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# Risk sharing across economic sectors

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## Abstract

We investigate risk sharing channels across different economic sectors to quantify to what extent they contribute offsetting idiosyncratic shocks. We examine the two most relevant channels of smoothing among OECD and EU countries: the international investment income and the savings channels. We find that the households' share in net foreign asset income has a significant role in risk sharing. This surprising result is strictly related to the accumulation of households' foreign asset holdings. On the contrary, governments' cross-border holdings produce a dis-smoothing effect and this might be imputable to the holding of EU countries' assets. This outcome is reversed for the new EU countries in the post Global Financial Crisis (GFC) period. With regard to the savings channel, we find that governments significantly contribute to risk sharing, and more significantly after the inception of the GFC. Moreover, the dividend smoothing theory reconciles with the risk-sharing findings since corporations (in particular non financial) significantly smooth shocks through their savings, however their contribution to risk sharing is weak in the post-GFC era.

**Keywords:** Risk sharing, savings, net factor income, economic sectors.

**JEL codes:** F21, F24, F36, F44, G15.

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# 1 Introduction

A growing number of studies has proved that greater financial globalization leads to increased risk-sharing, at least among industrial countries (e.g. Kose et al., 2003; Artis and Hoffmann, 2008; Kose et al., 2009). Income and consumption smoothing (risk sharing) among countries increases welfare and since monetary policies are not able to buffer the “asymmetric output shocks”, countries adhering to a union look at risk-sharing as the ultimate goal of the union. Just to give an example, when the domestic country is in a recession and other countries in the economic union are experiencing an economic boom, monetary policies might not be able to address the negative output shocks in the domestic economy. Therefore, risk-sharing among these countries can be a powerful tool for buffering these “asymmetric output shocks”.

Risk sharing has been studied and discussed extensively within the international economics literature. Within the empirical strand of the literature, Asdrubali et al. (1996) first derived a simple way of quantifying the relative contributions of various channels of risk sharing assessing the extent of risk sharing via these channels among US states. Later, Sørensen and Yosha (1998) applied the same framework to the Organization for Economic Cooperation and Development (OECD). Empirical studies have so far emphasized the role of the various channels between countries and searched for their possible contributions and determinants.

Therefore, risk-sharing channels have been quantified in a number of works. Sørensen and Yosha (1998) found that the bulk of consumption risk sharing is provided by procyclical saving channels, and recent studies (Sørensen et al., 2007; Balli et al., 2011, 2013, 2014; Balli and Rana, 2015) have documented the importance of the net factor income channel (net asset revenues) on the extent of the risk sharing.

These channels are quite important in explaining risk sharing among OECD or European Union (EU) members, but the contribution of economic agents to risk sharing is still under-investigated. In other words, the government, households, and corporations sectors contribute to risk sharing, but the extent of their role has not been so far quantified. In

this paper we aim to fill this gap by measuring the extent of risk sharing channels among different sectors of the economy.

Employing a sample of OECD, EU and NEW EU countries over the time horizon 1995–2013 and for the pre and post Global Financial Crisis (GFC) time samples,<sup>1</sup> we investigate those channels of smoothing identified by the extant literature as responsible of the bulk of risk sharing. Precisely, we study the contribution of the net factor income (net foreign asset income) and the savings channels through each sector of the economy (namely, governments, households, financial and non financial corporations). We found that, among economic sectors, households’ international revenues are quite effective in risk sharing, whereas both financial and non financial corporations do not significantly contribute to buffer shocks. More interestingly, governments’ investments on bonds have a negative and significant effect on risk sharing. This outcome might be due to – in particular for EU governments – involuntary bond holdings of the weaker member states, since this type of investments leaves no room to risk sharing objectives.

With regard to the savings channel, which represents the bulk of risk sharing, we find an increasing role of governments. In particular, during the post-GFC period, the governments’ share on the overall extent of risk sharing via savings increased considerably. This might be due to the pro-cyclical behaviors of governments to buffer the domestic output shocks as they increase the government spending to remove the adverse effect of the GFC. Within the corporations sector, non financial corporations significantly contribute to risk-sharing, in the pre-GFC period. This is consistent with the dividend smoothing theory, as firms are prone to pay less dividend in good times and pay more in bad times. However this dividend payment pattern is ruled out in the post-GFC period when the dividend payments of the corporations diminished. This states that corporations’ contribution in risk sharing is vulnerable to deep and persistent global shocks, while, on the contrary, government’s contribution is quite stable and even much more in the crises periods.

The remainder of the paper is organized as follows. Section 2 briefly recalls the most

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<sup>1</sup>For a list of countries see Table 1.

recent and relevant literature on the topic, Section 3 describes methodology and data. Section 4 reports our empirical findings, while Section 4 concludes.

## 2 Literature

In this Section, we summarize the main findings of some recent empirical works related to this paper. The present work is closely related to the category of studies that employ various regression models to measure the extent of risk-sharing and examine the impact of financial flows on the degree of risk-sharing. Our empirical work has particular relevance for studies that routinely monitor the progress of financial integration in Europe (e.g., European Central Bank, 2011).

Sørensen et al. (2007) propose a general framework to examine how financial integration facilitates international risk-sharing. Employing data over the period 1993–2003, they find that larger holdings of foreign assets are associated with better risk-sharing for EU and OECD countries, while foreign liabilities do not yield any noticeable risk-sharing. Somewhat similar results are obtained by Demyanyk and Volosovych (2008), who extend the Sørensen et al. (2007) study using additional data (1995–2006) and a large sample of countries. They notice that the effect of diversification on risk-sharing is roughly similar for foreign assets and liabilities. Balli et al. (2011), on the contrary, find that increased holdings of foreign assets caused income dis-smoothing during 2001–2007, the years surrounding the introduction of the Euro. They interpret their result as a consequence of increased business cycle synchronization across EMU and EU countries.

Bracke and Schmitz (2011), using annual data over 1970–2005 for 35 industrial and emerging market economies, find that net capital gains behaved in the required counter cyclical way (particularly since the mid-1990s) but only for the industrial countries, whereas emerging market economies do not seem to benefit from such risk-sharing. A similar result is obtained by Kose et al. (2009). Employing annual data over the period 1960–2004 for a sample of 69 countries – 21 industrial and 48 developing (of which 21 were emerging economies) – they find that only industrial countries had attained better risk-

sharing outcomes during the recent period of globalization, whereas developing countries have, by and large, been shut out of this benefit. These findings suggest that financial globalization has, so far, globally led to asymmetric benefits. Recently, Balli et al. (2012) examine risk-sharing through capital gains for EMU, EU and other OECD countries over the period 1992–2007. They find that risk-sharing from capital gains is higher than risk-sharing from factor income flows, whereas saving remains the most important source of overall international consumption risk-sharing in the Euro area.

### 3 Methodology

One simple way to analyze income smoothing from internationally diversified portfolios is to look at the difference between a country’s GNP and GDP over time. Consider the following identity

$$\text{GNP} = \text{GDP} + r_D A_D - r_F A_F$$

where  $A_F$  is the stock of domestic assets owned by foreign residents,  $r_F$  is the rate of return on these assets, while  $A_D$  and  $r_D$  are domestically owned foreign assets and their returns, respectively. The term  $r_D A_D - r_F A_F$  is widely known as the net factor income (NFI). If NFI is not perfectly correlated with GDP, the GNP of a country may be less variable than it would be in the absence of international assets, thus partially insulating income streams against the idiosyncratic fluctuations in GDP. Based on this reasoning, Sørensen et al. (2007) propose an empirical framework for testing the extent of international income smoothing using the following panel regression

$$\Delta \log \widetilde{\text{GNP}}_t^i = \nu_{i,t} + \beta_f \Delta \log \widetilde{\text{GDP}}_t^i + \epsilon_{i,t} \quad (1)$$

where  $\Delta \log \widetilde{\text{GDP}}_t^i$  is the annual change in GDP per capita in constant prices minus the union-wide (or aggregate) counterpart ( $\Delta \log \text{GDP}_t$ ),  $\Delta \log \widetilde{\text{GNP}}_t^i$  is the annual change in GNP per capita in constant prices minus the aggregate counterpart ( $\Delta \log \text{GNP}_t$ ), and  $\nu_{i,t}$  and  $\epsilon_{i,t}$  are constant and error terms, respectively. Depending on the sample examined, the aggregate variable corresponds either to OECD, EMU or EU member countries. The reason for

removing aggregate output fluctuations from country fluctuations is to isolate the smoothable output fluctuations (idiosyncratic fluctuations). The slope coefficient  $\beta_f$  measures the average co-movement of a country's idiosyncratic GNP growth (i.e., the deviation from aggregate/union-wide GNP growth) with idiosyncratic GDP growth in year  $t$ . The lower the  $\beta_f$ , the higher the income risk-sharing and *vice versa*. Therefore, the scalar  $1 - \beta_f$  measures the amount of income smoothing via net factor income flows. The metric  $1 - \beta_f$  will take the value 1 if risk-sharing is perfect and the value zero if GNP moves one-to-one with GDP.

### 3.1 A decomposition of the net factor income channel across sectors

Following Balli et al. (2011) and Balli et al. (2013), we decompose the factor income channel of smoothing into different sector holders; i.e, Households (HH), Government (GOV), Financial Corporations (FC) and Non Financial Corporations (NFC). Our estimated equations will be of the following type:

$$\Delta \log \widetilde{\text{GNP}}_{it}^{fc} = \nu_{fc,t} + \beta_{f,fc} \Delta \log \widetilde{\text{GDP}}_{it} + \epsilon_{it} \quad (2)$$

where  $\text{GDP}_{it}^{fc}$  is simply GDP plus the net factor income, contributed by the financial sector. Similarly, to capture the effect of households on net factor income risk sharing, we run the following equation:

$$\Delta \log \widetilde{\text{GNP}}_{it}^{hh} = \nu_{hh,t} + \beta_{f,hh} \Delta \log \widetilde{\text{GDP}}_{it} + \epsilon_{it} \quad (3)$$

where  $\text{GDP}_{it}^{hh}$  is simply GDP plus the net factor income, contributed by the households (HH). Accordingly, we run the same regressions to capture the extent of the risk sharing that is contributed by the non financial corporations (NFC) and government (GOV).

### 3.2 A decomposition of the savings channel across sectors

The role and the extent of channels of risk sharing have been studied extensively by the previous literature. According to the studies by Asdrubali et al. (1996), Sørensen and Yosha

(1998), Balli et al. (2011) and Balli et al. (2012), the bulk of the risk sharing is achieved through pro-cyclical savings and consequently the larger fraction of risk sharing is achieved through the savings channel. Therefore, in order to obtain a deeper understanding of the savings channel functioning, we examine which components of saving are more counter-cyclical. Accordingly, we decompose the net aggregate savings of the whole economy into households, government and corporate (financial and non financial) savings. Asdrubali et al. (1996) has performed the following regression to capture the extent of the risk sharing via savings:

$$\Delta \log \text{NDI}_{it} - \Delta \log(\text{NDI}_{it} - \text{saving}) = \nu_{s,t} + \beta_s \Delta \log \text{GDP}_{it} + \epsilon_{it} \quad (4)$$

where  $\text{NDI}_{it}$  is the Net Disposable Income and  $\beta_s$  provides the extent of the risk sharing via savings for the time interval, whereas  $\nu_{s,t}$  captures the time fixed effects. The extent of the risk sharing via savings is different across different regions and time periods. Asdrubali et al. (1996) quantify income smoothing via the savings channel around 40% across US states, while it is higher across Canadian regions according to Balli et al. (2012). Balli et al. (2013) measure the extent of the same channel around 30-40% among European Monetary Union members (EMU) and OECD countries. In order to decompose the extent of risk sharing across different economic sectors, we run the following regression:

$$\Delta \log \text{NDI}_{it} - \Delta \log(\text{NDI}_{it} - \text{saving}^{fc}) = \nu_{fc,t} + \beta_{s,fc} \Delta \log \text{GDP}_{it} + \epsilon_{it} \quad (5)$$

The slope of this equation ( $\beta_{s,fc}$ ) captures the extent of the risk sharing via the savings channel contributed by financial corporations.

Similarly, the slope of the equation below, captures the contribution of the households (HH) on the extent of the risk sharing through the savings channel. The contributions of the government (GOV) and non financial corporations (NFC) are also quantified via this model.

$$\Delta \log \text{NDI}_{it} - \Delta \log(\text{NDI}_{it} - \text{saving}^{hh}) = \nu_{hh,t} + \beta_{s,hh} \Delta \log \text{GDP}_{it} + \epsilon_{it} \quad (6)$$

All the test equations are estimated by using two-step Feasible Generalized Least Squares (FGLS). At the first step, we estimate the panel by applying ordinary least squares and use the estimated residuals to calculate the Variance-Covariance matrix. We account for heteroscedasticity across panels (the estimated variances is different for each country) and autocorrelation within panels, assuming that the error term in each country follows an AR(1) process. Due to the short sample and the related difficulties in estimating a country-specific autocorrelation coefficient, we restrict the autocorrelation parameter to be identical across countries.

### 3.3 Data

We use a dataset composed by 23 industrial countries with annual data between 1995 and 2013, surrounding the year of the introduction of the Euro. Country selection is essentially driven by data quality and consistency requirements. The sample is divided into several country groups: EU, NEW EU and OECD countries – see Table 1 for the complete country list. Per capita figures are obtained by normalizing over the population of each country. All series are expressed in real per capita terms. Major variables such as GDP, GNP, net savings, population and consumer price indices are taken from OECD National Accounts detailed tables (Volume II). Table 1 contains the basic ratios that describe the role of the economic sectors within the economy. The GDP ratio, simply states the contribution of each sector to the economy, showing that Non-financial corporations (NFC) have a big share on the economy (63%) and households (HH), on average, contribute to the economy by 20%. NFI ratio indicates the net factor income contribution of each sector. The net factor income is simply the net financial asset revenues from abroad and it amounts to 1–3% among financial corporations (FC) and government sectors, whereas it is about -44% among households and 32% for NFC. Big discrepancies between GDP and GNP occur for households, since households are strong net financial asset holders from abroad and

the net financial asset revenues make a remarkable difference between GDP and GNP. Similarly, higher NFI ratio in the NFC sector is due to the big differences between GDP and GNP. The big flows of foreign portfolio investments resulted in a relatively bigger amount of dividend and interest payments to abroad. Figure 1 contains NFI ratios on the country basis. The remarkable figures among NFC and HH can be also seen among each country. The contribution of FC and GOV are quite limited. The NDI ratio simply stands for the contribution of each sector to the total NDI, relative to total GDP. HH have the biggest portion as it is expected, NFC and GOV also contribute consistently. Country distribution of the NDI ratio is displayed in Figure 2. The relative contribution of FC is relatively low, in line with descriptive statistics reported in Table 1 and NDI ratios are quite similar among countries. Net Borrowing and lending ratios are on average relatively lower. Governments have, on average, -2% net lending and NFC have -1%. However, Figure 3 shows the clear difference among countries in terms of net borrowing ratios. In general, GOV have net borrowing, while for households and NFC there are marked differences. For Denmark, Netherlands, UK, Sweden, the NFC have a positive lending ratio, but among other countries NFC have a net borrowing position. FC have a relatively positive sign among all countries. Similarly, the household borrowing/lending are scattered among OECD countries. Half of the countries (richer ones) have a positive lending ratio and relative poorer OECD countries have negative lending ratios.

## 4 Results

### 4.1 The net factor income channel

In this paper we analyze the net factor income and saving channels among OECD, EU and NEW EU countries. Differently from the extant literature, we quantified for the first time the contribution of different economic sectors to risk sharing channels. Previous contributions focused on two main channels of smoothing, one of those is the net factor income which largely consists in the net revenues obtained from the foreign portfolio investments. In the

last 20 years, the increase in the cross-border portfolio allocation led to a considerable size of net asset revenues relative to GDP. Previous studies by Balli et al. (2011, 2013) showed that the increased amount of net foreign asset revenues held by countries has substantially led to a higher fraction of risk sharing through the net factor income channel. In general, the net factor income channel smooths about 8-12% of income shocks across OECD countries depending on the time period analyzed (Sørensen et al., 2007; Balli et al., 2011, 2013).

In Table 2, we quantify risk-sharing via net factor income channel for the time horizon 1995–2013. These analyses have been done across different country sets (OECD, EU, NEW EU members) and across different sectors. At the bottom of each panel, we have quantified the risk-sharing amounts for the total economies which is 5% for OECD set and 7% among EU members (coefficient  $\beta_f$ ). These results are highly consistent with the previous findings and more interesting insights can be obtained by looking at the contribution of the sectors. The extent of risk sharing via net factor income is significant and very high across households (in particular among OECD and EU countries). Between 2008 and 2013, this coefficient ( $1 - \beta_{f,hh}$ ) is around 10% and on the overall time interval it is around 5%. It is quite surprising that corporations (mainly financial) could not contribute substantially to risk sharing (see Tables 2 and 3). This finding is rather suggestive and called for a deeper investigation on the households' international portfolio allocation patterns.

Employing the IMF's Coordinated Portfolio Integrated Survey, we were able to gather data on the shares of sector holders on total portfolios of countries. Table 4 shows the share of the Households, Government and non Financial sectors on the total foreign equity and bond assets, respectively. At the first glance, we observe that within the households sector, in many EU countries (Austria, Belgium, Denmark, Spain, Germany, Italy), the household's share in foreign portfolio is quite remarkable. For instance, in Belgium, on average, households hold around 40% of total foreign equity portfolio between years 2001 and 2014, whereas, Italian households hold around 39% and Spanish households about 35%. All these figures indicate the importance of the household share on total foreign asset holdings, thereby leading to the impression that revenues originated from these assets

might be enough to smooth domestic output shocks.

Another interesting result is originated from the role of the government on risk sharing. From our analysis it emerges its negative and significant dis-smoothing role. Indeed, dis-smoothing is a weakness of the empirical analysis of risk-sharing models. The negative coefficient means that the revenues obtained from the government's foreign investments are more sensitive to the domestic output shocks and there is absolutely no chance of smoothing. As an example, it means that if domestic output decreases on average by 10%, the revenues deriving from international foreign asset decrease more than 10%. It is hard to explain this outcome but examining Table 4 it is clearly evident that governments hold mostly foreign bond in remarkable amounts. This pattern is ruled out in Finland and Sweden where both governments hold big amount of foreign equity and bond assets.<sup>2</sup> However, Austria, Belgium, Sweden, Finland and Germany hold a huge amount of foreign debts of the other EU members that are relatively weaker compared to these countries; this is due to a Euro bond bias among these countries (Balli and Sørensen, 2006; Balli et al., 2014). Data indicates that these countries are holding Euro bonds voluntarily or involuntarily – in the case of Greece, to save it from bankruptcy –, so that they do not give interest receipt revenues and do not allow for risk diversification (domestic output shocks offsetting). As the economies of the EU members are greatly synchronized there is very little room for any risk-sharing. To sum up, the dis-smoothing effect deriving from government net factor income contributions is likely to be originated from the Euro bond bias.

With regard to the NEW EU group of countries, households' asset holding contributes to smooth shocks at a comparable extent with respect to the EU states over the full sample and for the post-GFC period (about 10%), while during the pre-GFC horizon it did not exert any significant role (see Table 3). One of the most remarkable result is related to the role of government which smooths about 9% of idiosyncratic risk in the post-GFC period contrary to the perverse dis-smoothing role played among OECD and EU countries.

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<sup>2</sup>The reason behind this might be imputable to the large participation of Finnish and Swedish Institutions to the ownership of large national companies such as Ericsson and Nokia. Indeed this might imply a more similar behavior of the private and government sector.

On these results might have played a role the emergence of informal economy remittances from OLD EU member states as well as the increase in the flows of migrants from NEW EU (mainly Eastern European countries) to OLD EU members (see Kahanec et al., 2010).<sup>3</sup> Adhering to the European Union the NEW EU states benefitted from the free movement of workers among EU countries, which favored new flows of workers coming from NEW EU members, and the emergence of a fraction of grey market in labor.<sup>4</sup> The latter might be the case of workers coming from NEW EU countries who were already illegally resident in EU countries and employed off the books (particularly frequent in some EU countries where immigration rules were extremely restrictive). To this regard, it can be mentioned as in 2014 one third of the remittances coming from European countries went to the Balkans, Baltics and Eastern Europe (all regions that, at least partially, adhered to the EU during the 2004 and 2007 enlargements). At the same time, OLD EU countries such as the UK, Germany, Italy and the Netherlands see among the main recipients of their remittances those countries belonging to these areas. More precisely, for the UK can be mentioned Lithuania and Poland; for Germany the main recipients are Czech Republic, Hungary and Poland; while in the case of Italy and Spain the largest recipients is Romania; for the Netherlands we find again Poland (see International Fund for Agricultural Development, 2015).

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<sup>3</sup>The increase in the number of migrants in the OLD EU states was relevant between 2003 and 2007 and uneven among the fifteen European countries. In fact, if migrants from Eastern European countries were mainly absorbed by the UK and Ireland, migrants from Romania and Bulgaria (joining the EU in 2007) preferred Italy and Spain.

<sup>4</sup>The enlargement accounted for transitional arrangements for the access to the European labour market by the “new entrants”. It consisted in the possibility of OLD EU country to apply standard national immigration rules for the first two years following accession. Then national measures could be extended for a further period of three years and continue for a further two years if facing serious receiving problems. However, starting from the 2004 enlargement, the UK and Ireland decided not to benefit of the transitional arrangements and opened immediately the labor market, then followed Greece, Spain, Portugal, Finland and Italy in 2006; the Netherlands and Luxembourg in 2007; France in 2008; Belgium and Denmark in 2009.

## 4.2 The savings channel

The bulk of risk sharing is achieved through the savings channel among the groups of countries we take into account. Tables 5 and 6 report the results relative to the extent of risk sharing via savings channel across different economic sectors. The bulk of the risk sharing via savings ( $\beta_s$ ) brought about by the whole economy is around 30-40% across OECD and EU countries over the time horizon 1995–2007, which is consistent with previous studies (both Sørensen and Yosha, 1998 and Balli et al., 2012 found similar levels of risk sharing via savings across OECD countries). However, between 2008 and 2013, the extent of risk sharing decreased considerably, as the GFC changed the pro-cyclical saving behavior of economic agents. Among OECD countries, there is a sharp decline from 38% to 16%, similarly to what happened among EU countries. Decomposing the savings channel across sectors, we are able to clearly single out the contribution of each economic sector. This approach allows to tailor policy interventions in order to stimulate those sectors showing a better functioning in risk diversification with respect to the relative channel of smoothing.

The government contribution to risk sharing is stable and substantial. For the period of 1995–2007, the extent of the risk sharing via government ( $\beta_{s,gov}$ ) is 12% and 11% respectively for OECD and EU members and it increased to 20% and 17% in the post-GFC period. The recent increase in the government role is due to the restriction of the government due to the 1992 Maastricht requirements regarding government debt, and the subsequent Stability and Growth Pact, which both have been impediments to risk sharing from pro-cyclical government saving.<sup>5</sup> In the last years, since these countries have met these criteria and therefore there might be a boost in the risk-sharing via savings, as now governments are more independent in buffering the shocks.

Households may desire to smooth consumption through personal saving by borrowing and lending. The ability of individuals to smooth their consumption through cross-country

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<sup>5</sup>Gali and Perotti (2003) find that the Maastricht rules in practice have not limited the ability of fiscal policy in the EMU to be counter-cyclical. However, their metric is somewhat different from our risk sharing measure.

borrowing and lending depends on whether the banking system, and credit markets in general, are sufficiently integrated internationally; otherwise, say, an increase in the demand for loans may increase the domestic interest rate leading to less borrowing. Even though there are positive amounts of risk sharing gathered with household savings, in both Tables 5 and 6, it is glanced that the extent of risk sharing from household savings ( $\beta_{s,hh}$ ) is not significant in any period of times. It seems that the household savings are quite negligible at this stage.

The corporate sector contributes to risk sharing if it adjusts patterns of earnings retention so that a larger share of profits is distributed to shareholders during recessions. This is consistent with the standard textbook view that corporations smooth dividend payout ratios, adjusting them only in response to shifts in long-run sustainable earnings. According to the theory, basically, corporations pay more dividends and (save less) during the recessions, to keep the stock holders safe from suffering capital losses in recessions. This means the firms will save less in the recessions, i.e. a pro-cyclical saving pattern. Similarly, in a boom, a firm may decide to pay less dividends to the shareholders, as they already enjoy capital gains. This leads to more saving in economic booms, again another pro-cyclical patterns. Constructing the theoretical contribution of corporations on risk sharing, we have decomposed the corporations as financial and non financial corporations. We observed clearly that non financial corporations contribute substantially to risk sharing. The extent of risk-sharing via savings ( $\beta_{s,nfc}$ ) is around 22% for OECD countries and 15%, for EU members, between years 1995–2007 (see Table 5). In this period, corporations' contribution significantly improves the extent of risk-sharing. However, in the post-GFC period, we observe that the extent of risk-sharing decreased considerably becoming clearly insignificant. This might happen first due to profit and capital losses and, at the same time, for absent or inadequate corporations' dividend smoothing policy. Accordingly, the lack of the divided smoothing leads to a lower amount of risk-sharing. In Table 6 are reported the results for the NEW EU set of countries that reveal three main issues. First, in comparison with the OECD and EU countries, the whole economy over the entire time sample smooths a much lower but relevant amount of idiosyncratic risk. This outcome is

probably attributable to the lack of smoothing through the government sector (which does not have any significant role in risk sharing). If we look at the post-GFC period the saving channel of the NEW EU countries smooths a larger fraction of risk with respect to both EU and OECD countries (17% against 13% in the EU and 16% among OECD countries). Second, the role of the saving channel increases in the post-GFC, while it dropped consistently for EU and OECD countries from pre-GFC to post-GFC time horizons (from 38% to 13% for EU countries). Third, corporations (financial and non financial) have a smoothing role of about 9-10% in the post-GFC era, while this is not true for EU and OECD countries. This might be due to the FDI increase in some NEW EU countries often benefitting of convenient fiscal regimes which attract multinational companies.

## 5 Concluding remarks

This work fills an important gap in the risk sharing literature by evaluating channels of income smoothing through different economic sectors, thus evaluating the contribution to risk diversification brought about by each category of economic agent. Precisely, we investigate those channels already recognized by the extant literature as the most relevant (in terms of the fraction of shocks absorbed) among EU and OECD countries, i.e. the net factor income and the saving channels. Therefore, we analyze the contribution of households, government, financial and non financial corporations sectors to these two channels of smoothing for three groups of countries: OECD, EU and NEW EU.

The decomposition into economic sectors of the channels of smoothing might be particularly significant in terms of policy implications. Indeed, once identified which sectors better exploit a certain channel of smoothing, it might be possible to design policies that could calibrate a set of incentives for those sectors working worse, thus improving shocks absorption. We detect that as far as the factor income channel is concerned the largest fraction of smoothing is imputable to households, while the government sector plays a perverse dis-smoothing role in the OECD and EU, likely due to the Euro bond bias. On the contrary it smooths 9% of shocks in the post-GFC period among the NEW EU countries.

On this latter result might have played a significant impact the 2004 and 2007 EU enlargements which determined an increase in the flows of migrants from NEW EU (mainly Eastern European countries) to OLD EU members with a correlated effect on the fraction of NFI due to remittances.

The savings channel represents the bulk of smoothing among OECD, EU and NEW EU countries. A major role is played by the government sector for OECD and EU countries and it is even increasing in the post-GFC period, whereas for the NEW EU states the government sector has an insignificant impact. On the contrary, for these countries the non financial corporations sector has the largest part in smoothing risk, however the financial sector took off just during the post-GFC.

This work sheds new light on the functioning of risk sharing channels by evaluating the contribution of different categories of the economic agents, thus revealing strengths and weaknesses of the factor income and saving channels across economic sectors. This investigation allows a new thinking on the policy interventions to favor risk sharing which, as it emerges from our empirical investigation, should jointly take into account channel type and economic sector.

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Table 1: Descriptive statistics: 1995-2013

	GOVT	FC	HH	NFC
GDP ratio	0.13	0.05	0.19	0.63
NFI ratio	0.01	0.03	-0.44	0.24
GDP-GNP ratio	0.88	1.80	0.26	1.87
NDI ratio	0.20	0.03	0.52	0.14
Net Borrowing ratio	-0.02	0.01	0.01	-0.01

GOV, HH, FC and NFC stand for General Government, Households, Financial Corporation and non Financial Corporation sector, respectively. The time period covered in the study is between years 1995 and 2013. The GDP ratio stands for the contribution of each sector on the total GDP, averaged between years and countries. Similarly, the NFI ratio is the net factor income (NFI) contribution of each sector divided by the total GDP. Similarly, NDI (Net Disposable Income) and the Net Borrowing contributed by each sector to the economy are normalized by total GDP. Countries included are: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France Germany, Greece, Hungary, Ireland, Italy, Latvia, Netherlands, New Zealand, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK, and USA

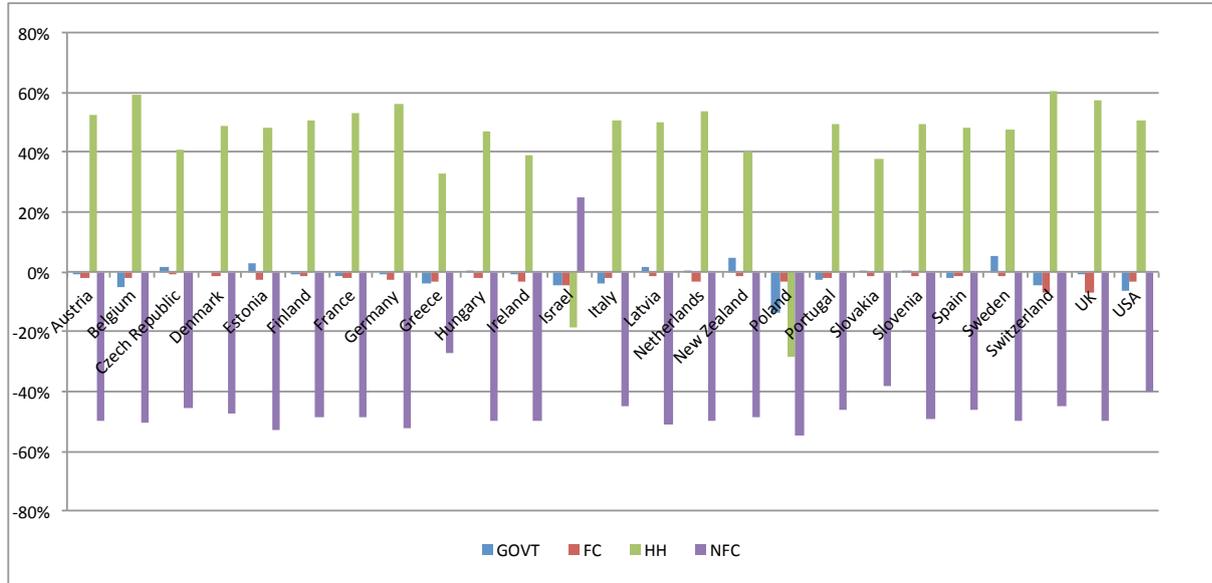


Figure 1: Net Factor Income to GDP Ratios

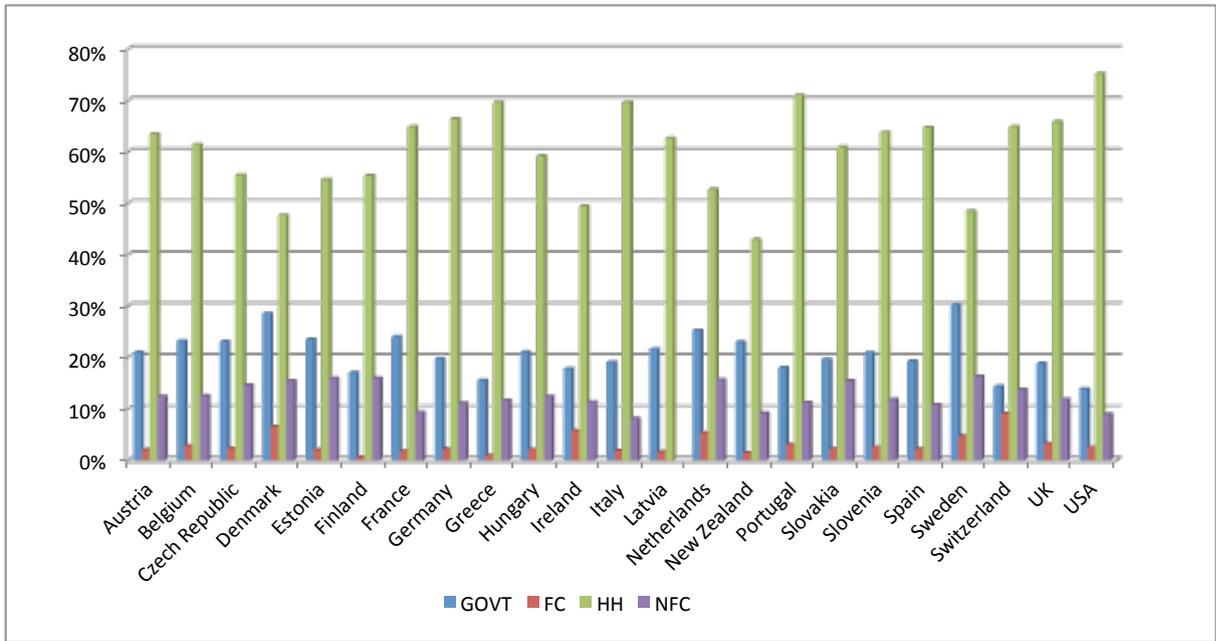


Figure 2: Net Disposable Income to GDP Ratios

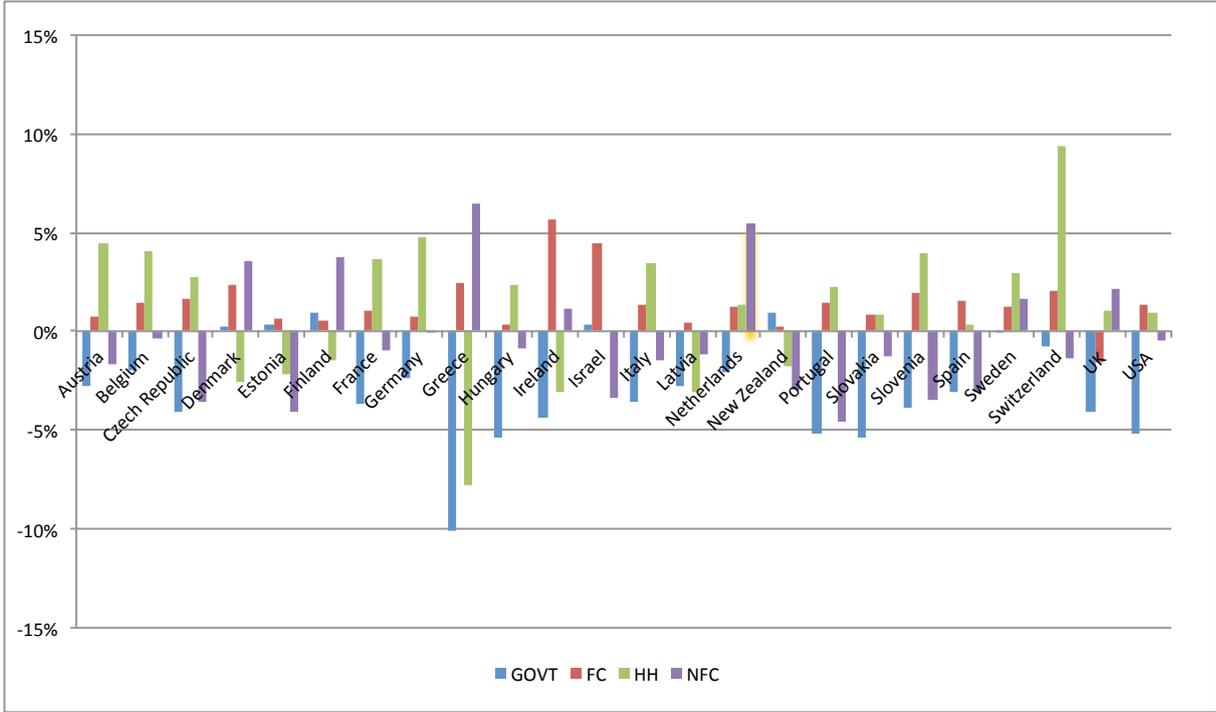


Figure 3: Net Borrowing to GDP Ratios

Table 2: Risk sharing via net factor income across different economic sectors (percentage)

Panel A: OECD			
	1995–2007	2008–2013	1995–2013
$(1 - \beta_{f,fc})$	1 (2)	-1 (3)	2 (3)
$(1 - \beta_{f,govt})$	-7*** (2)	-7* (3)	-9*** (3)
$(1 - \beta_{f,hh})$	6*** (2)	10*** (3)	4** (2)
$(1 - \beta_{f,nfc})$	2* (1)	-2 (3)	5* (3)
$(1 - \beta_f)$	3 (2)	1 (3)	5* (3)
Panel B: EU			
	1995–2007	2008–2013	1995–2013
$(1 - \beta_{f,fc})$	1 (2)	-2 (3)	2 (3)
$(1 - \beta_{f,govt})$	-6** (2)	-5* (3)	-8*** (3)
$(1 - \beta_{f,hh})$	6*** (2)	10*** (3)	5** (2)
$(1 - \beta_{f,nfc})$	2 (2)	-3 (2)	4 (3)
$(1 - \beta_f)$	3 (2)	1 (4)	7** (3)

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors in parentheses. *govt*, *hh*, *fc*, *nfc* stand for General Government, Households, Financial and non Financial Corporations sectors. Estimated equations allows for heteroscedasticity by using two-step Feasible Generalized Least Squares (FGLS). The estimations are represented in percentages.

Table 3: Risk sharing via net factor income across different economic sectors (percentage)

Panel A: new EU			
	1995–2007	2008–2013	1995–2013
$(1 - \beta_{f,fc})$	2 (2)	2 (3)	2 (2)
$(1 - \beta_{f,govt})$	-4 (3)	9* (5)	0 (1)
$(1 - \beta_{f,hh})$	-2 (2)	10*** (4)	5** (2)
$(1 - \beta_{f,nfc})$	2* (1)	-2 (3)	5* (3)
$(1 - \beta_f)$	-1 (2)	7 (4)	2 (4)

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors in parentheses. *govt*, *hh*, *fc*, *nfc* stand for General Government, Households, Financial and non Financial Corporations sectors. Estimated equations allows for heteroscedasticity by using two-step Feasible Generalized Least Squares (FGLS). The estimations are represented in percentages.

Table 4: Shares of sectors on the total foreign assets holdings (percentage)

	Equity Holdings			Debt Holdings		
	HH	NFC	GOV	HH	NFC	GOV
Australia	1.63	0.94	NA	NA	NA	8.50
Austria	23.90	3.69	0.26	4.40	2.50	39.40
Belgium	39.33	8.40	0.60	7.20	3.40	37.70
Denmark	5.80	4.91	2.14	5.40	3.60	0.80
Finland	3.78	1.60	51.60	1.20	8.50	36.20
France	16.61	12.66	2.12	7.20	4.14	22.20
Germany	44.32	12.12	0.56	4.51	5.40	16.95
Italy	39.04	5.36	0.91	28.14	3.03	0.31
Netherlands	6.90	7.25	NA	1.15	0.48	2.14
Portugal	15.87	19.87	6.57	NA	2.20	0.96
Spain	35.25	20.43	0.00	11.75	6.41	2.14
Sweden	14.25	3.62	18.12	11.42	2.13	16.14
UK	13.12	4.24	0.01	NA	NA	NA

GOV, HH, NFC stand for General Government, Households and non Financial Corporation sector.

Table 5: Risk sharing via savings across different economic sectors (percentage)

Panel A: OECD			
	1995–2007	2008–2013	1995–2013
$(\beta_{s,fc})$	2 (2)	-4 (3)	-2 (2)
$(\beta_{s,gov})$	12** (5)	20*** (5)	16*** (3)
$(\beta_{s,hh})$	5 (5)	2 (4)	2 (3)
$(\beta_{s,nfc})$	22*** (5)	1 (3)	12*** (4)
$(\beta_s)$	38*** (6)	16*** (6)	24*** (6)
Panel B: EU			
	1995–2007	2008–2013	1995–2013
$(\beta_{s,fc})$	2 (3)	-4 (3)	-2 (2)
$(\beta_{s,gov})$	11** (5)	17*** (5)	13*** (4)
$(\beta_{s,hh})$	7 (6)	1 (4)	3 (3)
$(\beta_{s,nfc})$	15*** (3)	-1 (3)	10*** (4)
$(\beta_s)$	37*** (6)	13** (6)	21*** (4)

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors in parentheses. *gov*, *hh*, *fc*, *nfc* stand for Households, Financial and non Financial Corporations sectors. Estimated equations allows for heteroscedasticity by using two-step Feasible Generalized Least Squares (FGLS). The estimations are represented in percentages.

Table 6: Risk sharing via savings across different economic sectors (percentage)

	Panel new EU		
	1995–2007	2008–2013	1995–2013
$(\beta_{s,fc})$	-1 (2)	10** (4)	3 (2)
$(\beta_{s,gov})$	4 (5)	3 (6)	3 (4)
$(\beta_{s,hh})$	3 (5)	-8 (8)	2 (4)
$(\beta_{s,nfc})$	6** (3)	9*** (3)	7* (4)
$(\beta_s)$	12*** (4)	17*** (4)	15*** (5)

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors in parentheses. *gov*, *hh*, *fc*, *nfc* stand for General Government, Households, Financial and non Financial Corporations sectors. Estimated equations allows for heteroscedasticity by using two-step Feasible Generalized Least Squares (FGLS). The estimations are represented in percentages.