GDP. We have compared our results with more standard alternatives and found that the degree of unsmoothed shocks might be underestimated. However, the main picture remains unaltered: the bulk of risk sharing takes place through the credit channel; public risk sharing seems to be non-existent and the capital markets channel is slowing taking off since the introduction of the euro. So there is room for enhancing risk sharing, especially, through the capital markets channel.

With panel VAR models we are able to analyse the dynamic behaviour of each channel discovering the different dynamic response achieved through the different channels. This might be due to de fact that some channels act ex-ante (the capital markets channel), some can act ex-post after a negative shock hits the economy (the credit channel) while the government channel can act both ex-ante and ex-post. The credit channel, which is the main driver of risk sharing in the various sets of countries analysed, has also a longer dynamic response, and after some smoothing when a GDP idiosyncratic shock hits an economy, it follows some dis-smoothing in subsequent periods, perhaps due to payback duties after borrowing in international credit markets. On the contrary, the small effect that we observe in the capital markets channel occurs on impact and decays quickly.

As a by-product of our analysis, we also obtain that the channels act as substitutes and if a positive shock hits one of the channels, it might partially dry the remaining channels. For instance, if a positive shock hits the government channel, the credit channel might shrink to some extent. This should be taken into account for policy purposes.

Using a rolling window of 20 years we are can conclude that the big picture is maintained through time although we can see the effect of the last great recession and subsequent debt crisis drying the credit channel, especially in the EU and the Euro Area.

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Appendix 1: The Dataset

The construction of the dataset employed to estimate the econometric model for risk sharing has followed the criteria usually employed in this strand of literature, as explained for example in Asdrubali and Kim (2004).

The statistical sources are AMECO, the annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN), and the database OECD Statistics.

In detail, we consider data for a subset of 21 OECD countries,[2] for years 1960-2014. The series included in the analysis are:

- Gross Domestic Product (GDP) at current prices, expressed in billions of units of local currency. Source: AMECO.
- Net Factor Income (NFI) at current prices, expressed in billions of units of local currency. Source: AMECO.[3] [4]
- Gross National Product (GNP) has been computed by applying the following identity GNP = GDP + NFI.
- Net International Transfers (NIT) at current prices, expressed in billions of units of local currency. Source: AMECO.[5] [6]
- Gross Disposable Income (GDI) has been computed with the following identity GDI = GNP + NIT.
- Consumption (C) at current prices, expressed in billions of units of local currency. Source: AMECO.
- Consumer Price Index (2000=100). Source: OECD.[7]
- Population (POP). Source: OECD.
- EUR-ECU Exchange rate (EXR): Units of national currency per EUR/ECU. Source: AMECO.
- PPS Exchange rate (PPS): Units of national currency per PPS. Source: AMECO.

In the first dataset the nominal variables (GDP, NFI, GNP, NIT, GDI, C) have been deflated with the CPI and have been computed in per-capita terms by dividing them by POP. Then, the series have been made stationary by computing the logged difference, which gives the annual growth rate of the real per-capita variables. Differently, in the second dataset the nominal variables (GDP, NFI, GNP, NIT, GDI, C) have been deflated instead by means of the PPS exchange rate. In the panel VAR model we included the idiosyncratic component of growth rates, given by the difference of each variable from the cross-country weighted average. In order to construct the averages, we have followed the weighting procedure

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[2] The 22 OECD countries included in the analysis are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

[3] For Germany, data for years 1960-1990 are missing. For years 1960-1989 the series for Germany is proxied by the series for West-Germany, while data for 1990 has been interpolated to smooth the discontinuity.

[4] For New Zealand, data for years 1970 and 2014 are missing. Data for 1970 has been linearly interpolated, while data for 2014 has been estimated by (GNP-GDP).

[5] For Germany, data for years 1960-1990 are missing. For the period 1960-1989 the series for Germany is proxied by the series for West-Germany, while data for 1990 has been linearly interpolated to smooth the discontinuity.

[6] For New Zealand, data for years 1970 and 2014 are missing. Data for 1970 has been linearly interpolated, while data has for 2014 has been estimated by (GDI-GNP), where GDI is estimated with the growth rate of Disposable Net Income (Source: OECD).

[7] For Denmark (years 1960-1966), Ireland (years 1960-1975) and Netherlands (year 1960) data are missing and are estimated with the growth rate of the corresponding series from AMECO.

described in Beyer et al. (2001), where it is recommended of aggregating growth rates rather than levels, by employing the time-varying weights of countries given by the real GDP in EUR-ECU, and obtained by dividing GDP in national currency for EXR and CPI.

Appendix 2: Tables

Table 2: Risk sharing estimates for the sample of European countries. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom. KAP stands for the capital markets channel, GOV for the government channel and CRE from the credit markets channel; UNS is the degree (as a share of 1) of unsmoothed shocks.

Sample: Europe												
	1960-2014				1960-1998				1999-2014			
	Univ. panel	Sure	Panel VAR impact	Panel VAR accum.	Univ panel	Sure	Panel VAR Impact	Panel VAR accum.	Univ panel	Sure	Panel VAR impact	Panel VAR accum.
KAP	-.0075 (.00612)	.0093 (.01142)	0.0049 (.0092)	0.0206 (.0100)	-.0140 (.0053)	-.0111 (.0078)	-0.0106 (.0069)	-0.0064 (.0096)	.0399 (.0095)	.0605 (.0342)	0.0332 (.0234)	0.0867 (.0400)
GOV	.0015 (.0029)	.0069 (.0043)	-0.0029 (.0035)	0.0154 (.0071)	.00434 (.0032)	.0010 (.0056)	-0.0012 (.0048)	0.0158 (.0091)	-.0038 (.0028)	-.0010 (.0060)	-0.0044 (.0041)	0.0123 (.0347)
CRE	.3464 (.0201)	.3441 (.0222)	0.2751 (.0190)	0.1961 (.0197)	.3607 (.0205)	.3568 (.0244)	0.2839 (.0231)	0.2274 (.0237)	.3451 (.0240)	.3123 (.0477)	0.2610 (.0333)	0.1348 (.0430)
UNS	0.6596	0.6397	0.7229	0.7679	0.6490	0.6533	0.7279	0.7632	0.6188	0.6282	0.7102	0.7662
N	864	864	864	864	608	608	608	608	256	256	256	256

Table 3: Risk sharing estimates for the sample of countries belonging to the European Union. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom. KAP stands for the capital markets channel, GOV for the government channel and CRE from the credit markets channel; UNS is the degree (as a share of 1) of unsmoothed shocks.

Sample: European Union												
	1960-2014				1960-1998				1999-2014			
	Univ. panel	Sure	Panel VAR impact	Panel VAR accum.	Univ panel	Sure	Panel VAR impact	Panel VAR accum.	Univ panel	Sure	Panel VAR impact	Panel VAR accum.
KAP	-.0122 (.0068)	.0060 (.0099)	0.0034 (.0082)	0.0199 (.0091)	-.0107 (.0060)	-.0095 (.0083)	-0.0066 (.0076)	-0.0125 (.0106)	.0168 (.0141)	.0540 (.0290)	0.0045 (.0184)	0.0853 (.0372)
GOV	.0071 (.0035)	.0091 (.0049)	0.0015 (.0039)	0.017 (.0074)	.0059 (.0040)	.0100 (.0062)	-0.0021 (.0055)	0.0135 (.0100)	.0042 (.0033)	.00645 (.0069)	0.0011 (.0044)	0.0203 (.0321)
CRE	.3091 (.0217)	.2970 (.0226)	0.238 (.0190)	0.1692 (.0194)	.3437 (.0224)	.3410 (.0260)	0.2869 (.0246)	0.2511 (.0251)	.1946 (.0308)	.1614 (.0443)	0.1418 (.0278)	0.0020 (.0341)
UNS	0.6960	0.6879	0.7669	0.7939	0.6611	0.6585	0.7218	0.7479	0.7844	0.7782	0.8526	0.8964
N	756	756	756	756	532	532	532	532	224	224	224	224

Table 4: Risk sharing estimates for the sample of countries belonging to the Euro Area. The set of countries comprises Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. KAP stands for the capital markets channel, GOV for the government channel and CRE from the credit markets channel; UNS is the degree (as a share of 1) of unsmoothed shocks.

Sample: Euro Area												
	1960-2014				1960-1998				1999-2014			
	Univ. panel	Sure	Panel VAR impact	Panel VAR accum.	Univ panel	Sure	Panel VAR impact	Panel VAR accum.	Univ panel	Sure	Panel VAR impact	Panel VAR accum.
KAP	.0051 (.0083)	.0136 (.0113)	0.0023 (.0091)	0.0257 (.0103)	.0046 (.0075)	.0028 (.0095)	0.0019 (.0088)	0.0091 (.0129)	.0241 (.0192)	.0604 (.0323)	0.0113 (.0195)	0.086 (.0398)
GOV	.0083 (.0049)	.0077 (.0057)	-0.0038 (.0044)	0.021 (.0090)	.0049 (.0036)	.0075 (.0073)	0.0045 (.0064)	0.0169 (.0124)	.0039 (.0051)	.0083 (.0077)	-0.0003 (.0047)	0.0241 (.0384)
CRE	.3245 (.0263)	.3053 (.0259)	0.2471 (.0213)	0.1777 (.0218)	.3617 (.0274)	.3568 (.0302)	0.3112 (.0289)	0.277 (.0295)	.2477 (.0457)	.1587 (.0485)	0.1307 (.0284)	0.0001 (.0388)
UNS	0.6723	0.6734	0.7544	0.7756	0.6380	0.6385	0.6952	0.7152	0.7243	0.7726	0.8583	0.8898
N	594	594	594	594	418	418	418	418	176	176	176	176

Appendix 3: Figures

Appendix 3.1: Impulse response functions

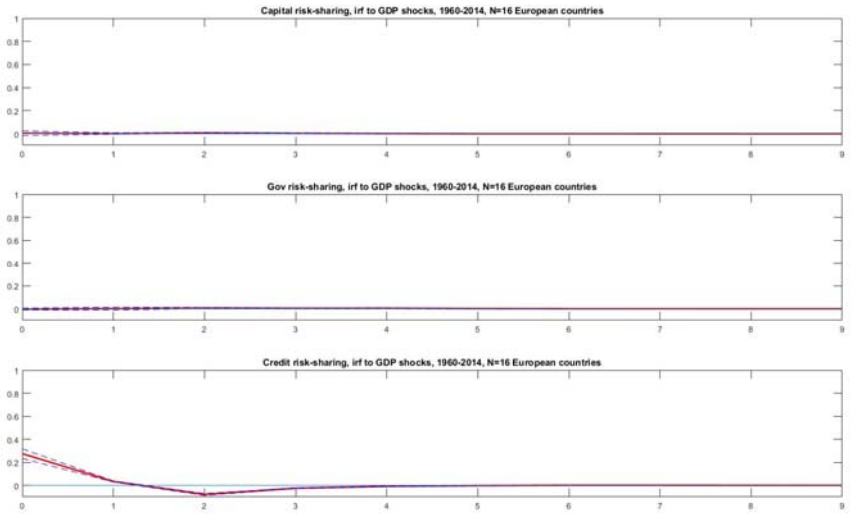


Figure 3.1.1: Impulse response functions of the capital markets (top panel), government (middle panel) and credit channel (bottom panel) to a GDP shock. N=16 Core European countries. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom. Sample 1960-2014.

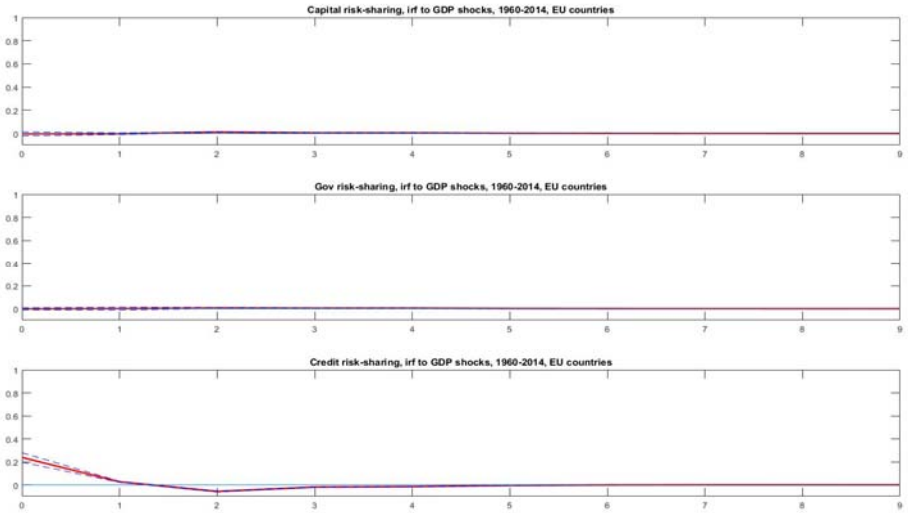


Figure 3.1.2: Impulse response functions of the capital markets (top panel), government (middle panel) and credit channel (bottom panel) to a GDP shock. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom. Sample 1960-2014.

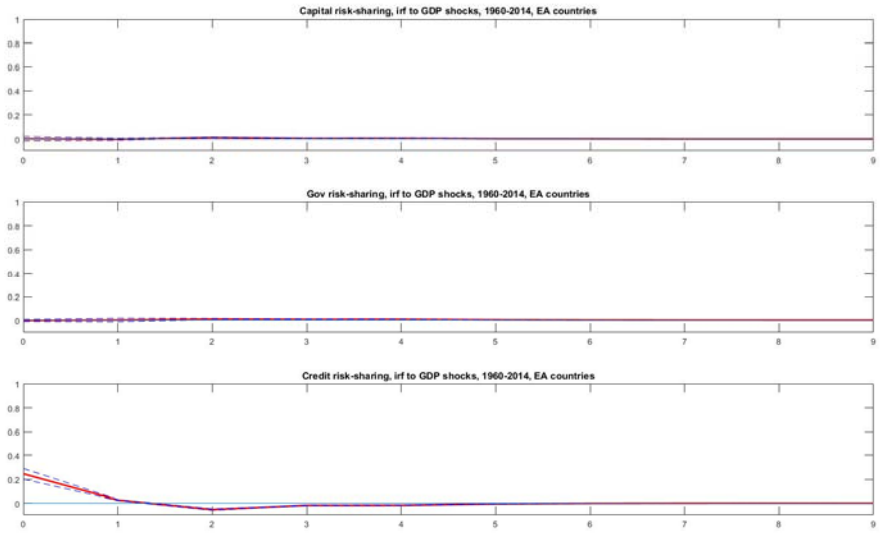


Figure 3.1.3: Impulse response functions of the capital markets (top panel), government (middle panel) and credit channel (bottom panel) to a GDP shock. sharing. Core EA countries. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. Sample 1960-2014.

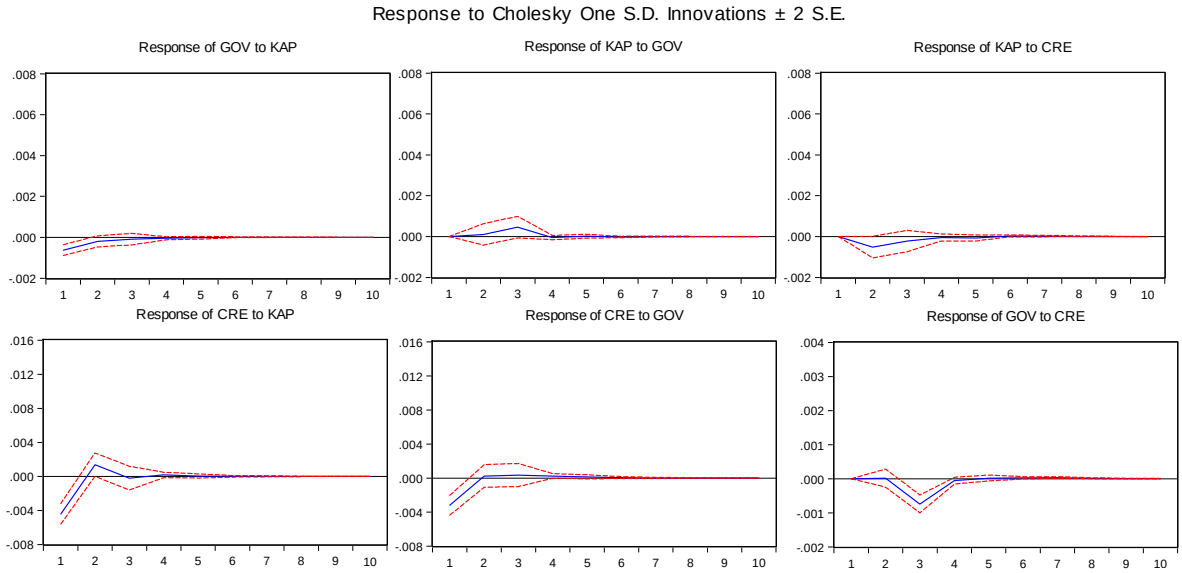


Figure 3.1.4: Impulse response functions of each channel to a shock in the alternative channels. The red line reflects the point estimates and the blue dotted lines are 95% confidence bands. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom. Sample 1960-2014.

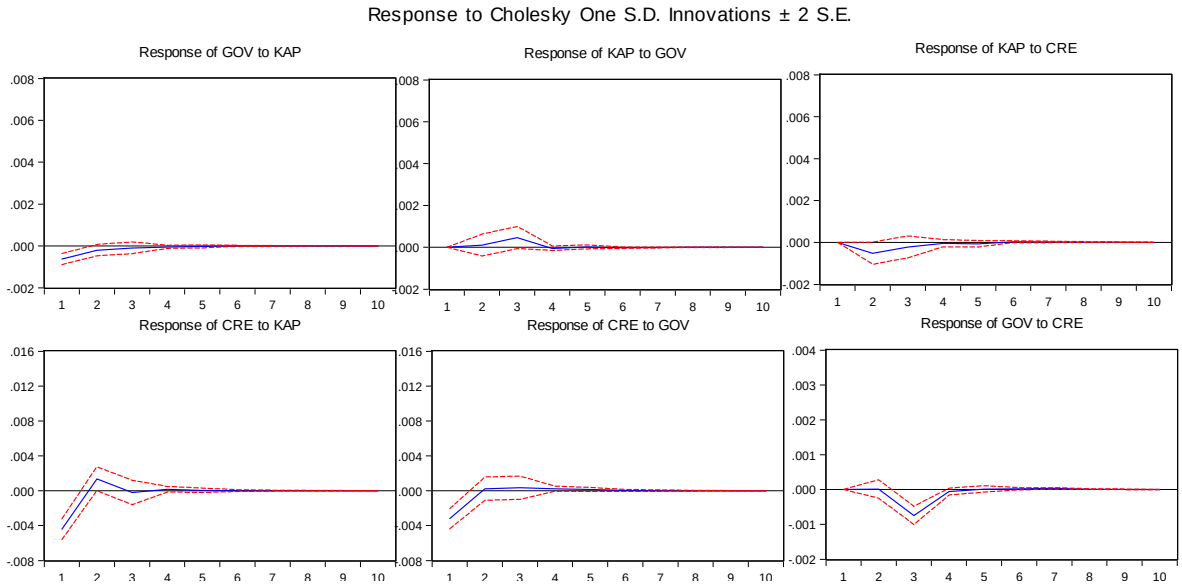


Figure 3.1.5: Impulse response functions of each channel to a shock in the alternative channels. The red line reflects the point estimates and the blue dotted lines are 95% confidence bands. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom. Sample 1960-2014.

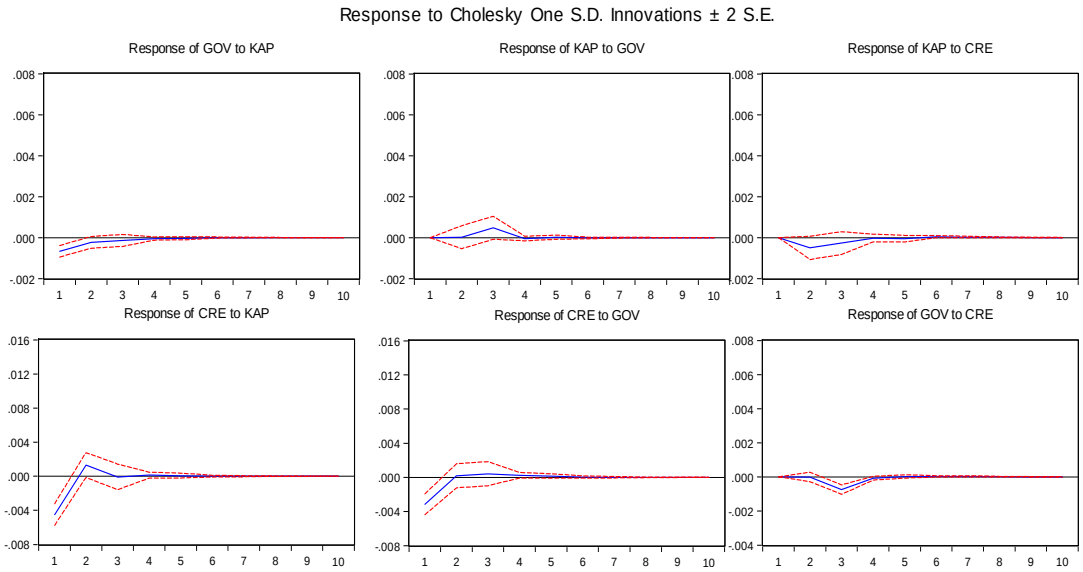


Figure 3.1.6: Impulse response functions of each channel to a shock in the alternative channels. The red line reflects the point estimates and the blue dotted lines are 95% confidence bands. The set of countries comprises Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal and Spain. Sample 1960-2014.

Appendix 3.2: Evolution of risk sharing over time

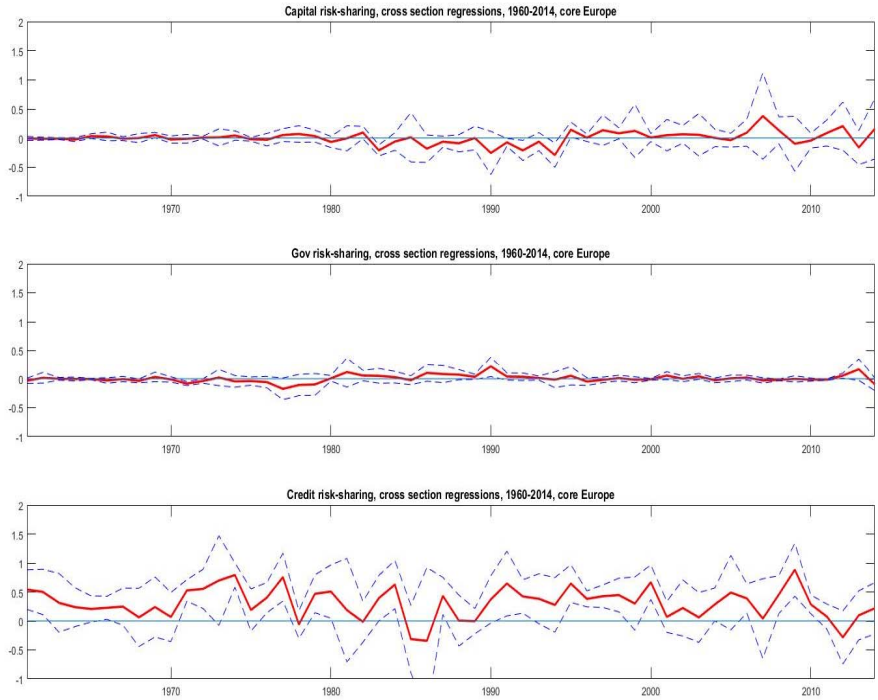


Figure 3.2.1: Estimated betas from year by year cross section regressions; top panel: capital markets, middle panel: public risk sharing, bottom panel: credit and savings risk sharing. N=16 Core European countries. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom. The time span goes from 1960-2014.

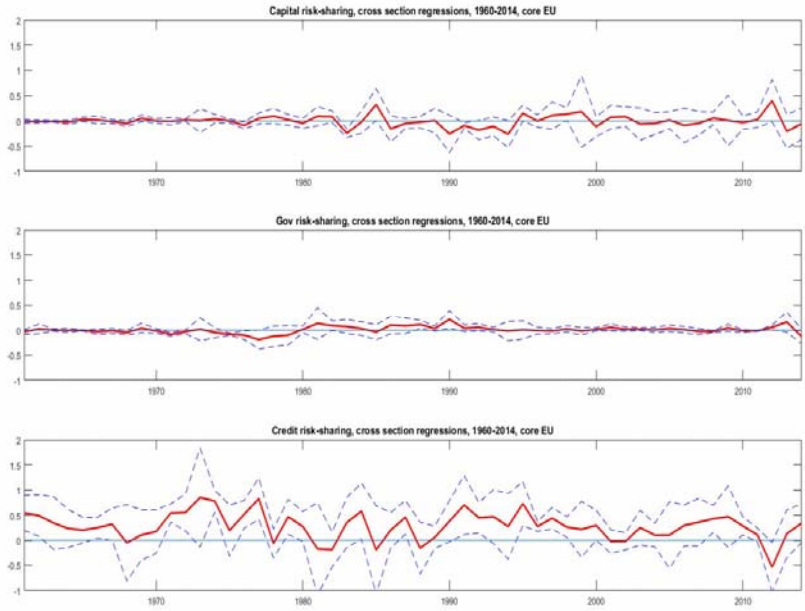
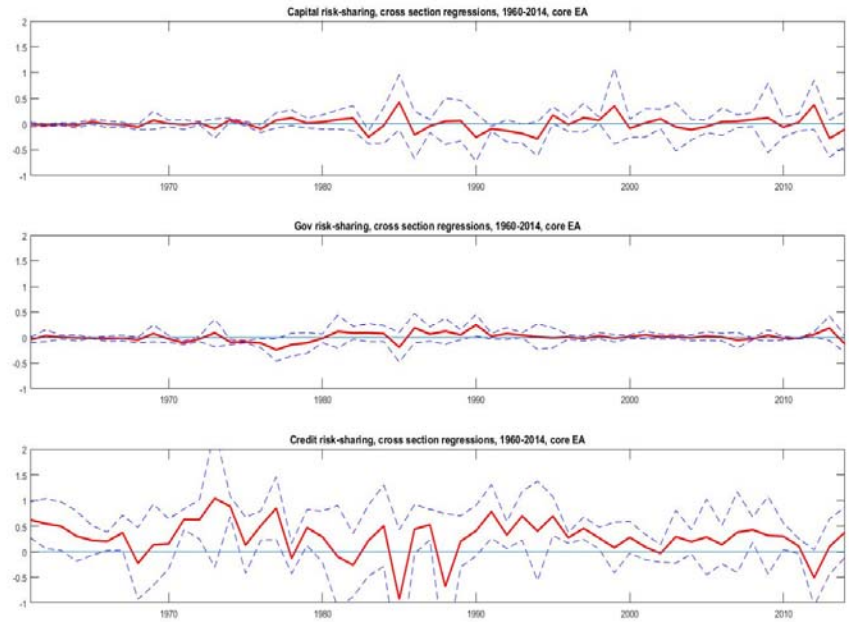


Figure 3.2.2: Estimated betas from cross section regressions; top panel: capital markets, middle panel: public risk sharing, bottom panel: credit and savings risk sharing. N=14 core EU countries. Red line are point estimates and blue dotted line are 95% confidence bands. The set of countries comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom. The time span goes from 1960-2014.



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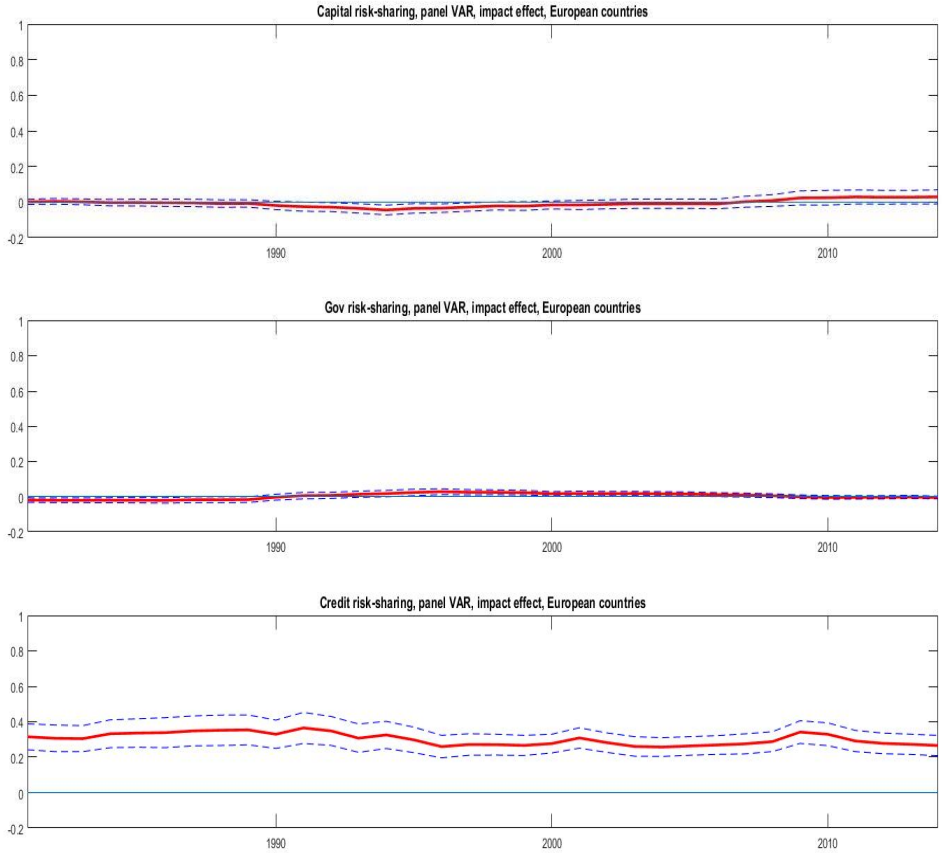

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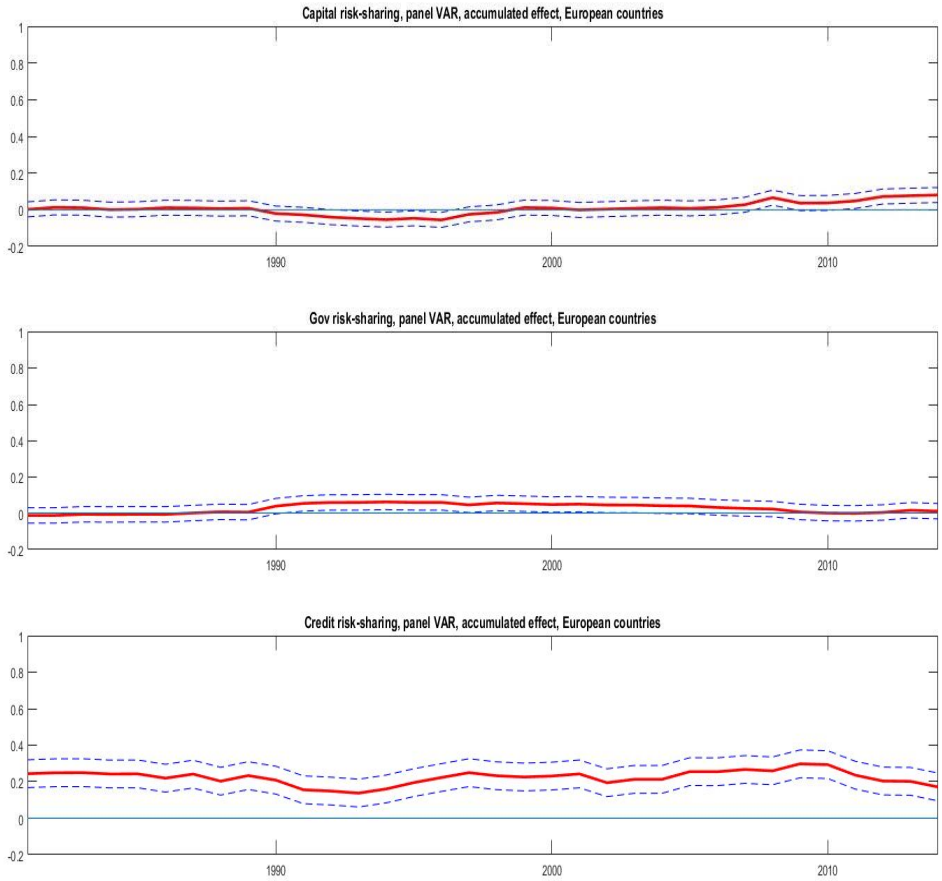

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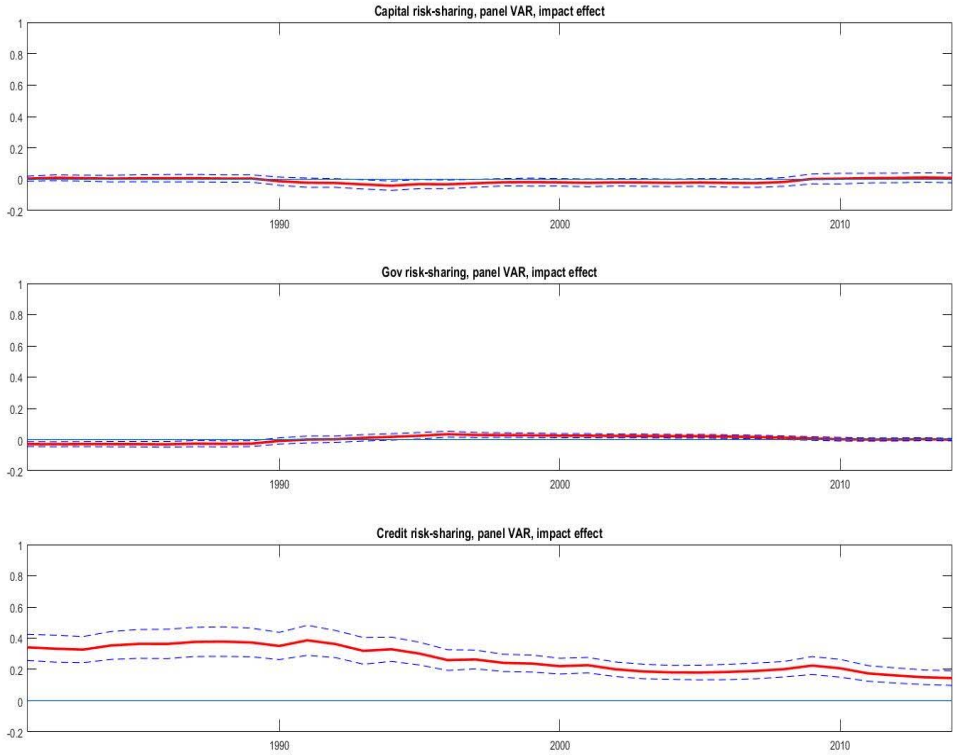

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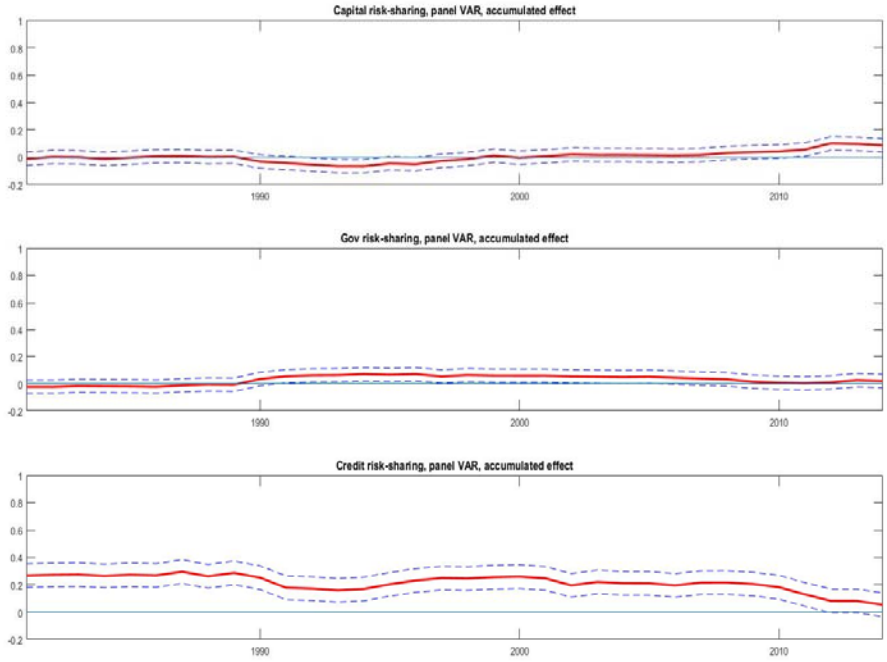

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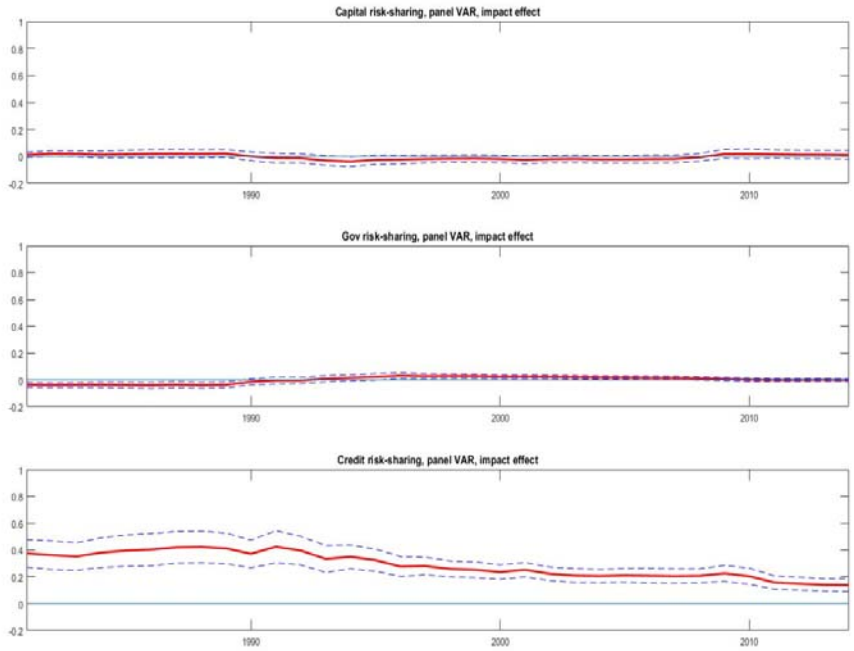

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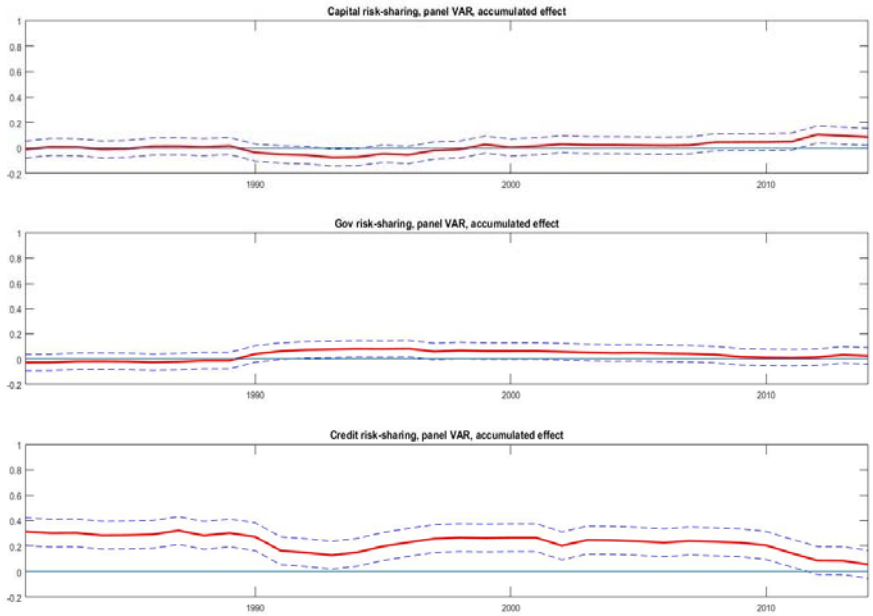

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List of abbreviations and definitions

ASY..... Asdrubali, Sorensen and Yosha (1996)

GDP.....Gross Domestic Product

VAR..... Vector Autoregressions

GNI..... Gross National Income

GDI..... Gross Disposable Income

S..... Savings

C..... Consumption

NFI..... Net Factor Income

NIT..... Net International Transfers

CPI..... Consumer Price Index

PPS.....Purchasing Power Standards

I(0)..... ... Integrated of order 0

GLS..... Generalized Least Squares

AR(1)..... AutoRegressive of order 1

KAP..... Capital Markets Channel

GOV..... Government Channel

CRE..... Credit Markets Channel

UNS..... Unsmoothed Consumption

N..... Number of Observations

POP..... Population

EXR..... Exchange Rate

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