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International financial markets and shock absorption in the euro area

Abstract:
This deliverable investigates the role of financial markets in smoothing the impact of asymmetric shocks in the euro area. The first part offers an assessment of international risk-sharing through international capital markets relative to other mechanisms and compares the euro area to the United States. The second part focuses on the role of international credit markets in providing consumption smoothing, as opposed to inter-state risk-sharing. In doing this, it distinguishes the part driven by policies of the governments from that associated with private sector's behaviour, and emphasizes the difference between domestic absorption and borrowing in international markets.

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Part I

Risk-sharing and Consumption-smoothing Patterns in the US and the Euro Area: A comprehensive comparison

Abstract

This paper compares the capacity to smooth the impact of asymmetric shocks in the US and in the euro area (EA) and examines the various mechanisms through which the shock absorption occurs. It first notes that comparable data for the US and the EA are not readily available, and that in the US, state accounting is such that what the literature commonly calls international risk-sharing in reality embeds inter-temporal consumption-smoothing through retained corporate earnings. With this in mind, we build euro area aggregates suitable for comparison. Our findings confirm that international capital markets in the US are a more powerful tool for risk-sharing than in the EA, but less so than previously reported. The better performance of the US is explained by very poor shock-absorption dynamics in the peripheral euro area countries, especially after 2010, as well as by a higher persistence of shocks in the euro area relative to the US.

Keywords: risk sharing, consumption smoothing, shocks absorption, OCA

JEL Classification: E21, F40, G11

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1 Introduction

In recent years, and in particular after the sovereign debt crisis, the idea of international risk-sharing as a tool to increase the resilience of the monetary union to asymmetric shocks has become part of the debate on the reform of E(M)U governance.

International risk-sharing is a notion that has been developed in the macroeconomic literature independently from the context of monetary unions and is linked to international financial integration (e.g. Obstfeld & Rogoff, 1996). Economic theory has long recognised the potential benefits of open capital markets, both in the direction of promoting growth and smoothing the time profile of consumption and investment, but also of diversifying idiosyncratic country-specific risks.[1]

In the 1990s, the experiment of European monetary integration inspired a considerable body of empirical research on international risk-sharing (e.g. Sorensen & Yosha, 1998). However, interest in the concept has only gained significant prominence among policy-makers following the euro area crisis. The recent focus on international risk-sharing marks a shift in the thinking about the functioning of EMU, departing from the optimum currency area (OCA) theory, which represented the theoretical framework of reference during the construction of EMU.[2]

While the OCA theory has evolved significantly over the years, after the seminal work of Mundell (1961), the linkages between and the consistency of principles across the OCA theory and international risk-sharing theory have been rarely investigated. Policy prescriptions based on the different formulations of the OCA theories tend to support measures aiming to increase the flexibility of prices (and wages) and the mobility of factors of production in order to absorb the impact of asymmetric shocks through market mechanisms. From this viewpoint, other than structural reforms, both financial and commercial cross-country market integration is seen as beneficial[3] to the extent that it contributes to higher cross-country synchronisation of business cycles. Under these circumstances, the cost of giving up national sovereignty over monetary policy in favour of a common policy is thus reduced.

In risk-sharing theory, which formalises how disconnecting domestic consumption dynamics from domestic income is beneficial when a country is hit by an asymmetric shock, a certain degree of heterogeneity across business cycles does not pose a risk, but rather is potentially an asset, as it increases the room for international diversification (Imbs & Mauro, 2007). From a theoretical point of view, asset portfolio diversification (to hedge against adverse states of nature) allows a country to diversify income sources across-borders, which in principle is only feasible when output growth rates across countries display different dynamics. In order to reap these benefits, financial integration is usually considered a necessary condition for increasing the completeness of markets (expanding the set of available assets per state of the economy).

[1] Still, despite the continuing process of financial integration and globalisation, it is unclear whether such benefits are fully exploited in actual practice.

[2] In the end, the idea of building a framework for nominal convergence (Maastricht criteria) was preferred to the prescription of the OCA theory, which was more strongly oriented towards real convergence.

[3] See endogenous OCA theory, Frenkel & Rose (1997 and 1998).

This implies that both the OCA theory and the international risk-sharing theory prescribe market integration for their functioning but for different, and even opposite, purposes. While becoming an 'OCA' implies further flexibility for a better synchronisation of business cycles, the risk-sharing approach focuses on the cross-country synchronisation of consumption, taking differences in output growth as an opportunity for diversification.

The increasing attention paid to the concept of risk-sharing has been driven by a desire to understand the drivers of the (more) successful experience of existing federations, in particular the US, in the face of the financial crisis. In this respect, the limited capacity of EMU to face shocks is often attributed to the low level of market-based risk-sharing. In this sense, the euro area appears to contrast with the high degree of private risk-sharing in the US. Evidence of such feature of the US economy is found in an influential paper by Asdrubali et al. (1996), who argue that over 60% of shocks to a US state are smoothed through market mechanisms. However, economic literature focusing on alternative approaches, for instance Del Negro (2007), reaches the conclusion that that inter-state risk-sharing may be significantly more limited.

Beyond methodological considerations, one fundamental problem is that an accurate measurement of inter-state private risk-sharing is made difficult by the limited availability of data, namely bilateral cross-country income flows. This implies that the measurement of private risk-sharing in the end has to rely on approximations, which may entail measurement errors, or which embed different mechanisms to absorb the impact of shocks.
Against this background, this paper seeks to provide a comprehensive comparison of risk-sharing (and consumption-smoothing) patterns in the US and the euro area, focusing on the role of markets.[4]

As a first step, it presents stylised facts, in the vein of Del Negro (2007), to provide evidence of the 'broad' degree of international risk-sharing based on the comparison of consumption and output correlations patterns within the US and euro area over time. It then uses the framework of Adsrubali et al. (1996) to analyse and compare different channels for risk-sharing and consumption-smoothing. In order to do this, we first review some measurement and data issues relevant for measuring international risk-sharing and, above all, for the correct comparison between the two regions.

The results stemming from the two parts are then compared. The objective is not to reconcile the findings of the two different methodologies, but rather to investigate changes over time and compare patterns across the two regions.

Lastly, we attempt to explain the differences between the two regions by looking into whether the different capacities to absorb shocks, and international risk-sharing in particular, can be related to the persistence of shocks.

The rest of the paper is structured as follows. Section 2 reviews key findings of the literature on how the impact of shocks can be smoothed through different channels in the US and Europe, and presents a few stylised facts about international risk-sharing. In section 3, we offer an appraisal of the different channels of income and consumption-smoothing in the US and the EA, using fully comparable data. Section 4 attempts to explain the main differences, based on features of the euro area and on differences in the persistence of shocks. Section 5 concludes.

[4] See Alcidi & Thirion (2017) for an in-depth analysis of the role of fiscal institutions in the US vs. the EA.

2 International risk-sharing and consumption-smoothing

In macroeconomics, the international risk-sharing framework is based on the assumption that country-specific shocks[5] cannot be avoided, but their effects can be distributed over other countries (spatial or cross-country risk-sharing) to reduce their impact on domestic consumption. The literature focusing on the performance of federations in terms of absorbing the impact of asymmetric shocks considers not only mechanisms for spatial risk-sharing (income-smoothing) but also intertemporal risk-sharing or, as it usually called consumption-smoothing. The latter refers to the possibility to smooth the impact of shocks on consumption (and welfare) also over time, by intertemporal choices about savings and consumption, through access to domestic and international credit markets.

In the context of a pool of countries, like the euro area or a fully-fledged federation like the US, cross-country risk-sharing is provided at a private level by the international ownership of assets and international wage transfers,[6] usually called international factor income, as well at the fiscal level (if it exists), by cross-country transfers of fiscal resources, for instance from a federal budget. Consumption-smoothing, instead, is determined by intertemporal choices in spending and saving of both the private sector (households and corporations) and the (national) government.

The most widely used framework to measure the different channels (i.e. international factor income, transfers and savings) through which the impact of an output shock is absorbed is the one formulated by Asdrubali et al. (1996) and refined in Sorensen & Yosha (1998), and this is based on a (GDP) variance decomposition approach.

The key finding of Asdrubali et al. (1996), who analysed US data between 1963 and 1990, is that 39% of the shocks to the per capita gross product of individual states in the US is smoothed on average through transactions on capital markets, 23% through consumption-smoothing, a small part (13%) by the federal tax-transfer and grant system and 25% of shocks is not smoothed.

This suggests that although perfect insurance is not achieved, there is considerable risk-sharing among US states. These results are broadly confirmed by more recent data, as shown in the next section.

Sorensen & Yosha (1998) analyse risk-sharing patterns among EU member states (and also OECD countries) between 1966 and 1990, and show that less than 50% of the shock is smoothed, well below the 75% of the US, and find that this is achieved through corporate savings and budget deficits,[7] not through capital markets.

The work of Furceri & Zzdienicka (2013), which analyses risk-sharing patterns for 15 euro area member states between 1979 and 2010, confirms that factor income flows do not contribute to smooth income across countries in the euro area and that risk-sharing mechanisms are particularly ineffective

[5] Or the asymmetric effect of common shocks. We are not able to distinguish the two cases.

[6] It should be noted that in this context, 'international' refers to cross-state transfers within the US federation. Similarly, in the EA, it refers to transfers across euro area member states. This clarification, which is conceptually important, is not accounted for when it comes to the empirical analysis because existing data are simply flows from/to individual states vis-à-vis the rest of the world, and it is not possible to distinguish the part that remains within the US federation or within the EA from the total.

[7] Interestingly, as the authors note, this needs no actual international flow of funds as it can happen simply through changes in domestic savings without international borrowing or lending.

during financial crises. Since factor income flows, which form the most important component of income smoothing, are driven by capital markets integration, the finding seems to suggest that European capital markets are less integrated than US capital markets and that this has remained a fact even after the creation of the single currency.[8]

Against this background, we start our analysis from the theory on international risk-sharing and try to establish some stylised facts about it, drawing on US and the euro area data over several decades.

2.1 Stylised facts on the US and the euro area

International risk-sharing is grounded on the idea that access to international financial markets leads to international diversification of country risks by allowing for a diversification of portfolio opportunities. An optimal portfolio allocation implies that consumption in one country is only affected by symmetric risks, which are not insurable through diversification. As a result, the correlation in (the growth rate of) consumption across the countries of the pool considered – the US or the EA in our case – should be high, while the correlation between domestic consumption and domestic output should be low.

In a more sophisticated fashion, the degree of risk-sharing can be assessed based on the following two inequalities of correlations:[9]

$$cor(GDP_i, GDP_w) < cor(CONS_i, CONS_w) \quad (1)$$

$$cor(CONS_i, GDP_i) < cor(CONS_i, GDP_w) \quad (2)$$

Where CONS and GDP indicate growth rates of consumption and output, respectively, and the subscript *i* stands for domestic (state or member state) and *w* for the pool of countries (either US or EA), respectively.

Inequality (1) implies that correlations in GDP (between each US state and the whole US and between each EA member state and the whole EA) should be lower than correlations in consumption (between each same state, or member state, and the respective region). This inequality is based on the idea that additional flows of international income (associated with non-nationals and non-residents and hence not captured by GDP) affects consumption and disconnects it from domestic GDP. Under the hypothesis of complete markets, one should expect $cor(c_i, c_w) = 1$.

Inequality (2) implies that the correlations between domestic consumption and domestic output should be lower than correlations between domestic consumption and output in the rest of the region. Likewise for inequality (1), this is the case in the presence of international income insurance through large cross-country factor income flows and international transfers, which are captured by the income but not by the national GDP.

The figures below show the four correlations involved in the two inequalities above over two different time samples (to account for the break associated with the introduction of the single currency in Europe and with sample data revisions in the US), both for the US and the euro area.

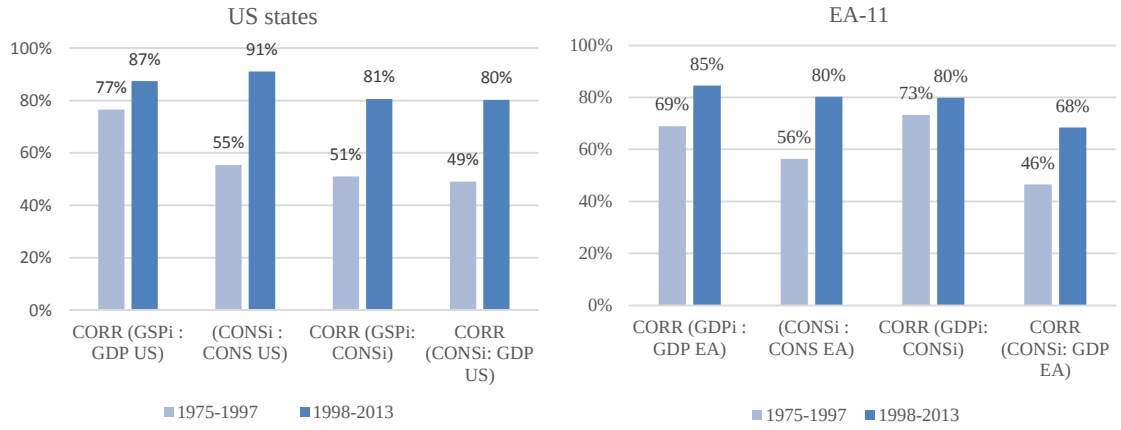
[8] See, for instance Allard et al. (2013) and Allard et al. (2014).

[9] Correlation is defined, as usual, as a ratio of covariance of the product of standard deviations and it ranges between -1 and 1.

Overall it is quite interesting to note that, at first sight, the difference between the US and EA is not as dramatic as one might imagine based on the common understanding that risk-sharing in the US is much larger than in the euro area, and this seems to be the case both before and after 1998. Below we consider the figures in detail.

The first condition for international risk-sharing – as defined in inequality (1) – is that the consumption correlation coefficients must be higher than GDP correlation coefficients (comparison between the first and second set of bars in the two figures). In the period 1998-2013, the consumption correlation among US states is about 0.9 (not far from 1, which would be consistent with full risk-sharing) and is higher than in the EA countries (0.8) and higher than GDP correlations (91% against 87%). This was not the case in the years 1975-1997, and it is still not the case in the EA (80% against 85%). This result implies no meaningful risk-sharing over that period. In both regions, consumption correlations have substantially increased since 1998 (bars are higher for the more recent sample) and in the US overtook correlations in GSP (gross state product), hinting at risk-sharing. This finding seems to be consistent with the idea that financial liberalisation, which took place from the 1990s onwards at global scale, led to greater financial integration and increased the completeness of markets and hence diversification opportunities. In the euro area the process of financial integration, which was driven and reinforced by the creation of the single currency, seems (we are not claiming causality) to have led to an increased correlation in consumption across member states.

Figure 1. (Real per capita) Consumption and GDP correlations, US (LHS panel) and euro area (RHS panel), 1975-1997 and 1998-2013



Note: EA-11 = Austria, Belgium, France, Germany, the Netherlands, Finland, Italy, Portugal, Spain, Ireland and Greece. The bars depict cross-country average correlation coefficients, calculated over the periods 1975-1997 and 1998-2013. Reported correlation coefficients are respectively between domestic (i.e. state or member state) and US/EA output growth; domestic and US/EA consumption growth; domestic consumption and domestic output growth; domestic consumption growth and US/EA output growth.

Source: Authors' formulation.

Backus et al. (1992),[10] Baxter (1995), Stockman & Tesar (1995) and Sorensen & Yosha (1998) all investigated risk-sharing, focusing on the comparison between cross-country GDP and consumption correlations until the 1990s, and find that consumption correlations were lower than output correlations, which is similar to what the light bars in Figure 1 indicate. This finding was usually

[10] They are the first to introduce the so-called 'quantity anomaly', the evidence that de-trended consumption is less correlated cross-country than output.

interpreted as evidence against full risk-sharing, but Sorensen & Yosha (1998) point out that it is more than that. While the lack of full risk-sharing is consistent with consumption correlations lower than 1, the lack of risk-sharing cannot explain consumption correlations that are smaller than output correlations. This is a well-documented international consumption correlation puzzle in the literature. Stockman & Tesar (1995) advance the hypothesis that low consumption correlation is consistent with risk-sharing when countries face taste shocks. If this hypothesis is true, such shocks are still important in the euro area, while their role in the US has decreased over time.[11]

Del Negro (2002) argues that the problem is not necessarily shocks in preferences, but one of measurement and contends that interstate risk-sharing in the US is lower than reported in Asdrubali et al. (1996) because of a measurement error in the output when using such approach.
Inequality (2), which posits that the correlation between domestic consumption and domestic GDP should be lower than correlation between domestic consumption and the output of the whole region (comparison of the third and fourth sets of bars in Figure 1) is never satisfied, for any region in any time period.

Overall, the above findings suggest poor evidence of international risk-sharing before 1997, in line with previous literature, and a change after that; indeed correlation in cross-country consumption becomes higher than output after 1998. In the US international risk-sharing is not full but higher than in the euro area, where the key condition is not satisfied.

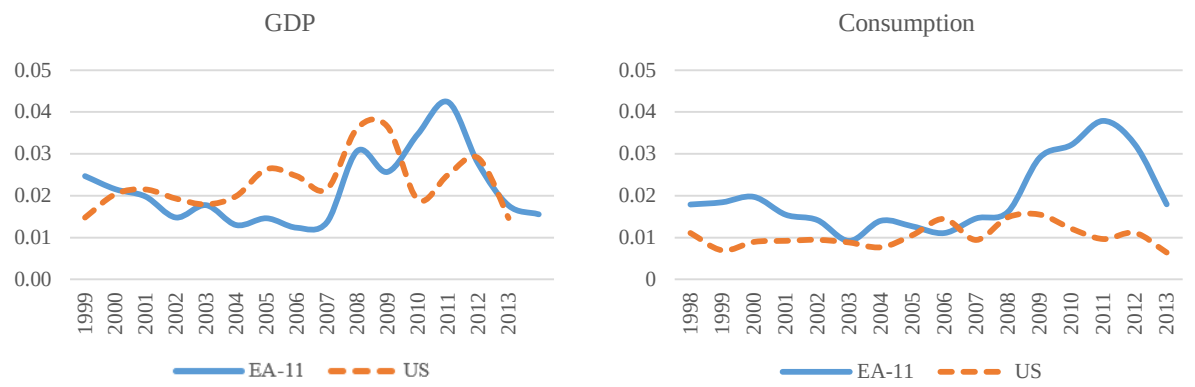
The two panels in Figure 2 compare the patterns (in growth rates) of output and consumption dispersion for the US and the euro area. Unlike correlation, cross-sectional dispersion measures the distance from the average and gives a sense of heterogeneity within the region. In practice, high correlation could coexist with high dispersion, which would capture differences in the magnitude of growth rates.

A shown, consumption dispersion in the US is very stable and lower than in the euro area, especially after 2008. In the euro area, dispersion in consumption seems to mimic GDP dispersion and its increase is likely to be related to the different way the crisis played out across euro area member states. This implies that in the US, GSP growth rate differences are higher than consumption growth rate differences,[12] which may suggest that mechanisms are in place that allow for consumption to be less sensitive to swings in GSP. This is usually taken as evidence to support international risk-sharing (see Del Negro, 2002). The same is not true for the euro area, which tends to display a lower degree of dispersion in GDP compared to the US but a higher degree of heterogeneity in consumption.

[11] This could also explain why consumption correlation increases while the fraction of smoothed shocks in the US, as estimated in the next section, is constant over time. Indeed, the Asdrubali et al. (1996) methodology is immune to taste shocks (see Sorensen & Yosha, 1998, p. 231)

[12] As shown in Alcidi & Thirion (2017), a similar finding holds when comparing GSP and changes in employment rates.

Figure 2. Cross-section dispersion in GDP growth (panel a) and consumption growth (panel b): EA11 vs. US states (1998-2013)



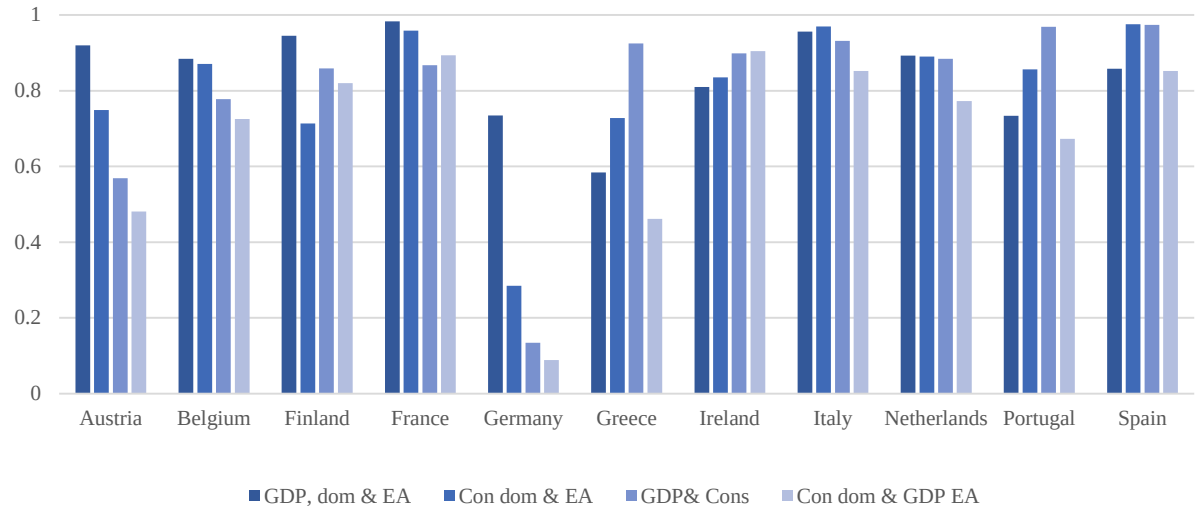
Note: The dispersion in output and consumption growth rates (real per capita) is measured as the respective standard deviation among EA and US countries.

Source: Authors' computations based on OECD national account for EA countries, and Bureau of Economic Analysis (BEA), US Department of Commerce.

In sum, the correlation approach suggests that after 1998 there seems to be evidence of inter-state risk-sharing in the US, while this is not the case in the euro area.

Figure 3 moves away from the US-EA comparison and sheds light on the risk-sharing differences across euro area member states, by displaying the four correlations in inequalities (1) and (2) by country. The data suggest that the aggregate picture (averages) as shown in Figure 1 hides substantial cross-country differences.

Figure 3. Real per capita consumption and GDP correlations between domestic and euro area growth rates, EA member states, 1998-2013



Note: Correlation coefficients are calculated over the period 1998-2013 for each country. Reported coefficients are respectively between domestic and EA GDP growth; domestic and EA consumption growth; domestic consumption and domestic output growth; domestic consumption growth and EA output growth.

Source: Authors' computations based on OECD national account data.

The special feature of Germany is patent. Consumption seems to follow very peculiar dynamics, completely disconnected from domestic GDP and consumption in the rest of the area. Austria also displays similar features. Such disconnection seems to suggest that Germany and Austria are able insulate their consumption patterns from GDP fluctuations, but this is not the result of risk-sharing with other euro area member states. It could be either the result of risk-sharing at international level (outside the EA) or consumption-smoothing through domestic savings and/or absorption. Interestingly, few countries satisfy the condition that output correlation is lower than consumption correlation (comparison of the first and second bar for each country), as predicted by the risk-sharing theory; these are Greece, Ireland, Italy, Portugal and Spain. This is the 'usual' group of peripheral euro area countries, which received large capital inflows during the early years of monetary union, grew at high rates and, above all, were able to substantially increase their consumption. Since 2010, they have been hit hard by the crisis and their GDP growth fell more than in the rest of the euro area. Yet, the very high level (on average over the 16 years) of consumption correlation (in Spain and Italy it is close to 1) suggests that some mechanisms work in the direction of disconnecting GDP dynamics for consumption dynamics. Other than the usual intertemporal (savings and fiscal policy) and market mechanisms, the ECB interventions in support of banks and the emergency support facilities (EFSF and others) may have played a role.

3 Comparing risk-sharing in the US and the EMU

Against the prima facie evidence of limited risk-sharing in the euro area and a lower degree of risk-sharing than in the US, this section enriches the analysis by following the standard framework used in the literature, as initiated by Asdrubali et al. (1996), to measure risk-sharing in response to GDP shocks. This consists of applying a variance decomposition of shocks to GDP in order to quantify the share of smoothing achieved via the various channels. It is based on national accounting and the starting point is the disaggregation of member states' GDP (GSP for the US states) into: national income (NI), net national disposable income (NNDI) and total consumption (C+G). From these aggregates, we identify the following channels through which GDP shocks are smoothed:

GDP-NI =*international income transfers (factor income flows)*
NI-NNDI = *net international taxes and transfers*
NNDI-(C+G) = *total (private and public) net savings*
We then consider the following identity:

$$(1)\ GDP_i = \frac{GDP_i}{NI_i}\frac{Ni_i}{NNDI_i}\frac{NNDI_i}{(C+G)_i} * (C+G)_i$$

Taking logs and first differences (1), we obtain four equations, which come down to a simple variance decomposition of GDP into four factors, the (so-called) market channel (measured by the international factor income), international transfers, net total savings and consumption being the last one.[13]

Before focusing on the outcome of the regression estimates, we first look into the features of the data to ensure full comparability between the US and the euro area.

The dataset for the US states is built following Asdrubali et al. (1996). Detailed information on the construction of the time series is available in their seminal paper and the description of the main elements are summarised in Box 1. As already mentioned in Sorensen & Yosha (1998), US and euro

[13] The detailed derivation of the equations and steps of the estimates can be found in Alcidi & Thirion (2016).

area data are not readily comparable, because of the different degree of richness of data at the level of euro area member states and US states. US states' data are poorer; in particular, GNI does not exist at the level of each state. The problem is overcome by building a database14 starting from information on income, taxes, contributions and transfers at personal level, which is then used to derive the state income (SI). The latter is taken as a proxy for GNI. By contrast, for the euro area countries, GNI comes directly from national accounts and data are much more detailed, including at the sectoral level.

One crucial implication of the US approach in building states' statistics is that the difference between GSP and SI in the US includes not only international factor income but also net savings from the corporate sector (mostly retained earnings), which in the euro area statistics is part of the total net savings (often called the credit channel) and not accounted for in the difference between GDP and GNI. The latter is factor income, in a 'proper' sense.

As a consequence, without adjusting the data, the comparison of the different channels between the US and the EA will be biased. The so-called capital market channel (in broad sense, the factor income) is over-estimated in the US relative to the EA and, in the EA, the net savings (or credit) channel is overestimated relative to the US (provided that corporate savings contribute positively to consumption-smoothing).

Box 1. Understanding US data

US data are available for the period 1963-2013; they are state-level, yearly, real and per-capita.

Gross State Product (GSP) is the 'value added' of the industries at the state level.

State Income (SI) is composed of personal income[15] (income received by persons from all sources), federal and state (and local) non-personal taxes (and contributions), and interest on state and local funds, minus public direct transfers. At the national level, State Income roughly corresponds to Gross National Income (GNI).

Disposable State Income (DSI)

Disposable state income is composed of state income plus federal aid to state and local governments, plus federal transfers to individuals (unemployment benefit), minus federal personal and non-personal taxes.

Net Federal Transfers to States

Net federal transfers to states are defined as the sum of federal aid to state governments, federal transfers to individuals (unemployment benefits and other transfers to individuals), minus federal personal and non-personal taxes (direct, social security and indirect).

State[16] Government Net Savings

State Government net savings is the difference between government disposable income and government final consumption or the difference between current revenues and current expenditures.

[14] We are grateful to B. Sorensen for providing us with information about the time series used in the original estimates.

[15] Personal income is the sum of wages, salaries, supplements to wages and salaries, proprietor's income with inventory valuation adjustment and capital consumption adjustment (CCAdj), rental income of persons with CCAdj, personal income receipts on assets (dividends and interests), personal current transfer receipts less contributions for government social insurance.

[16] Including local governments.

Government disposable income is the sum of (state non-personal) taxes, federal aid to states and other revenues, minus direct transfers to individual and state consumption.

State Consumption

State consumption is defined as the sum of private and public (state and local governments) consumption. Private consumption by state is only available since 1997; as in Asdrubali et al. (1996), to obtain the previous years we rescale the total retail sales by the ratio of aggregate US private consumption to aggregate US retail sales.

Lastly, capital depreciation, which is usually estimated as a separate channel for the EA, cannot be isolated at the level of US states and is included in the capital market channel. This is a fixed proportion of the capital stock, so it tends to be highly pro-cyclical (hence, it tends to reduce risk-sharing) and is not very informative, but can be quite large.

3.1 Main results: US vs. EA

Against this background, we begin by presenting the estimates of the channels for shock absorption as usually presented when comparing the US and the euro area (figure 4, LHS), and then the estimates based on adjusted data which yield comparable estimates for the US and euro area (figure 4, RHS).

We start by showing the main results for the period 1998-2013, and then provide a breakdown to account for the effect of the different stages of financial crisis. This time period was chosen because in the euro area the separation of retained corporate savings from household savings is not available before 1996, and US data exhibit a structural break due to a methodological change in the collection of GSP and consumption data in 1997.[17] In order to obtain a so-called 'capital market' variable comparable to the US, we add corporate savings and the capital depreciation[18] to the international factor income. Conversely, corporate savings are removed from net savings in the EA. While this allows for an accurate comparison of the respective channels, it is important to note that the amount of income-smoothing provided by capital markets does not necessarily fully consist of cross-border components (i.e. corporate savings do not involve cross-border income-smoothing).

In the case of the euro area we consider only 11 member states, namely the current members with the exception of the new member states (namely the Baltic states, Slovakia and Slovenia), because data are not available for most years, and Luxembourg, Malta and Cyprus, which are very small and atypical.

The US results (Figure 4) are in line with the findings from the literature presented above, although the time period is different and covers only the most recent years. Compared to the results of Asdrubali et al. (1996), the absorption of shocks through capital markets and consumption-smoothing (essentially personal savings and state-level fiscal policy) has remained unchanged compared to 1963-1990. At the same time, the role of federal transfers has slightly decreased in recent years (8% compared to 13% in the original study of Asdrubali et al. (1996)).The results for the EA (no adjustment) also confirm previous findings from the literature (e.g. Furceri & Zdzienicka, 2013). They

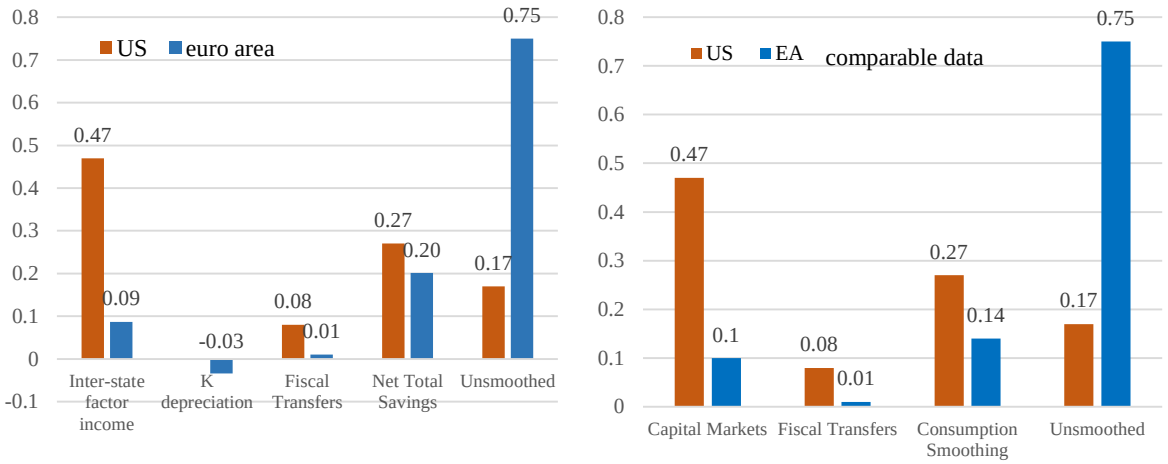
[17] Gross state product (GSP), issued by the US Bureau of Economic Analysis (BEA), changed from SIC industry definitions to NAICS industry definitions in 1997. Personal consumption data are only available after 1997.

[18] Capital depreciation cannot be isolated in the US data.

validate a very limited role of capital markets, a dominant role of savings and a large (as much as three times as in the US) share of the impact of shocks not smoothed.

Figure 4. Income and consumption-smoothing in the US vs. EA-11

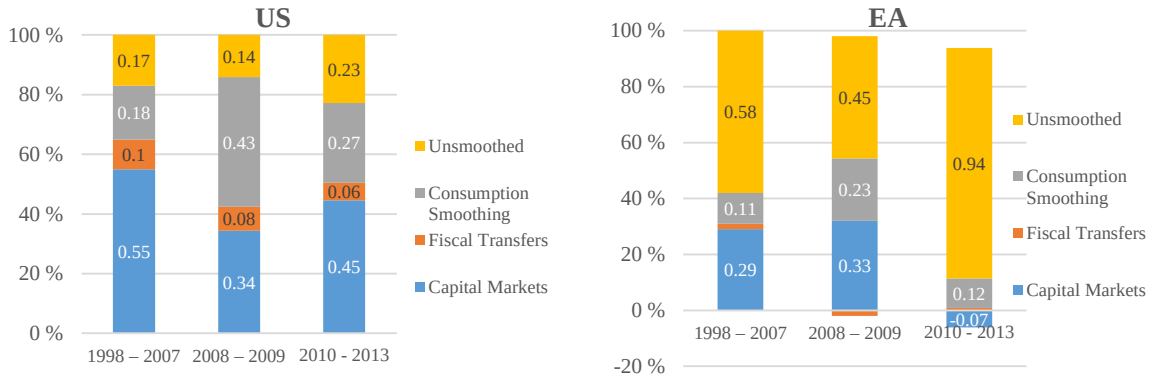
No-adjustment in data (left panel) Fully comparable data (right panel), 1998-2013



Source: Authors' computations based on US Bureau of Economic Analysis and OECD national account data.

The results shown in the right panel of Figure 4 are those with comparable data for the euro area. Findings (Figure 4, RHS) indicate that while coefficient estimates are slightly affected, the overall message emerging from previous findings does not change substantially. The so-called capital market channel plays a large role in the US while it is very limited in the EA. Hence, accounting for the new aggregation does not seem to be crucial, at least on average. However, given that the 16 years we considered have been characterised by large cyclical swings and a profound crisis, time averages may hide large differences. We therefore break down the time sample into sub-periods and assess whether the results still hold.

Figure 5. US-EA comparison by sub-periods (comparable data), 1998-2013



Note: 2008-09 are very special years, with the collapse of Lehman Brothers and then the coordinated fiscal stimulus.
Source: Authors' computation.

In section 5, we present a time breakdown of the empirical results presented on the left panel of figure 4 with adjusted euro area data. Breaking up the sample into sub-periods (see Figure 5, left panel), we find that US fiscal transfer absorption capacity, as provided by the federal budget, is overall limited

and even has fallen during 2010-2013, suggesting that the US fiscal stimulus did not focus on smoothing asymmetric shocks. Yet, in the US the unsmoothed part of the shock remains small, although it slightly increased in recent years – which may partially be a direct reflection of the relatively low absorption through inter-state transfers during – but much less than in the EA.

Interestingly, capital markets and consumption-smoothing (driven by personal savings) exhibit the largest variability; the role of capital markets appears to have declined since the eruption of the financial crisis, while that of savings has increased (with a dramatic increase during the peak of the crisis), but their sum has almost remained constant over time (see section 3.2 for more details on the US). Despite its significant decline in 2008-2009, the capital markets channel has recovered in 2010-2013, and remains the most powerful way to absorb shocks.
In the euro area, still under the new aggregation, capital markets seem to perform significantly better in 1998-2009 than what we had found on average. This is true at least in the first two sub-periods. Although one would ideally compare the respective role of corporate saving in the US with the EA, the finding that using comparable estimates leads to a much smaller (yet significant) discrepancy between the US and the EA is a crucial result of this study. On the one hand, it qualifies the gap between both regions during 'normal times'. On the other hand, it points to the importance of well-functioning capital market integration during a prolonged crisis.

After 2010, the so-called capital market channel collapses and de-smooth the impact of the shocks in the EA (figure 5, RHS). This can be explained by several factors. First, in the new aggregation of data the capital market channel includes capital depreciation, which appears to be relatively large, up to 10 percentage points, and highly pro-cyclical.[19] Second, according to the finding from Sorensen & Yosha (1998), corporate savings account for half of the smoothing in the EA. However, as shown in Alcidi et al. (2017), the smoothing role of corporate savings collapsed during the 2010-2013 period. This is in line with the evidence that savings are sensitive to the cycle and tend to not work properly when negative shocks hit.[20] The weak performance of the comparable measure of capital market in the euro area thus seems to explain why incorporating corporate savings into capital market smoothing did not affect the results significantly. As argued by Asdrubali et al. (1996), this is compounded with the fact that larger shocks weigh more heavily on the coefficient estimates, which means that the low amount of smoothing during the crisis has a relatively larger impact on the overall coefficient estimate.

In the euro area, net savings (excluding corporate savings) have provided relatively limited shock absorption and even less over the last sub-period (2010-2013), which was marked by a collapse of consumption smoothing through government budgets (Alcidi and Thirion, 2007). To some extent, the growing unsmoothed part can be understood as the result of savings' inefficiency in the face of persistent or permanent shocks.

In order to shed light on this point, we first look into specific dynamics of two euro area country groups, the core and the periphery; and second, we try to appreciate the potentially different role of the nature of shocks in the US and in the EA.

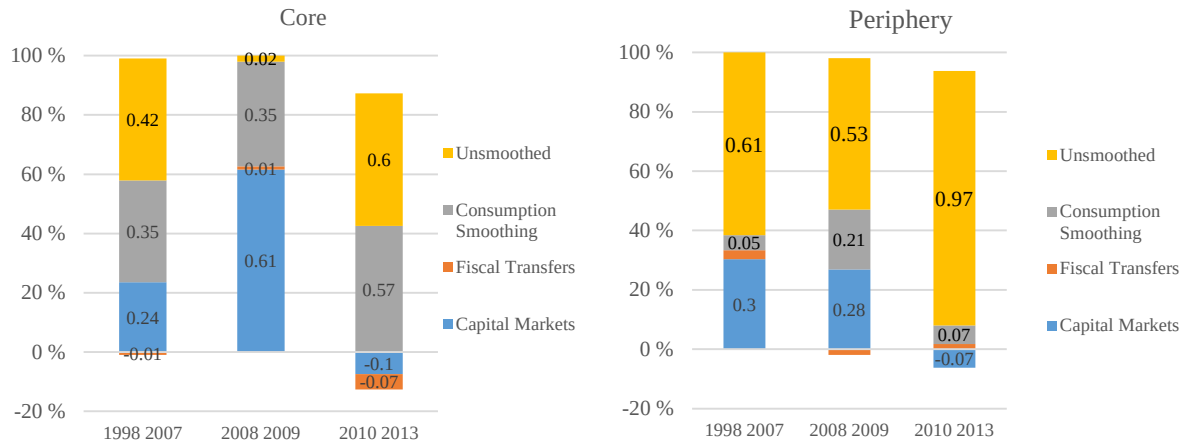
[19] It is such by definition, given that it is computed as a fixed percentage of fixed capital formation, which by its nature is highly pro-cyclical.

[20] See also Furceri & Zdzienicka (2013) on this point.

3.2 Euro area internal dynamics

As in Alcidi & Thirion (2016), we start by clustering euro area countries into two groups, core and periphery, where core includes Austria, Belgium, France, Germany, the Netherlands and Finland while periphery includes Italy, Portugal, Spain, Ireland and Greece and then compare the performance of the different channels.

Figure 6. Income and consumption-smoothing in EA core versus periphery (US-like aggregation)



Note: The channels are measured according to the US aggregation, and hence corporate savings are accounted in the capital markets channel. This explains why results do not exactly match the findings of Alcidi & Thirion (2016).

Source: Authors' computation.

The two charts in Figure 6 show that capital markets and consumption-smoothing exhibit a high volatility over time and great variance across the two country groups, especially after 2007 (except transfers, which always have a zero smoothing property). In particular, the unsmoothed part of the shock is systematically higher in the periphery than in the core. However, it is only in the latest years of the sample that this went well above the 60% found in the literature, mostly due to the lack of any smoothing coming either from savings or factor income. The higher resilience to shocks in the core countries after 2007 is fully explained by savings in the corporate sector (especially in the 2008-09 period) and then personal and public savings (after 2010).[21]

The charts above also suggest that the results for the euro area as a whole are largely driven by dynamics in the periphery, where the capacity to absorb shocks has been always lower.

3.3 US international long-term patterns in risk-sharing and consumption-smoothing

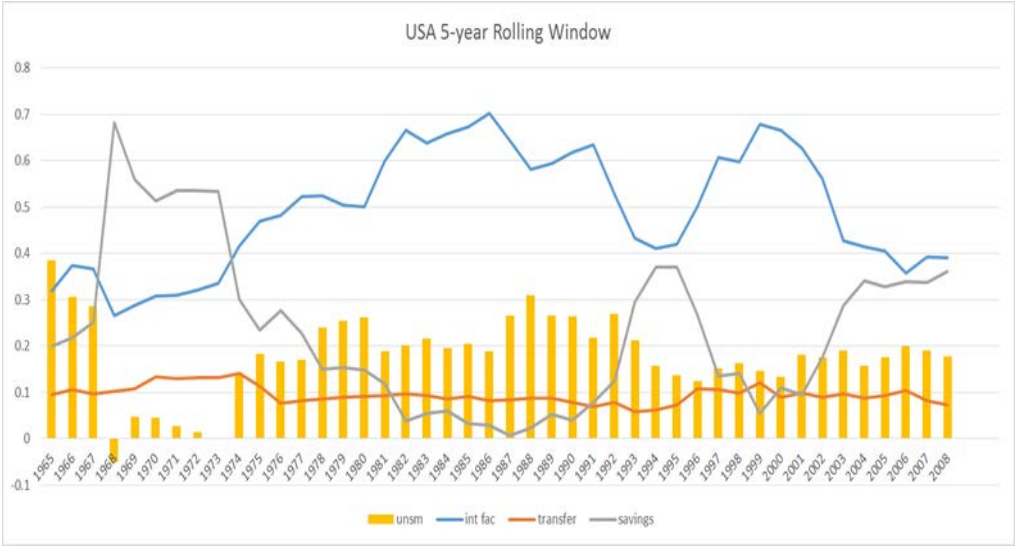
In this sub-section we focus on the US and look at how risk-sharing and consumption-smoothing patterns have evolved over almost 50 years, between 1965 and 2013, using full data availability. Using the same methodology as before, based on Asdrubali et al. (1996), we identify the effectiveness of different channels in smoothing the impact of shocks and illustrate them using five-year rolling windows.

[21] See Alcidi et al. (2017) for a detailed analysis of the behaviour of net savings.

As shown in Figure 7, the share of GSP shocks that remains unsmoothed has lingered below 30% for almost the 50 years considered and slightly declined, on average, from over 20% before 1993, to below 20% in the following period. The degree of income shock-smoothing through factor income (the blue line) has increased dramatically until the 1990s and then moved, following large cyclical swings. At the same time, the smoothing via net savings was on a declining trend until the early 1990s; after that it started to increase with an inverse u-shape pattern during the 1990s, and then grew again. Such an increase in the use of credit markets for risk-sharing purposes may have arisen from the increase in access to borrowing during the 2000s. In parallel, the amount of income shocks smoothed via international capital markets has fallen for more than a decade (since mid-2000s). As argued above, the Lehman crisis may have hit the functioning of the international market channel. It is not yet possible to assess whether this is a temporary or a long-lasting phenomenon. Interestingly, from the picture it emerges that international factor income mirrors the savings channel and their sum remains almost constant over time, at least since the mid-1970s.

To better understand the interaction between these two channels, we run a Granger causality test, to test the hypothesis that the functioning of capital markets affects the net savings. In other words, we want to test whether changes in the capacity to smooth shocks through the capital markets leads (in the Granger sense) to changes in the consumption-smoothing through savings and borrowing.

Figure 7. Channels of inter-state risk-sharing and consumption-smoothing 5-year rolling windows, 1965-2013



Note: 1965 refers to period 1965-1970 and 2008 to 2008-13.
Source: Authors' formulation[22].

The formulation of this hypothesis is based on the findings of Asdrubali & Kim (2004),[23] who analyse the interaction between international risk-sharing (fiscal or through capital markets) and inter-temporal consumption-smoothing (through net savings) channels in the US. They find that international capital markets and (federal) fiscal risk-sharing channels tend to be complementary and crowd out (or reduce) the consumption-smoothing through savings. The explanation put forward by

[22] the values of the unsmoothed part for the years 1968-1973 rolling windows are not significantly different from zero
[23] They use a panel VAR, so a different framework, to assess the interaction between risk-sharing and consumption-smoothing.

Asdrubali & Kim (2004) is that capital markets and fiscal transfers are *ex-ante* insurance mechanisms; they exist as a tool to deal with potential future shocks. On the other hand, consumption-smoothing is an ex-post mechanism, which eventually is triggered after the shocks have occurred and only when the other (ex-ante) channels are not able to fully absorb the initial shock. If this hypothesis is true, we should find that the capital market leads the credit market channel and reject a causality going from consumption-smoothing to the factor income.

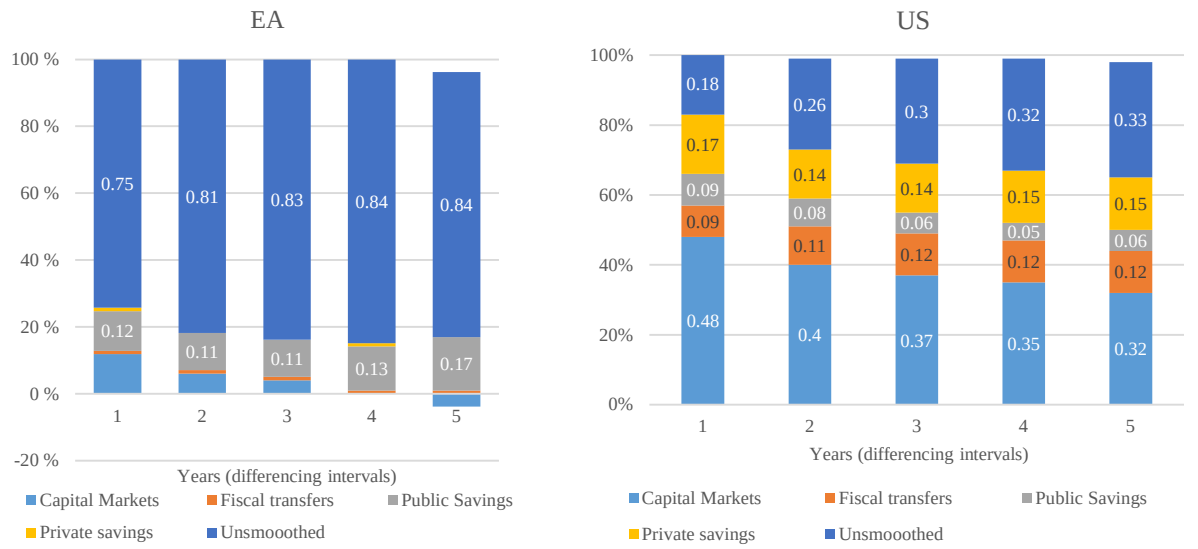
The results of the Granger causality test[24] confirm the hypothesis that the amount of consumption-smoothing is determined by the absorption capacity of the capital markets, while the causality in the other direction is always rejected. An important implication of this is that if income smoothing through international capital markets is weak and net savings, especially private savings, are affected by the cycle and the persistence of the shocks in times of long negative shock, the impact of GDP shocks tend to translate more widely on consumption. In the next section we focus on the issue of the persistence of shocks.

4 Transitory and persistent shocks

We now look at whether the different capacity to absorb shocks between the US and the euro area can be explained, at least partially, by the different nature of shocks or structural features of shocks.
Following the permanent income theory, if a negative shock is persistent or permanent, personal savings are not effective in smoothing consumption. Moreover, credit institutions tend to reduce their credit supply in the face of long-lasting shocks. For the same reason, governments may have only limited capacity to access credit markets to borrow. This implies that in regions like the euro area, where savings seem to play an important role in reducing the impact of shocks, negative persistent shocks are unlikely to be smoothed effectively. By contrast, given its nature, international risk-sharing through capital markets should be 'immune' to persistent shocks, as far as shocks are uncorrelated across countries. This would put the US in a better position than the euro area in the face of long, negative shocks.

[24] We perform the pairwise Granger causality test using 1, 2 and 3 lags, for each of the two alternative hypotheses.

Figure 8. Income and consumption-smoothing at different differencing intervals, from 1 and up to 5 years, euro area and US (1998-2013)



Note: The channels are measured according to the US aggregation; hence corporate savings and capital depreciation are in the capital markets.

Source: Authors' formulation.

In order to take these considerations into account, we consider the patterns of risk-sharing among euro area countries and US states at one and five-year intervals. This should give us a sense of what happens to the effectiveness of channels when the shock lasts not one year but five years. For the purpose of having better insight into the different categories of net savings, we split governments' budgets from personal/households savings. On the one hand, the results can help to empirically assess whether the (close to) 50% capital market income smoothing among US states (shown in Figure 4) is driven mostly by factor income flows rather than by corporate savings patterns, as argued earlier. In the Asdrubali et al. (1996) framework, the capital markets channel in the US remains stable (actually increasing) when considering longer differential intervals. In that context, the conclusion was that corporate savings did not play a great role, because corporations do not smooth distributed profits at the three-year horizon and above, and hence the core absorption capacity had to come from the international factor income. Our results, as shown in Figure 9, show that the role of capital markets declines when considering longer time intervals, and that at the three-year and above horizon, it falls by about one-quarter, suggesting that something has changed compared to the period before 1990.

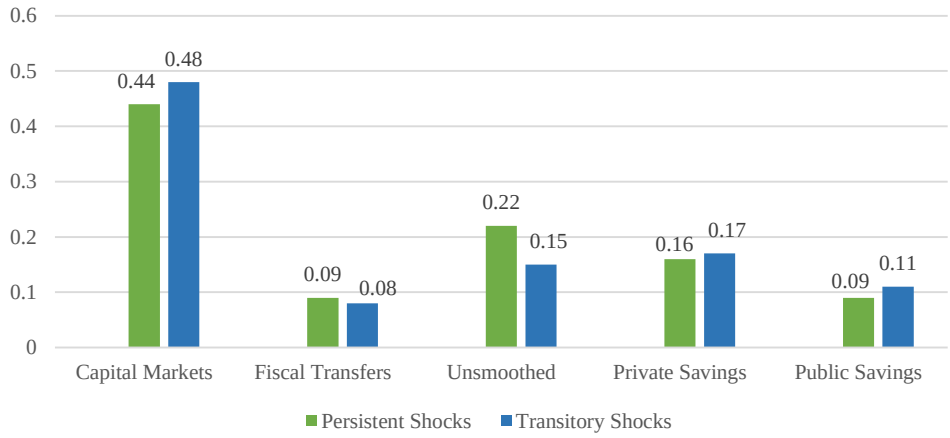
The picture is much bleaker in the euro area, where capital markets' capacity to absorb the impact of a shock is not only reduced when the differencing interval lengthens, it disappears after four years. In fact, this is in line with previous findings whereby private market risk-sharing was very limited and corporate savings (included in the same channel), which provide some absorption capacity, are unable to respond to long-lasting shocks. In the euro area, the only resilient channel is net government savings, which is nothing but fiscal policy at the level of the member states.[25] This is also in line with previous findings, whereby consumption-smoothing among OECD countries is not driven by personal savings, but rather by national government savings, and the role of the latter tends to increase

[25] See Alcidi & Thirion (2017) for an in-depth analysis on the effectiveness of this channel.

at longer time intervals as government spending becomes effective with a lag (see Asdrubali et al., 1996).

As some of the results for the US seem to contradict previous findings, we try to isolate the response to transitory from permanent shocks using a different methodology. For this purpose, rather than looking at longer differencing intervals, we analyse the pattern of income and consumption-smoothing for states facing persistent shocks and states facing transitory shocks. As a measure of the persistence of fluctuations, we use the one proposed by Campbell & Mankiw (1987).[26, 27] As in Asdrubali et al. (1996), in order to keep the number of parameters reasonably low, we estimate an autoregressive model with three lags. We then split our sample into two groups: states with highly persistent shocks to GDP growth, namely the top third, and the rest. In doing so we find that over the period considered, the inertia coefficient of the GDP series is 1.45 for the high persistence group and 0.83 for the low persistence group.[28] Once the country groups are identified, we again measure the performance of the different channels for risk-sharing. Figure 9 records the results and these are in line with those yielded from the previous methodology, and as shown in Figure 8. The role of capital markets is higher for transitory shocks, while the contribution of personal savings does not significantly decline, moving from transitory to persistent shocks. Lastly, previous findings relative to the role of federal transfers and state budgetary policy (public savings) remain valid.

Figure 9. Income and consumption-smoothing, transitory and persistent shocks to GSP, US (1998-2013)



Source: Authors' formulation.

How can the drop in capital market channels and the resilience in personal savings be explained? It is difficult to find accounts supported by empirical evidence, but here we advance two hypotheses based on the narrative. The first hypothesis is that the role played by corporate savings (included in the

[26] This measure is based on the coefficients of an autoregressive process for the US states' GSP. The measure is equal to $\frac{1}{(1-\sum_{1=1}^{p}\rho_i)}$ where the $\rho_i$are the p coefficients of the AR(p) process $\Delta GSP_t = \mu + \sum_{1=1}^{p}\rho_i \Delta GSP_{t-i}$

[27] Unfortunately, the exercise can only be done for the US, as the number of observations for the euro area is too low (because of the number of countries) to be relevant.

[28] Interestingly, in Asdrubali et al. (1996), where the period considered was 1965-1990, the average persistence coefficient for the high-persistence group was 1.72, whereas for the low-persistence group it is 0.96. Both measures are higher than in our sample.

capital market channel) increased after the 1990s and resulted in a smaller part of the shock that is absorbed when the length of the interval increases. However, this hypothesis is not consistent with other findings. As illustrated by the estimates in Figure 4, which measure transitory shocks, the capital market channel as a whole has declined over time by about 9 percentage points, with an even larger fall in 2008 and 2009. For transitory shocks, it is impossible to differentiate the role of savings from international factor income. The second hypothesis is that the financial crisis that followed the collapse of Lehman Brothers in 2008 was a shock to the capital market channel. The global financial crisis was a negative systemic shock, which has affected the functioning of the capital market channel (consistent with Figure 6 and the 2008-09 trough) by reducing international diversification opportunities and drastically increasing risk aversion. These factors may have broken the absorption capacity of international private transfers and the effect may have been even more visible in the face of lasting shocks.

Another interesting aspect of the US results is the surprising resilience in the shock-absorption capacity of personal savings. This also emerged from Figure 9. Their consumption-smoothing capacity usually falls when the length of the shock increases. This fact has theoretical foundations (permanent income theory) and is usually supported by evidence. However, it does not seem to be the case in this context. How can this be explained? It should be remembered that during the financial crisis, the losses, especially those linked to the bursting of the housing bubble and the subprime mortgages crisis, have been absorbed through measures that are not directly identifiable in the national accounting decomposition as federal intervention, but they may well have indirectly resulted in an effect on net savings, safeguarding them. Examples of these are the interventions of the Federal Deposit Insurance Corporation (FDIC) – to protect deposits – as well as the action plan to avoid the default of the two federal mortgage institutions.[29]

The findings about federal transfers, and in particular its growing absorption capacity when differencing interval increases, is in line with previous findings for the US. It also is interesting to note that when accounting for the breakdown of the net savings to isolate the role of the states' savings, the sum of state channels and the federal transfer's channels is constant over the different time intervals.

4.1 Comparing the persistence of shocks in the US and the euro area

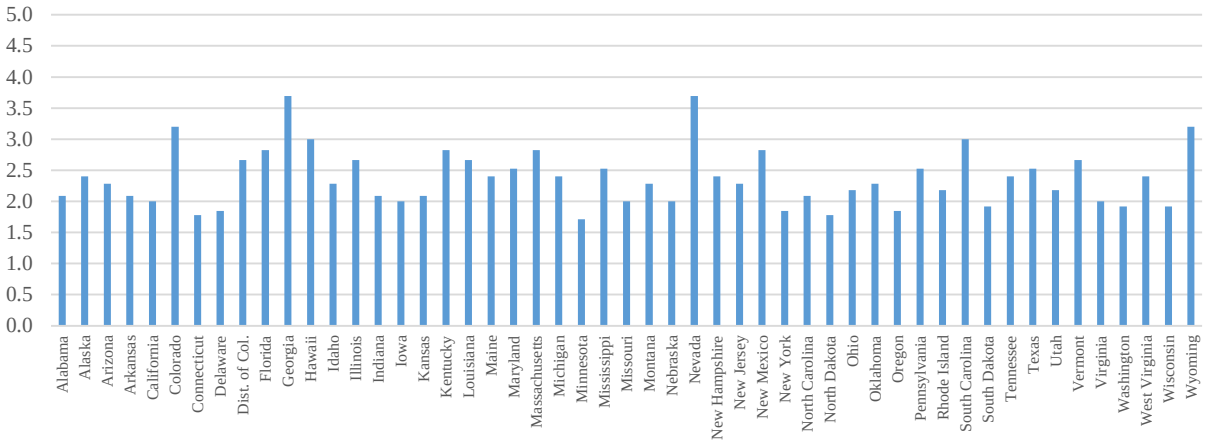
To overcome data limitations in the econometric analysis and to get a sense of the differences in the persistence of the shocks between the US and the euro area, we calculate the average duration of shocks (positive and negative) for each US state and each euro area member state, over the period 1990-2013. Similar to the econometric technique used earlier, we defined a shock as a deviation from the (weighted) average (GDP growth rate) across the region and consider the number of consecutive years above or below such average.

As will be shown below, the comparison points to a longer duration of shocks in the euro area relative to the US, but also larger cross-country differences. Overall, this evidence is consistent with the previous finding that in the euro area the capacity of savings to smooth shocks is lower than in the US.

[29] In the fall of 2008, the US Treasury placed into conservatorship the government-sponsored enterprises (GSE) Fannie Mae and Freddie Mac, and the Federal Reserve started the purchase of their debt, to avoid the default.

In the case of the US (Figure 10), the average duration goes from just below 2 to about 3.5 years, and more than 30 of the 52 states have an average duration of around 2 years.

Figure 10. US: (weighted) average duration of shocks, by state (1965-2013)

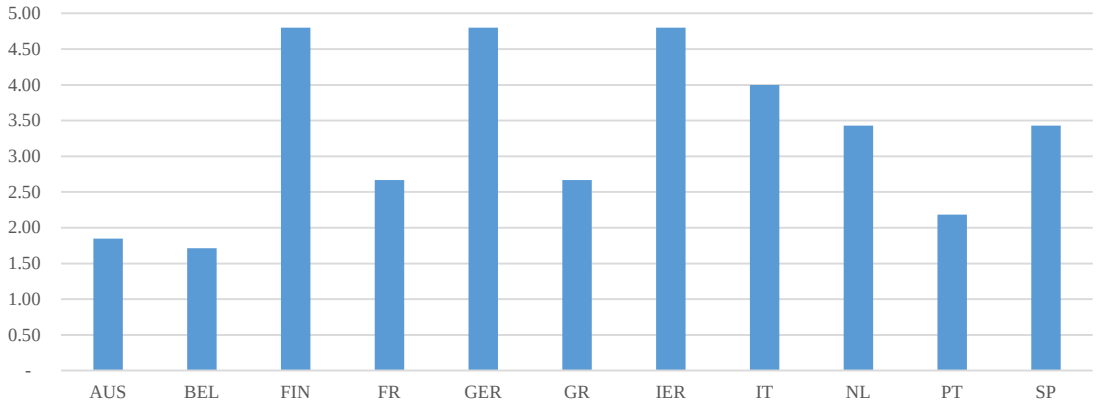


Note: We consider the 1965-2013 period, even though it does not correspond to the period considered for the euro area because the break in the data in 1997 would require that we cannot take a period 1990-2013.
Source: Authors' formulation based on OECD data.

In the case of the euro area (Figure 11), the average persistence of shocks can vary substantially across countries, from less than two years to almost five years.

It should be noted that this measure of persistence says nothing about the size or the sign of the deviation from the average; in other words the persistence could also be associated with very small deviations, positive or negative, from the average. Therefore our indicator of the persistence of shocks should rather be read as the length of a fictitious business cycle (based on the average growth rate of the region rather than the potential output of each country).

Figure 11. Euro area: shocks' average duration (1990-2014)

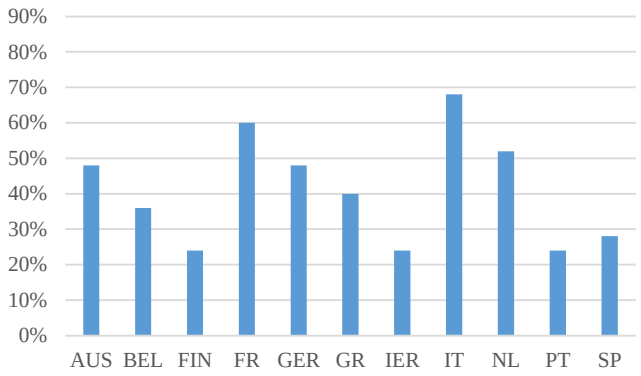


Source: Authors' compilation based on OECD data.

Figure 12 complements the information on the persistence with the number of years with negative and positive shocks. Some countries have been persistently below or above the average. Finland, Portugal and Ireland, on the one hand, and Italy, on the other, are the extreme cases. Over the 25 years considered, for 17 years (70% shown in the chart) Italy has been below the euro-area average, while

for Finland, Portugal and Ireland the opposite is true, 19 years above the average. Even though Italy has always been very close to the average euro-area growth rate, the result hints at structural differences, at least vis-á-vis Finland and Ireland, where the growth rates have been much higher than average.

Figure 12. Euro area: portion of negative shocks (1990-2014)



Source: Authors' compilation based on OECD data.

From a risk-sharing perspective, differences across countries in the form of negative correlations foster diversification and hence are positive. By contrast, too limited changes in the sign of the shocks may hint at structural differences associated with systematic under-performance or over-performance relative to the average. This implies that the shock structure might also hinder risk-sharing because of investors' decisions. A fund manager would probably avoid investing in a country that is constantly below the average, even for risk diversification purposes. Combined with still-high home-bias, this helps to explain the limited role of capital markets in the euro area.

4.2 International risk-sharing, OCA theory and the shocks in the EA

As explained in the introduction, the international risk-sharing view of monetary union departs from the OCA theory (at least its original formulation) and also from the Maastricht framework, which did not explicitly embed the issue of the synchronisation of business cycles or the role of financial integration. However, these contributions to the literature are somewhat united in the instrumental role that financial integration is expected to play in these theoretical predictions.

The literature investigating whether the introduction of the single currency boosted financial integration and contributed to increasing business cycle correlations or international risk-sharing is difficult to compare and the overall results do not always go in the same direction. On the one hand, Kalemli-Ozcan et al. (2010) show that the channels for risk-sharing evolved after the creation of EMU. In particular, they find that risk-sharing through factor income flows and capital gains was close to zero prior to the introduction of the euro in 1999, but has since increased to 6% for each channel. Kalemli-Ozcan et al. (2008) find that increased holdings of foreign assets and banking integration in the EMU have spurred risk-sharing, "improving ex-post the optimality of the EMU." By contrast, estimates by Demyank et al. (2007) point to a decrease in the overall international credit smoothing in the five years following EMU, compared to the five previous years.
On the other hand, De Grauwe & Yi (2016) find that the synchronisation of the business cycle has increased over time since the start of EMU, but so has the difference in the amplitude of the cycle across countries. Likewise, Belke et al. (2016) find that, since the late 1990s, in the euro area a strong

common cycle is associated with large differences in cyclical positions, even if national cycles are strongly correlated.

Overall, it seems from these findings that when looking at the experience of the euro area, the financial integration associated with the euro may indeed have increased correlation in business cycles, which may have prevented a higher degree of diversification and hence international risk-sharing. At the same time, however, it also increased the differences in the amplitude of business fluctuations, which may have prevented reaping the benefits of cycle synchronisation, as predicted by the OCA theory.

Deeper financial integration in the context of the EMU project has always been perceived as a good achievement, despite a lack of clear understanding of its specific benefits for the monetary union. Financial integration is usually considered a necessary condition for increasing completeness of markets, and hence for international risk-sharing, as well for increasing the synchronisation of business cycles, as the OCA theory confirms. In reality, it is not a sufficient condition for any of them and the stylised facts and empirical evidence shown in this paper, in line with other recent empirical literature, seem to suggest that the benefits of a higher degree of completeness of markets and increased synchronisation did not materialise.

The correlations illustrated in section 2 suggest very poor cross-country international risk-sharing in the euro area, if any at all, even though some improvement occurred after 1998, and this is in line with the empirical findings about the very limited capacity of international capital markets to absorb the impact of shocks. The evidence of high and heterogeneous persistence of the shocks, combined with the evidence of systematic under- and over-performance of certain member states, helps explain the limited international risk-sharing. It also suggests that while the correlation of cycles may have increased over time, there are structural cross-country differences. This feature is not desirable from an OCA theory perspective because it does not make monetary policy more effective, nor does it from the point of view of risk-sharing because it is likely that this kind of heterogeneity does not allow for good hedging.

5 Concluding remarks

The evidence presented in this paper attempts to shed light on the capacity of the euro area to smooth the impact of shocks over time and relative to the US, and tries to understand differences in the role of the various mechanisms through which the shock absorption happens. In doing so, we start by building fully comparable data for the US and the EA and then we estimate the different channels using a standard analytical framework, as in Asdrubali et al. (1996).

Our findings confirm that capital markets in the US perform far better than in the euro area in supplying risk-sharing. In the euro area, this channel has never been strong, not even after the introduction of the euro and during the good years of financial integration. However, under the new aggregation, prepared for comparability purposes, the channel performed better than was previously found, at least until 2008. After that it collapses and after 2010 it seems to amplify shocks rather than absorb them.

In trying to understand why this is the case, we found that results for the euro area as a whole are driven by dynamics in the peripheral euro area countries, where the unsmoothed part of the impact of the shock is systematically higher than in the core countries. Moreover, the role of the different

channels varies considerably over time and across the two groups, while this also partially holds for the US due to the large cyclical swings of the last 15 years. In the last sub-sample the EA shock-absorption capacity was very small and almost vanishes in peripheral countries.

We also find that the persistence of shocks is an issue in the euro area relative to the US, for two reasons. In the euro area, total savings and borrowing, which include corporate and households as well as national budgetary policy (public savings), seem to play a greater role than in the US, where instead capital markets provide the largest part of risk-sharing. Since shock absorption through saving and borrowing does not usually work in response to persistent/permanent shocks, the persistence of the euro area debt crisis may explain why after 2010 the unsmoothed part of the shock increased dramatically in the euro area and much less so in the US.

In addition to this and in contrast with previous findings, in the US, personal savings have been very resilient in smoothing the impact of persistent shocks. It should be noted that net savings means both use of savings and borrowing through access to credit markets. We advance the hypothesis that such resilience can only be explained by measures taken in response to the financial crisis, from the FDIC intervention to the rescue of Fannie Mae and Freddy Mac. In the euro area, domestic (member state) fiscal policy seems to have been the only tool that contributed to smoothing the effect of shocks, but this has been limited in size.

Further analysis suggests that higher persistence of shocks in the euro area, relative to the US, combined with lasting under- and over-performance of certain countries, can explain low international risk-sharing. This would also be consistent with the findings that the correlation of cycles has increased over time, but remains very different.

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Part II

Intertemporal Risk Sharing and European Monetary Integration

Abstract

This paper sets out to provide a comprehensive examination of the mechanisms through which intertemporal risk sharing allows consumption to be smoothed in the event of asymmetric shocks in the euro area. We find that inter-temporal risk sharing accounts for over 30% of the response to output shocks; it is the main absorption channel in the EMU. This channel is the dominant smoothing mechanism in the euro area given the limited role played by cross-border capital income even after the introduction of the euro, and in the absence of a euro area central transfers mechanism. Household savings provide a negligible amount of smoothing but corporate savings are significant and steady. Government budgets tend to be the dominant source of shock absorption, with major exceptions in the periphery during the debt crisis. The public and private sectors tend to complement each other over time as a shock absorption channel. An important finding of this paper is that intertemporal risk sharing is mostly achieved domestically through pro-cyclical investment adjustments. International credit markets provide only limited intertemporal risk sharing. The analysis of the main international financing instruments suggests that FDI and international bank lending did contribute to intertemporal smoothing, while short-term portfolio investments had a negative role. This appears to be at odds with the common understanding that greater financial integration should lead to international risk sharing and consumption smoothing.

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Keywords: inter-temporal risk sharing, consumption smoothing, net saving, financial integration, European Monetary Integration.

JEL Classification: E21, F40, G11

CONTENTS

1 Introduction

According to economic theory, one of the main benefits of financial integration is that it creates opportunities to increase international risk sharing and consumption smoothing.[30] The relationship between financial integration and risk sharing is theoretically straightforward: as integration intensifies, well-functioning and integrated markets allow households and financial institutions to diversify risks ex-ante both geographically and across asset classes, thereby reducing exposure to idiosyncratic shocks when asset ownership is diversified across countries (Obstfeld and Rogoff, 1996).

In the context of a monetary union, the rationale for risk-sharing mechanisms is grounded in the idea that asymmetric output growth rates (shocks) do not necessarily increase the cost of being part of a monetary union and of relinquishing monetary policy sovereignty, if risks are shared between states and output fluctuations do not result in welfare losses (e.g. loss of income, consumption or employment).[31] This generated the expectation that monetary and financial integration following the introduction of the euro would result in higher cross-country holdings of assets and capital. While international risk sharing per se was not the primary objective of financial integration in the euro area (which was rather seen a tool for spurring growth in the region) monetary and financial integration should have increased risk sharing across member states and enhanced consumption smoothing through access to international credit markets.

Since full risk sharing is normally not achieved through market operation, in accomplished federations governments provide additional risk sharing (fiscal rather than market-based) via a system of inter-state tax and transfers whereby the federal government provides insurance against the risk of state-specific income loss.[32] In addition to inter-state risk sharing, fiscal policy at the state level – like euro area member states - can also further contribute to smoothing consumption over time through government budgets.

Monetary and financial integration can in principle affect all of the above-mentioned channels of income and consumption smoothing. It can indirectly facilitate governments' role in absorbing the impact of shocks by enhancing borrowing conditions due to the increased size of the saving pool in a monetary union. Moreover, financial integration, by enhancing market discipline, could improve the counter-cyclicality of fiscal policies (Agenor, 2003) and through its effects on international risk sharing, may in turn improve fiscal positions (Fatas and Mihov, 2003). Accordingly, one would expect that financial integration in the euro area should have facilitated the absorption of asymmetric shocks by fiscal policy tools, not only by market mechanisms.

In this paper, we first aim to review the rich literature that has tried to examine the effect of financial integration on risk sharing among member states in the euro area, focusing on the ex-ante insurance role of capital markets. The choice to treat the relationship between financial integration and cross-border capital market income in this paper only through a review of the literature is fundamentally driven by the difficulty to conduct further innovative research in this area. Indeed, data limitations on cross-border capital income by asset class prevents us from addressing issues that are yet unsatisfactorily studied in the literature. Thus, the lack of detailed data on the different components of

[30] See, among others, Kose et al. 2007
[31] See, for instance, Mundell (1973)
[32] Note that the amount of smoothing delivered by the different channels is not only the result of private decisions but also a product of the way in which public authorities shape financial institutions.

international factor income and, in particular on the bilateral flows of income restrict the scope for shedding further light on how monetary and financial integration in the EMU have affected the degree of international risk sharing through cross-border capital market income. Nevertheless, Alcidi et al. (2017) provides a novel contribution that allows comparing the role of capital markets in smoothing income in the US and the EA.

Against this backdrop, the empirical part of this work focuses on (ex-post) intertemporal risk sharing through net savings (ie. consumption smoothing). More specifically, it seeks to disentangle the role of domestic savings and international financial markets in absorbing shocks, as well as the possible interactions between the private and public sector. In doing so, we address a gap in the literature; namely the lack of a comprehensive treatment of the role of savings and credit in providing intertemporal risk sharing in the EMU over different periods of the process of European integration.

For this purpose, we update and deepen the empirical analysis of net savings, looking at its different sectoral components: government, households and corporate savings. We find that government saving has remained, on average, the largest consumption-smoothing channel, although it broke down during the sovereign debt crisis, in particular at the periphery.

We then attempt to gauge the respective roles of domestic and external consumption smoothing, in the same vein as the seminal paper by Sorensen and Yosha (1998) and the subsequent work of Melitz and Zumer (1999). In this perspective, we distinguish between domestic absorption (i.e. changes in domestic investment to allow consumption smoothing) and through external absorption (ie. via international financial markets). We find that the bulk of intertemporal smoothing is obtained through the domestic component of savings, which means that consumption is smoothed by a pro-cyclical adjustment of investment to output shocks. By contrast, the role of the external component of net saving, namely consumption smoothing through borrowing from international financial markets, tends to be negative in the period under analysis. The finding that international lending and borrowing does not provide additional consumption smoothing is at odds with some pre-crisis studies[33] but also with the literature mentioned above, according to which greater financial integration should lead to a greater capacity to counter the impact of shocks.[34] To contribute to the understanding of this conundrum, we decompose credit markets consumption smoothing as provided by the main classes of financial instruments. Our preliminary findings suggest that FDI and bank lending did contribute to intertemporal smoothing, while short-term portfolio investments played a negative but dominant role.

The rest of this paper is organised as follow: section 2 reviews the empirical literature that examines the relationship between financial integration and capital market risk sharing as well as consumption smoothing in the euro area. Section 3 describes the empirical framework used to measure the various channels of income and consumption smoothing and the subcomponents of the net saving channel. Section 4 presents the results, starting from the main channels and then 'zooming' in to the net saving channel to disentangle its different subcomponents, by sector and then between smoothing driven by domestic mechanisms and that driven by access to international credit markets. Section 5 investigates whether the degree of consumption smoothing differs with the nature (positive and negative) of the shock. The last section offers conclusions.

[33] See among others Demyanyk et al. (2008), risk sharing and portfolio allocation in EMU.

[34] As pointed out in Alcidi and Thirion (2016), a key problem relates to the nature of the shocks, for instance whether shocks are fiscal or financial. The crisis in the euro are was fundamentally a large financial shocks and the degree and quality of financial integration that was achieved seem not to have provided shocks absorption. Most literature considers 'standard'output shocks, associated with business cycle fluctuations.

2 Integration and cross-country risk sharing in the EMU

2.1 The mixed effects of financial integration on risk sharing through cross-border income in the EMU

An empirical question of particular interest is whether monetary integration had measurable effects on risk sharing within the EMU. Mundell (1973) – who departs from the most well-known OCA policy prescriptions of his seminal work of 1963 – notes that market integration can improve the optimality of a monetary union by fostering interstate risk sharing. This section offers a review of the main empirical studies related to the effect of financial integration on international risk sharing through capital income diversification.

A number of studies examine whether cross-country risk sharing has increased since the adoption of the EMU – a so-called 'euro effect' compared to the EU. Theoretically, a high degree of international risk sharing would be achieved in the euro area if the rates of return on foreign assets (i.e. debt, equity and FDI) were highly correlated with the euro area growth and the return on foreign liabilities were highly correlated with output growth in each member state. Under such conditions, income would be smoothed if payments on foreign liabilities was high when output growth is high and if income from foreign assets was high when domestic output growth is low.

In order to examine the relationship between financial market integration and cross-border capital income smoothing, Sorensen et al. (2007) proposed an extension of the framework of Asdrubali et al. (1996) consisting of interacting the variable measuring output shocks with total foreign asset/liability holdings, which measures financial integration. Studying the effect of the home bias on risk sharing for the period 1993-2003 in a group of OECD countries, they find that a larger holding of foreign assets is associated with increased risk sharing in the EU, while foreign liabilities tend not to yield any significant risk sharing. Following a comparable approach but focusing on the role of portfolio investment's composition, Demyanyk et al. (2008) investigate whether income risk sharing between EU and EMU countries has increased since the adoption of the euro as a result of portfolio investment diversification. Their general finding is that financial integration between the EMU countries, and financial globalisation in general, has facilitated the smoothing of income. In particular, their findings point to an increase in the overall income risk sharing in the five years following the formation of EMU, compared to the previous five years. Moreover, the improvement was more marked for the group of EMU countries compared to the EU, which is interpreted as the additional effect of monetary integration on risk sharing in the EMU.

The authors are cautious in their interpretation of these results due to the short time period studied, however. In addition, asset holdings outside the EMU tend to have the largest risk-sharing properties per euro invested, as their return is less likely to be correlated with the euro area cycle. As pointed out in Alcidi and Thirion (2016) this observation has important implications when it comes to the future impact of a capital market union: convergence in business cycles and correlation in asset returns could indeed reduce the scope for risk sharing within the EMU. In fact, Balli et al. (2011) find that increased holding of foreign assets caused income dis-smoothing during 2001-07 (i.e. amplification of shocks), which they interpret to be a result of increased business cycle synchronisation across EMU countries.

Instead of measuring the effect of different types of banking or financial integration measures on income risk sharing, other works take a different approach, namely to estimate the incidence of the different channels of risk sharing over different key time periods in the (des)integration process of the

EMU. These studies, which measure the relevant channels individually, indicate that the risk-sharing potential of capital markets remains largely untapped in the EMU (Valiante, 2016). In particular, while US interstate risk sharing through factor income reaches 40%, most recent estimates for the euro area range between 0-10%. Kalemli-Ozcan et al. (2013) find that during the crisis, international factor income did not provide any risk sharing; on the contrary, it acted as a shock amplifier. Focusing on the financial crisis, Balli et al. (2013) take advantage of the OECD detailed national account tables to decompose international factor income inflows (debt, equity and FDI holdings' income receipts). They use a similar time period (1999-2011) and a country selection similar to Sørensen et al. (2007), Demyanyk et al. (2008) and Balli et al. (2011) find that risk sharing through cross-border portfolio receipts was a better shock absorber than portfolio payments. They further show that in the aftermath of the crisis, receipts from debt securities had higher income- smoothing properties than equity receipts. FDI holdings were not associated with higher income risk sharing, however. When decomposing output shocks between positive and negative shocks, the results reveal that debt assets and equity liability performed better under negative and positive output shocks respectively.

As Allard et al. (2014) point out, the main explanation for the subdued international risk sharing in the euro area is that the cross-border ownership of assets (as opposed to short-term interbank lending) remains very limited within the union, which currently reduces the scope of capital markets' insurance. This has important implications, since capital markets are less subject to reversal and can absorb loss associated with permanent shocks, whereas intertemporal consumption smoothing can only address temporary shocks (Bolton et al., 2013 and Valiante, 2016).

However, in a context where the diversification benefits of capital market development remain subdued, Ekinci et al (2008) pose a pertinent question; namely whether social capital variables – such as the extent to which an investor's decision depends on his/her degree of trust in foreign individuals and institutions – shape the patterns of international risk sharing within the EU. They find that the latter is indeed a significant explanatory factor of risk sharing through international factor income. This should bring our attention to the fact that removing formal regulatory barriers to financial integration is a necessary condition, but not a sufficient one.

Finally, Balli et al. (2011) extend the scope of analysis of capital markets by attempting to quantify the contribution of capital gains to risk sharing. Since capital gains are not captured by national account statistics, this exercise expands the framework of Asdrubali et al. (1996) to consider an additional channel. This extension is particularly relevant given that financial globalistion has led to a large increase in gross holdings of foreign assets. This implies that fluctuations in asset prices and exchange rates can produce very large effects on net wealth, which in turn can play a significant role in the process of adjustment to international imbalances (Gourinchas and Rey, 2007). Balli et al. (2011) find that risk sharing through factor income flows and capital gains was close to zero before the introduction of euro in 1999, but it then increased to 6% for capital gains, which appear to play a greater role than capital income in the euro area. Interestingly, the amount of risk sharing through capital gains appears to be remarkably stable across country samples and time periods, unlike capital income, which may possibly owe to the systematic response of domestic asset prices to output growth (negatively correlated) in good times.

Another question relates to the effect of patterns of banking integration on consumption and income risk sharing. In a comprehensive treatment of the impact of banking integration on total market risk sharing, Kalemli-Ozcan et al. (2008) finds evidence that increased cross-border banking integration in the EMU "has improved ex-post the optimality of the EMU by fostering risk sharing." Their results

suggest that both the euro and the harmonisation policies have contributed significantly to cross-border banking integration, which in turn lead to an increase of risk sharing.

Demyanyk et al (2008) also investigate the effect of banking market integration on risk sharing. They argue that domestic banking consolidation has increased income risk sharing over time (within country estimates). However, countries with a higher average level of banking consolidation do not on average obtain more risk sharing (cross-section estimates). These authors do not find any evidence of a similar effect from foreign banking consolidation, but argue that this is because too little foreign consolidation has occurred to be able to detect such an effect.

2.2 The dominant role of net savings in smoothing shocks: domestic vs international effects

Due to the lack of a fiscal union and the still incomplete integration of capital markets documented in the previous section, intertemporal risk sharing through net saving is the only smoothing channel at work in EMU. Intertemporal risk sharing (or consumption) can be thought of as an alternative to income insurance. If income insurance is not complete, then households, governments and corporations can still manage to decouple idiosyncratic shocks to output from consumption growth by smoothing consumption over time. This is possible by adjusting domestic net savings after a shock on output has occurred (ex post). It can, but does not necessarily embed a cross-country dimension that can ultimately involve international risk sharing.

Arguably, the most comprehensive treatment of this channel remains the seminal paper by Sorensen and Yosha (1998) and the work by Melitz and Zumer (1999) quantifying the channels of risk sharing at the dawn of the EMU. They find that 30-40% of shocks are absorbed through net saving. Half the total amount of consumption smoothing happens through pro-cyclical government savings, and the other half via corporate saving patterns.

Furceri and Zdzienicka (2013) note that the bulk of risk sharing has come through borrowing and savings since the creation of the EMU. However, they stress that the role of net savings and credit decreased since the introduction of the EMU. They attribute this outcome to the fact that credit flows have become less counter-cyclical since the introduction of the euro, despite larger cross-border flows. According to their findings, credit markets also tend to be ineffective during crises because of the pro-cyclicality of credit, whose integration was dominated by the interbank market. They attribute low amounts of risk sharing during economic crises, and even more so financial ones, to the tendency of credit markets to collapse during such episodes (Reinhart and Rogoff, 2008).

Kalemli-Ozcan et al. (2014) focus on identifying the dynamic of the role of private and sovereign saving during the sovereign debt crisis. They show that international consumption smoothing remained stable during the global financial crisis in 2008-09. This is explained by the fiscal stimulus enacted by governments, which compensated for the fall consumption smoothing through private savings. By contrast, the outbreak of the sovereign debt crisis in 2010 collapsed the role of governments in responding to shocks. In particular, countries that had run prolonged expansionary policies in the booming years, or had experienced bubbles, were forced to save when the crisis erupted.

Overall, the literature seems to suggest that, in Europe, the capacity to respond to shocks remains weak, and it is vulnerable during crises, compared to federations. Although there is no doubt that the EMU boosted financial integration, governments and private savings are still unable to ensure sufficient risk sharing during periods of great stress. A major shortcoming in the literature, however, is that there is no full picture of the role of intertemporal risk sharing in the EMU throughout different phases of European integration and during the crisis.

Against this background, we update and deepen the analysis of net savings as an intertemporal smoothing tool, looking at its different components: government, households and corporate savings. We then gauge the respective role of the domestic and external consumption smoothing, in the same vein as the seminal paper of Sorensen and Yosha (1998) and the subsequent work of Melitz and Zumer (1999). In this perspective, we distinguish intertemporal domestic absorption (i.e. compensated by domestic net investment) and net investment abroad (or use of net exports as a smoothing mechanism).

3 Methodology: Quantifying the channels of consumption and income smoothing

3.1 Baseline methodology

We follow the empirical strategy proposed by Asdrubali, Sorensen and Yosha (1996) (henceforth ASY) and Sorensen and Yosha (1998). We use national accounting identities to measure the fraction of output shocks absorbed by consumption and income smoothing channels. We implement a cross-sectional variance decomposition of shocks to GDP to measure the relative smoothing capacity of the various channels of absorption. The underlying idea is thus to decompose output shocks into the different channels, allowing for income and consumption smoothing.

This decomposition allows us to identify the respective roles of three main consumption and income smoothing channels when subject to output shocks: capital markets; interstate fiscal transfers; and net saving. The fraction of shocks left unsmoothed is captured by the correlation between GDP and final consumption.

The variance decomposition is based on the following national account identity, valid for each year and each country (or region) under analysis:

$$GDP_i = \frac{GDP_i}{GNI_i}\frac{GNI_i}{Ni_i}\frac{Ni_i}{NNDI}\frac{NNDI_i}{CONS_i} * CONS_i \qquad (1)$$

Where i is an index of countries while GDP is decomposed in: Gross National Income (GNI), National Income (NI), Net National Disposable Income (NNDI) and total consumption (CONS) that is equal to the sum of private (C) and government (G) consumption. Moreover, the following identities applies:

GNI = GDP + *Net Factor Income*
NI = GNI - *capital depreciation*
NNDI = NI - *net international taxes and transfers*
(C+G) = NNDI – *total net savings*

In order to obtain a measure of the different absorption mechanisms, we start from equation (1), take logs and difference and multiply both sides by $\Delta \log GDP$ minus its mean to obtain (2):

$$var\,(\Delta \log GDP) = cov\,(\Delta \log GDP, \Delta \log GDP - \Delta \log GNP) + cov\,(\Delta \log GDP, \Delta \log GNP - \Delta \log NI) + cov\,(\Delta \log GDP, \Delta \log NI - \Delta \log DNI) + cov\,(\Delta \log GDP, \Delta \log DNI - \Delta \log CONS) + cov\,(\Delta \log GDP, \Delta \log CONS) \quad (2)$$

Dividing by $var(\Delta \log GDP)$ we obtain $\beta^f + \beta^d + \beta^t + \beta^s + \beta^u = 1$, where the β coefficients are the OLS estimates of the slope in the cross-sectional regressions. For instance, β^f is the estimate slope coefficient of $\Delta \log GDP - \Delta \log GNP$ on $\Delta \log GDP$, that is:

$$\beta^f = \frac{cov\,(\Delta \log GDP, \Delta \log GDP - \Delta \log GNP)}{var\,(\Delta \log GDP)} \quad (3)$$

If full risk sharing is achieved through international factor income, $cov(\Delta logGDP, \Delta logGNI) = 0$, consequently, the numerator of equation (3) will be equal to $var\,(\Delta \log GDP)$ and $\beta^f = 1$. In the latter case, shocks to GDP are fully absorbed by international factor income. If $cov(\Delta logGDP, \Delta logGNI) \neq 0$, there will be room for further risk sharing through the other channels of income and consumption smoothing. The β coefficients can be interpreted as the incremental fraction of shocks absorbed by the different channels, where β^f refers to net factor income, β^d to capital depreciation, β^t to international transfers and β^s to consumption smoothing through savings. β^u measures the fraction of unsmoothed shocks. When $\beta^u = 0$, full risk sharing is achieved, otherwise, a fraction of the shocks to GDP is left unsmoothed, consumption will commove with GDP, with $\beta^f + \beta^d + \beta^t + \beta^s < 1$ and $\beta^u > 0$

In practice, the following panel equations are estimated independently:

$$International\ factor\ income: \Delta \log GDP_{i,t} - \Delta \log GNI_{i,t} = a_t^{if} + \beta^f \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

$$Capital\ depreciation: \Delta \log GNI_{i,t} - \Delta \log NI_{i,t} = a_t^d + \beta^d \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

$$International\ transfers: \Delta \log NI_{i,t} - \Delta \log NNDI_{i,t} = a_t^t + \beta^t \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

$$Total\ net\ savings: \Delta \log NNDI_{i,t} - \Delta \log CONS_{i,t} = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

$$Total\ consumption: \Delta \log TOT\ CON_{i,t} = a_t^c + \beta^c \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

where a_t stands for time fixed effects. Equations are estimated with OLS, and we correct for panel heteroskedasticity and an AR(1) process in the error term. The regression's coefficients are to be interpreted in the following way: β_s capture the percentage of shocks absorbed by the various smoothing channels; a_t denotes the time-fixed effects, controlling for year-specific effects on growth rate. With the introduction of time-fixed effects, we control for shocks on aggregate GDP, while the β coefficients are weighted as an average of the yearly cross-sectional regressions. As previously mentioned, the implication of the time-fixed effect is that we consider the deviation of country-specific growth rates with respect to the average growth rate in the sample. This is because we only want to include country specific shocks, removing the aggregate component. It is worth mentioning that this implies that countries will experience positive and negative shocks, no matter whether all countries are, say, in a recession or boom at the same time.

Note that GDP growth rates are assumed to be exogenous,[35] even though Kalemli et al. (2013) argue that this is not essential since regressions are not structural. Since our panel estimation includes time-fixed effects, estimates are fully consistent, even in the presence of common taste shocks (Sorensen and Yosha, 1998).

3.2 Decomposition of net savings

3.2.1 Decomposition by sector

After having broken down national income following the original methodology presented above, we further decompose savings to obtain the respective contribution of household, government,[36] and corporation saving. Governments can adjust their level of deficit in order to smooth out consumption along the business cycle, using fiscal policy in a counter-cyclical fashion. Similarly, the corporate sector can insure shareholders' income if it is able to adjust its patterns of earnings retention so that a larger share of profits is distributed in the form of dividends during recessions. Finally, households can smooth consumption by using their own saving, or by borrowing (credit) and lending (increasing savings/deposit) to smooth their consumption over the business cycle. This can occur at the domestic level, by using the country's available savings, typically in countries with large among of savings, or externally by borrowing from the international credit markets.

This decomposition allows us to better understand the possible barriers behind consumption smoothing patterns. For instance, it is possible that the EU fiscal governance framework limits domestic policymakers' ability to use fiscal policy tools to stabilise consumption over the cycle. At the same time, the functioning of credit markets might affect the ability of households to smooth their consumption over time, either by not saving (consumption tends to increase too much if access to credit is too easy) or not consuming (for instance during a credit crunch) optimally.

The following equations are calculated to measure the relative role of the three abovementioned channels of consumption smoothing:

$$Governement\ Savings: \Delta \log NNDI_{i,t} - \Delta \log(NNDI_{i,t} - Gov\ Savings_{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

$$Private\ Savings: \Delta \log NNDI_{i,t} - \Delta \log(NNDI_{i,t} - Prv\ Savings_{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

$$Households\ Savings: \Delta \log NNDI_{i,t} - \Delta \log(NNDI_{i,t} - Households\ Savings_{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

$$Corporate\ Savings: \Delta \log NNDI_{i,t} - \Delta \log(NNDI_{i,t} - Corporate\ Savings_{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$$

3.2.2 Domestic versus external smoothing

The second key empirical question is to gauge how much consumption smoothing occurs respectively via domestic and external mechanisms. An important misconception that one encounters in the literature concerns the interpretation of the coefficient on 'net saving' as a measure of the amount of smoothing via 'international credit markets'. As was already stressed in the early literature studying risk sharing (see Sorensen and Yosha, 1998, Melitz and Zumer, 1999), smoothing through the net saving need not involve actual cross-border flows of funds, or credit. In theory, domestic consumption smoothing in a closed economy is limited since, if households and firms attempt to simultaneously

[35] For robustness we further estimate the model in the same vein as Asdrubali and Kim (2004) using a VAR model in order to take into account endogeneity. Results are very much in line with those presented below.

[36] Government savings are defined as the difference between disposable income (taxes and other revenues) and consumption.

increase their saving, they will generate pressure on the real interest rate, which will fall (increase) reducing (increasing) the incentive to save (dis-save) (Christiano, 1987).

On the other hand, integrated international financial asset markets release this constraint since when individuals in one country increase savings, funds can be channelled to other countries. This distinction is particularly relevant if one is interested in the relationship between financial integration and consumption smoothing. If domestic saving simply responds to country-specific shocks without involving any international lending and borrowing, smoothing through net saving would then measure the contribution of pro-cyclical domestic investment, and would not embed any international component. It would simply reflect an adjustment in domestic net investment, and would not imply any form of cross-country risk sharing, only purely intertemporal risk sharing.

In order to measure the relevance of the domestic and external components, we explore the simple national account identity: Saving = I + CA, which allows us to distinguish between the use of savings for domestic physical investment (Net Investment) and net international borrowing (current account balance). Both investments and current accounts contribute to risk sharing when they commove with GDP. For instance, a negative shock on GDP should be followed by a decrease in savings, so that consumption is not affected. This variation is reflected in a reduction of domestic investment (domestic component) or of the current account balance (external component).

The following equations are estimated and results are displayed in figures 6 and 7:

Investments (domestic savings) : $\Delta \log GDP_{i,t} - \Delta \log(GDP_{i,t} - Net\ Inv._{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$

Current Account (external Savings) : $\Delta \log GDP_{i,t} - \Delta \log(GDP_{i,t} - CA) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$

3.2.3 The effects of international financial instruments

The financial account is decomposed into net FDI, portfolio, and other investment (mainly deposits and bank loans), and derivatives. Over time, the amount of smoothing provided by the financial account components should correspond to that provided by the external smoothing channel outlined in the previous section. Formally, the following equations are estimated for the period 2004-14:[37]

$Net\ FDI : \Delta \log GDP_{i,t} - \Delta \log(GDP_{i,t} - Net\ FDI_{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$

$Net\ Portfolio\ Inv : \Delta \log GDP_{i,t} - \Delta \log(GDP_{i,t} - Net\ Port\ Inv._{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$

$Net\ Other\ Inv : \Delta \log GDP_{i,t} - \Delta \log(GDP_{i,t} - Net\ Other\ Inv._{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$

$Net\ Deriv : \Delta \log GDP_{i,t} - \Delta \log(GDP_{i,t} - Net\ Deriv._{i,t}) = a_t^s + \beta^s \Delta \log GDP_{i,t} + \varepsilon_{i,t}$

[37] The sample period is shorter due to data restrictions.

4 Empirical analysis

Regressions are based on a dataset comprising a total of 17 OECD countries, for the period 1990-2014. The data was collected from AMECO, OECD and IMF databases.

	Countries	**Time**
EA Core	Austria, Belgium, Netherlands, Germany, Finland, France	1990 – 2014
EA Periphery	Greece, Italy, Ireland, Spain Portugal	1990 – 2014
EA 11	EA Core + EA GIIPS	1990 – 2014
EU	EA11 + UK, Sweden, Denmark	1990 – 2014
OECD	EU + US, Japan, Norway	1990 – 2014

4.1 Channels of risk sharing (1990-2014)

The overall results are displayed in Figure 1. The panel equations presented above were estimated using OLS and time-fixed effects. As customary in the literature, we apply panel-corrected standard errors and assume an AR(1) process in the error term (see Furceri and Zdzienicka, 2013). For every country grouping, we estimate the four equations described above separately. Thus, all the reported percentages correspond to the result of a different regression.

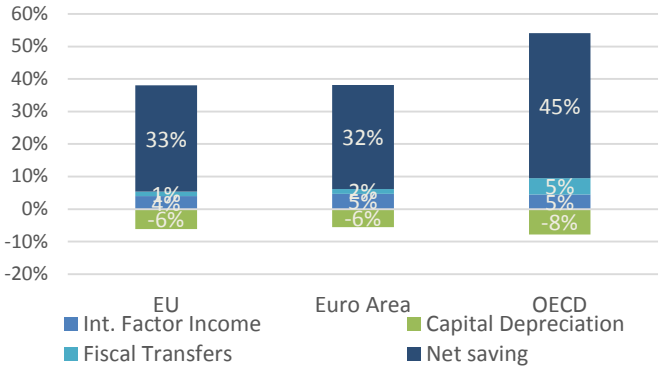
Under the hypothesis of complete risk sharing, idiosyncratic disturbances in output growth are fully compensated such that consumption in each country commoves with aggregate consumption but not with idiosyncratic shocks (Mace 1991, Cochrane 1991).

Results confirm the broad picture depicted by the most recent literature (e.g. Furceri and Zdzienicka, 2013, Kalemli-Ozcan et al. 2013). More specifically, it shows that the full risk-sharing hypothesis does not hold, and that the bulk of country-specific output shock remains unsmoothed among EU and EA11 countries. Overall, about 68% of relative output shocks in the EU and EA11 countries remain unsmoothed. The vast majority of smoothing occurs through net saving, our variable of interest. Considering a broader group of OECD countries yields an additional 10% of risk sharing. This indicates that the US, Japan and Norway have on average smoothed a larger portion of asymmetric output shocks, essentially through consumption smoothing via adjustment patterns in net savings.

The amount of income smoothing provided by factor income appears to be largely similar among the three groups over the period 1990-2014, although very low at 4%. If one includes capital depreciation, which acts as a source of dis-smoothing,[38] we even obtain a negative coefficient for the income smoothing role of capital income. This suggests that international risk sharing via the diversification of asset holdings remains weak across the board, in particular compared to large amount of interstate risk sharing observed in accomplished federations (Hepp & von Hagen 2013, Asdrubali et al. 1996).

[38] Since capital depreciation per se is not an economically significant variable, the rest of this paper abstains from discussing this channel. It tends to produce a dis-smoothing effect because it is calculated as a fixed portion of existing capital stocks, implying that if GDP increases (decreases), it becomes a smaller (larger) portion of GDP.

Figure 1: Channels of consumption and income smoothing in EU, EA11, and OECD (1990-2014)

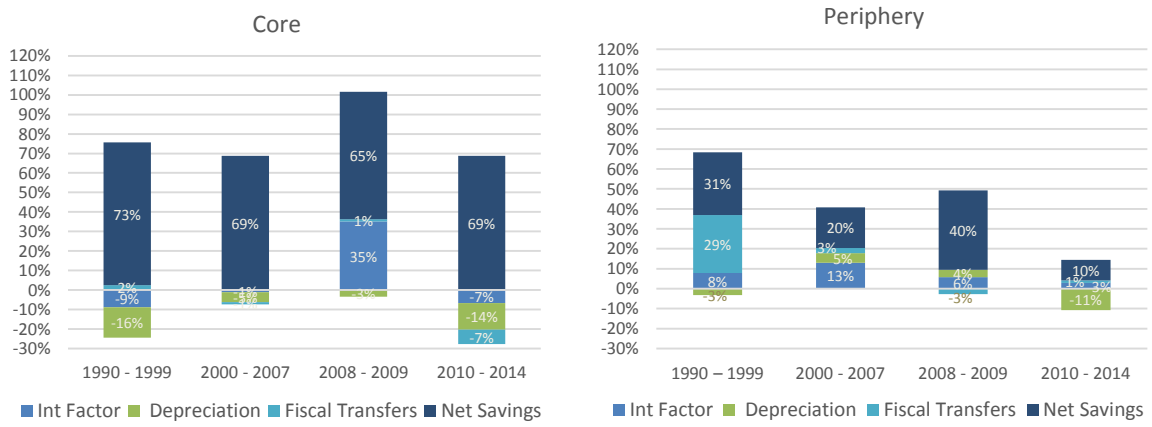


Source: OECD national accounts. OLS estimation with panel corrected standard errors

4.1.1 Consumption and income smoothing over time: Core vs Periphery

Moving forward, and with a view to shedding light on the evolution of risk-sharing patterns over pivotal periods in the EMU integration process, be it for financial market integration or the introduction of fiscal governance rules in 1992, the rest of the paper will distinguish between four key periods. As previously explained, this follows the simple methodology employed by Furceri and Zdienicka (2013) and Kalemli et al. (2013) which consists in interacting time-specific and country group dummies with the output variable.

Figure 2: Consumption and income smoothing: Core vs Periphery



Source: OECD national accounts. OLS estimation with panel-corrected standard errors. See intro of section 4 for groupings.

The proposition that net savings have virtually been the only channel at work is confirmed over all the periods. Important differences exist between the periphery and core countries, however, with the latter group displaying higher and more stable consumption smoothing. The introduction of the euro in 1999 does not appear to have narrowed this gap as the amount of consumption smoothing has decreased by about 10% in the periphery, against a slight decrease of 4% in the core countries between the period 1990-99 and 2000-07.

Distinguishing the amount of smoothing in core and periphery countries highlights the fragmentation between the two regions when it comes to their capacity to smooth output shocks, even during 'normal times' (i.e. prior to 2008). Consumption smoothing is consistently higher in the core countries than in the periphery, with the gap between the core and the periphery appearing to widen since the introduction of the euro.

This finding is somewhat surprising at first sight given the increasing degree of financial integration that followed monetary unification but likely reflects the fact that the latter was mostly based on debt instruments rather than equity. The introduction of the euro might have increased the degree of pro-cyclicality of cross-border financial flows. This was particularly apparent in the Periphery, in particular in Spain, Ireland, and Greece which received extensive amounts of capital inflows, including from outside the EA11 countries. These flows primarily served to finance consumption and credit-driven domestic growth and fuel housing bubbles rather than financing productive investment that could deliver income smoothing.

Regarding the crisis years, our results suggest that the smoothing gap between periphery and core was the largest in 2010-14, when it was needed the most. Consumption and income smoothing bottomed to about 0 in the periphery over that period. This result is mostly explained by the collapse of the net saving channel, which possibly reflects the lack of available domestic savings or/and the disruption related to the episodes of sudden stops that hit a number of countries in the region.

4.2 Government, corporation and household savings (1995-2014)[39]

The previous results point to the salience of the national saving channel, and underline its fragility in crisis times. However, the sectoral composition of net saving involves three very different types of economic agents, namely, governments, corporations, and households. Understanding their respective role in reaction to economic shocks, positive (booms) or negative (busts) is highly relevant since the smoothing capacity of the different actors depends on different factors. It is also relevant to understand whether the different economic agents substitute each other under certain circumstances.

Results (figures 3 to 5) highlight the dominant role of the government deficit as an intertemporal risk-sharing instrument during two key periods: in the pre-EMU years of 1995-99 and subsequently in 2007-08 when most countries enacted significant fiscal stimulus packages. This finding should further suggest that the countries whose output was hit the most – in relative terms – also ran larger fiscal deficits than those in a better situation. Interestingly, the coefficients display a similar magnitude across the three groups during that period, with fiscal policy smoothing out between 42 and 52% of country-specific output fluctuations.

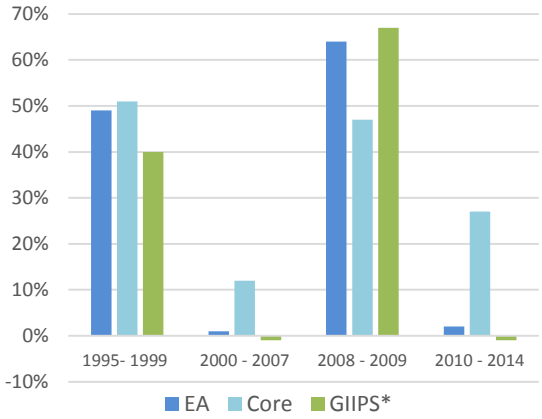
By contrast, the period corresponding to the early years of the EMU (2000-07) is associated with a collapse of consumption smoothing via government deficits in the EA.[40] This finding is not surprising given the growing evidence documenting the a-cyclicality of government deficits in the EMU (see Alcidi et al. 2016). In particular, the pro-cyclical character of public spending in the GIIPS during the boom years is well documented in the literature and explains that peripheral countries have not smoothed consumption over that period.

The period 2009-13 coincides with the process of fiscal adjustment in most economies, with particularly severe implications for countries hit by the sovereign debt crisis. Overall, and in line with the findings of Kalemli et al. (2015) for 2010, our findings indicate that government saving became ineffective as of 2010, with the exception of saving in the core countries.

[39] Due to data availability restrictions for the subcomponents of savings the sample used in the rest of this study covers the period 1995-2014.

[40] As a matter of comparison, the degree of consumption smoothing remains significantly unaffected (at 42%) in the broader group of OECD countries

Figure 3: Government net saving



As far as the EMU is concerned, part of the explanation lies in the fact that the most distressed member states found themselves forced to adjust the path of their government spending to restore the sustainability of their public finances, thereby reducing government expenditure as output fell across the board. This phenomenon is reflected in the estimates for government smoothing in the periphery, which is slightly negative, thus dis-smoothing consumption as a result of pro-cyclical fiscal policies.
Private savings – corporate and household (figures 4 and 5) – provide a slightly more modest contribution to consumption smoothing in the EMU, with household savings even providing negative consumption smoothing in 1995-99, at a modest 8% prior to the breakout of the financial crisis.

Figure 4: Personal saving

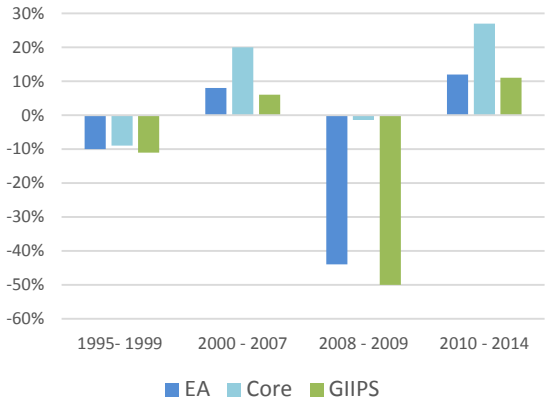
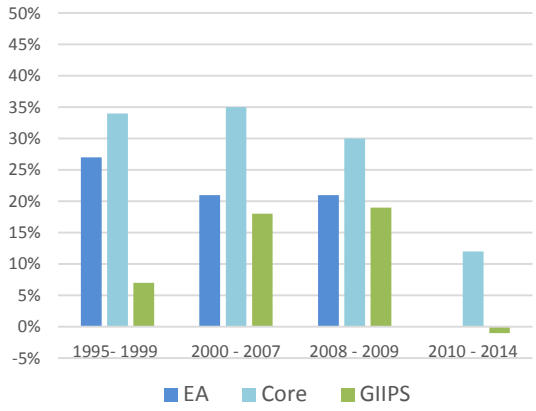


Figure 5: Corporate saving



Source: *OECD national accounts. OLS estimation with panel corrected standard errors.*

Interestingly, patterns of consumption smoothing seem to feature a substitution effect between the government (Figure 3) and household saving (Figure 4). Indeed, the negative correlation between the changes in the smoothing role of government and household saving is present in the four periods (see figures 3 and 4). The periods during which household savings have worked as an output shock amplifier, namely 1995-99, and even more so 2007-08 coincide with an increasing smoothing effect from the governments' deficit. Conversely, household smoothing is positive in the EA (8%) in 2000-07 as government smoothing decreases. A similar pattern can be observed in 2010-13 (12% in the EA) when a number of distressed governments were either bound by fiscal rules or forced to adjust to the sudden stop. The results in core and periphery countries are in line with general expectations. In particular, the fact that periphery countries have lower savings than the core (and higher external debt) is in line with the observation that they are less able to smooth consumption in the face of a large country-specific shock. The particularly low level of smoothing in the GIIPs possibly reflects the pro-cyclicality of bank lending to the region.

Finally, firms' savings (Figure 5), which comprises firms' retained earnings[41] (undistributed profits) provided a relatively stable and large amount of consumption smoothing until 2008-09, although more pronounced in the core (about 35%), than in the periphery (between 7-18%). Most private consumption smoothing thus occurs in the form of an increase or decrease in retained earnings in response to profit shocks. The period 2010-14 stands out as the exception to this pattern. One explanation for the sharp reduction in the period 2010-14, particularly in the periphery, is that firms are not able to contribute to risk sharing when faced with long-term shocks.[42] As argued in Alcidi et al. (2017), who examine the amount of risk sharing for shocks of different persistence, corporates do not retain earnings for more than two years

4.3 Domestic absorption versus international consumption smoothing

The question that we address in this section is whether net saving absorb shocks via its domestic dimension – adjustment in investment – or via the current accounts[43] (net foreign borrowing). In order to assess the relevance of both sub-channels we proceed as described in section 2, and break down net saving into its domestic (investment) and external components (trade balance).

Figure 6: Domestic smoothing (Net I)

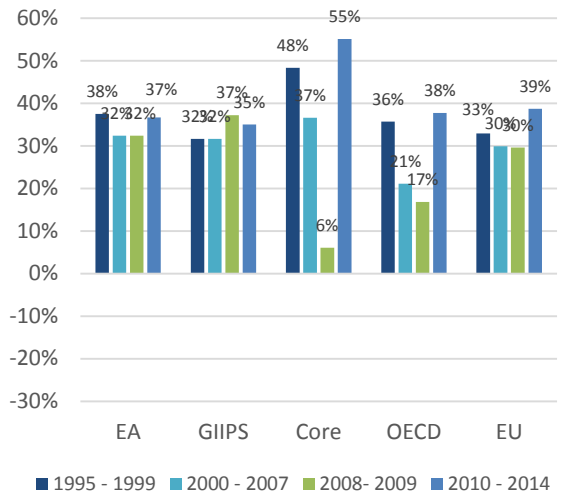
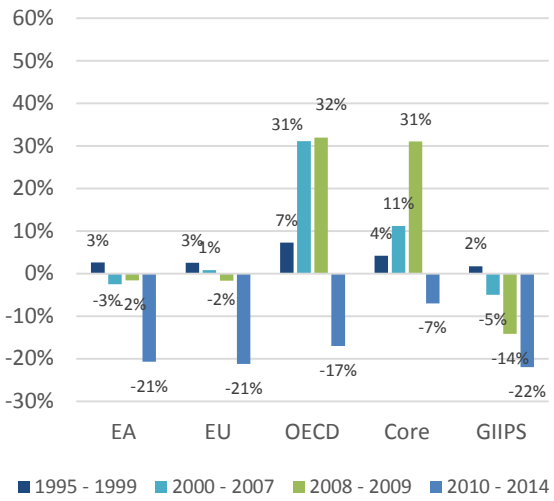


Figure 7: External smoothing (trade balance)



Source: *OECD national accounts. OLS estimation with panel corrected standard errors.*

As it turns out, the bulk of consumption smoothing in the EA and EU is achieved via domestic absorption – i.e. lower domestic investment in response to negative shocks – rather than through changes in the trade balance. This finding is consistent with that by Sorensen and Yosha (1998) and Melitz and Zumer (1999), who show that investment behaves pro-cyclically, and suggests that international credit markets generally provide for very limited (or negative) cross-border consumption smoothing. The results displayed in Figure 7 suggest that European monetary integration has not significantly fostered cross-country consumption smoothing through market integration.

[41] This can be achieved by adjusting the payout ratio on profits, or by borrowing.
[42] See Alcidi et al. (2017)
[43] Since the current account includes international fiscal transfers and capital income, which we already account for in the baseline framework, we instead use the trade balance. The two being highly correlated, notably due to the weak smoothing property of factor income in the EA, results are almost identical in both cases.

An interesting pattern emerges when distinguishing core and periphery. On the one hand, in the core, net foreign borrowing does contribute positively to consumption smoothing until 2009. In fact, it progressively increases from 4% in 1995-99 to reach 31% in 2008-09, although this is no longer the case after 2009 (-7%). On the other hand, periphery countries display a reverse pattern: smoothing through international credit markets negatively evolved from 2% in 1995-99 to gradually reach -22% in 2010-14.

One explanation for this mirror effect is that international borrowing has been pro-cyclical across the board, most notably in the periphery that borrowed heavily from the core countries as they were experiencing a credit-driven consumption boom. However, the positive and progressively increasing role of international credit markets in the core until 2010 suggest that core countries still manage to adjust their trade balance in a countercyclical fashion, despite the most pro-cyclical financial flows that characterised the 2000-09 period. Non-EMU related patterns may thus have allowed the core to compensate for the mostly pro-cyclical lending patterns with the EMU periphery.[44]

Overall, domestic absorption largely prevails, although it appears to fall over time, in particular in the core countries until 2010, and to a lesser extent in EA11, EU and in the OECD, but not in GIIPS, where it was stable until 2007 before further increasing in 2007-13.

These findings convey important qualifications to scholars and policymakers who interpret the net saving channel as an 'international credit' channel. For instance, in an influential paper, Furceri and Zdienicka (2013) use 'saving' and 'credit' channel interchangeably and conclude that the net saving channel collapses primarily as a result of the failure of credit markets to function when they are needed most: during financial crises. Surely, there is strong evidence that credit markets tend to collapse during such crises (Reinhart and Rogoff, 2008). Our results support the existence of such an effect since international credit markets are found to have dis-smoothed consumption in 2010-14 in all the examples presented above.

Yet the finding that international credit markets tend to produce large destabilising effects during crises does not mean that it provides additional smoothing during normal times. Indeed, our results stress the dominant role of domestic absorption over external smoothing during 'normal times'. This suggests that there is more to the collapse of the net saving channel during financial crises than the poor functioning of credit markets during crises.

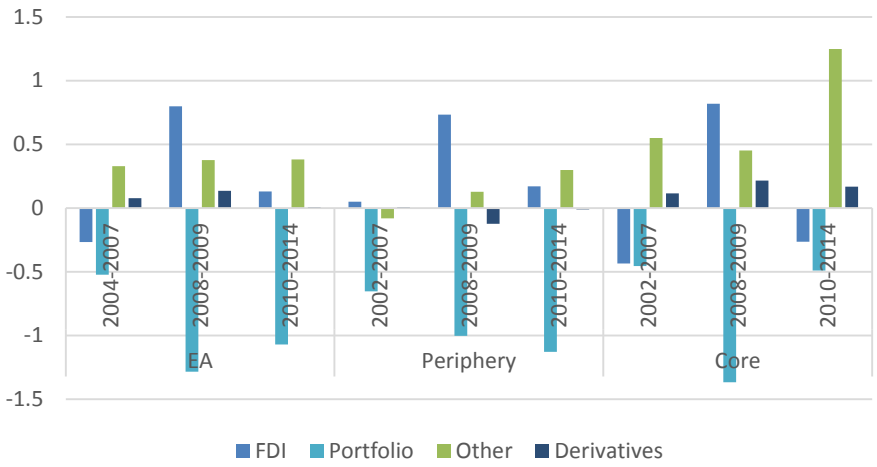
4.4 Decomposition of the financial accounts

In order to further disentangle the drivers of consumption smoothing through international credit markets, this section moves from the current account to further decomposing the financial accounts – assuming the net capital account balance is equal to zero in its different asset and liability components. Using balance of payment data (from the OECD BoP database) allows us to look at the different classes of financial instruments that act as a source of external consumption smoothing. The intuition here is that in order to obtain positive consumption smoothing, countries facing a positive shock to GDP should increase savings and channel these extra resources to other countries. At the same time, countries with negative shocks to output should access foreign financial resources (in the form of credit or other instruments) to sustain their consumption. Also note that this section only focuses on net asset flows, and not on the income generated by the same assets.

[44] Indeed, one must bear in mind that while the shocks are based on the sample selection, cross-border consumption smoothing can stem from countries outside the sample. Assessing the exact intra-EMU risk sharing would require bilateral data on the flows of capital income, assets/liabilities, and transfers. This data does not exist.

It must be pointed out from the onset that the results (see Figure 8), which cover the period 2004-14, are essentially statistically insignificant, and should therefore be taken with a grain of salt[45]. Our findings mirror the complexity of the channel and do not allow for clear-cut conclusions, although a number of points emerge. Firstly, 'other investments', contribute to intertemporal smoothing. These instruments, mainly cross-country lending and borrowing, smooth between as much as 25% of output shocks in the periphery to 50% in the core and this role seems to be consistent over time. The positive and significant role of this channel during the sovereign debt crisis is likely to be due to the impact of the ESM programmes (which are recorded under this channel) and to the role of the ECB, which guaranteed a steady supply of liquidity to the banking sector during the crisis years through conventional and longer-term refinancing operations.

Figure 8: Smoothing via financial instruments in EA10 (2004-14)



Source: *OECD BoP data. OLS estimation with panel-corrected standard errors. Core: Austria, Germany, Netherlands, Finland, France. Periphery: Italy, Spain, Greece, Portugal.*

Secondly, portfolio assets and liabilities act in a dis-smoothing way in every country group and during the different time periods. The pro-cyclical role of this channel grows during the financial crisis and decreases during the sovereign debt crisis in the euro area periphery. Overall, FDI flows seem to produce smoothing, in particular during the financial crisis. It is possible that FDI acted as a substitute for the outflow of portfolio investment during this period; more generally, this finding underlines the role of FDI as a risk-sharing tool against short-term investments. Finally, net derivative appears to modestly smooth consumption only in the core.

4.5 Downturns and upturns: Is the level of consumption smoothing asymmetric over the cycle?

This section analyses consumption smoothing for negative and positive shocks, testing for the possibility of asymmetric consumption smoothing over the positive and negative portions of the cycle. This could be the case if, for instance, political decisions related to budgets are made by office-seeking politicians, it is possible that the discretionary portion of the government deficit reacts more strongly to negative shocks than to positive shocks. Conversely, individuals or firms might save during good years, but find it difficult to borrow during hard times. This exercise is carried out using the same breakdown as in the previous section.

[45] Although the sign of the coefficient appears to be stable over time and across the periphery and core.

In order to address this question we interact GDP with two different dummy variables. These variables take on respectively one for positive shocks and negative shocks and zero otherwise. We thus estimate one coefficient for positive shocks and another one for negative shocks within the same equation. Note that a positive (negative) shock is defined *relative* to the average output growth rate in the sample and not a positive or negative growth rate.

The decomposition of savings distinguishing positive and negative shocks in figures 10 and 11 adds insightful elements to this picture. Results, which cover the period 1995-2014, indicate that government budgets achieve about 23% during negative country specific shocks for only 14% of negative shocks in the EA. By contrast, private saving provides a larger amount of consumption smoothing during positive shocks, mainly driven by corporate saving but also, albeit to a lower extent, by personal saving. On average, private saving does not seem to smooth consumption in the wake of negative shocks, mainly because the counter-cyclical behaviour of personal savings is dis-smoothing.

The shock absorption capacity through domestic and external mechanisms also differs, critically depending on the sign of shocks. In particular, positive shocks tend to smooth to a lower degree by domestic investment adjustments (30%) compared to negative shocks (43%). Conversely, the role of the trade balance appears to be neutral (i.e. providing no smoothing) in the face of positive shocks, whereas it tends to be a significant force amplifying negative shocks (-21%).

Figure 9: Government, personal and corporate (1995-14)

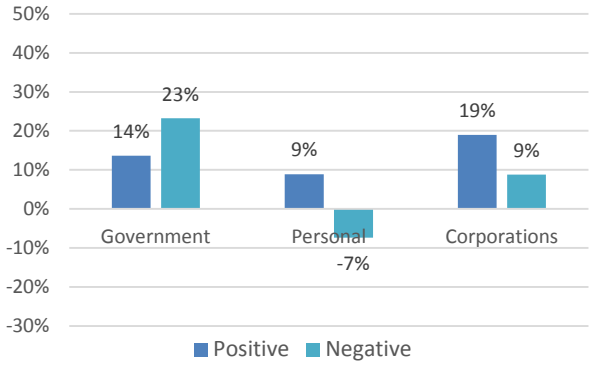
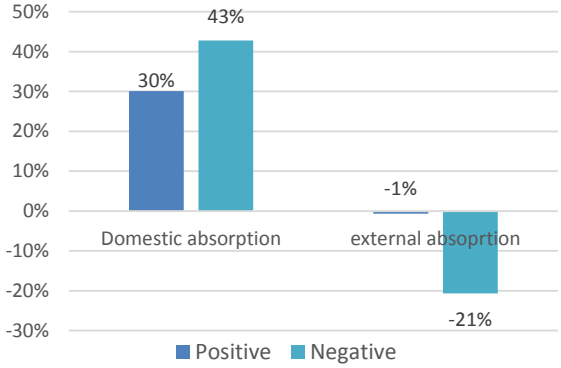


Figure 10: Domestic vs External (1995-14)



Source: OECD national accounts. OLS estimation with panel corrected standard errors. See intro of section 3 for groupings.

The result reported in tables 2 and 3 display respectively the results for positive and negative relative shocks over four key periods of our sample, and between the core and non-core countries. Both results convey a very similar message, in particular when one keeps in mind which countries faced positive and negative shocks over the different time periods.

One key finding regards the role of government deficits (first columns in tables 1 and 2). The latter tends to smooth a larger portion of output shocks during downturn than upturns, with the exception of the period 2010-14. [46] This points to the fact that the relatively large amount of government consumption smoothing in the core over that period is due to the conjunction of relatively large fiscal retrenchment while experiencing better output growth. This is consistent with the finding that core countries tend to smooth a much larger portion of shocks than the periphery during the crisis.

[46] See Alcidi and Thirion (2017) for a detailed analysis of the role of fiscal policy in smoothing the impact of shocks.

Table 1: Positive and negative shocks by period, EA11

	Government	Household	Corporations	Domestic absorption	External absorption
Positive 95-99	0.419***	-0.055	0.274**	0.353***	-0.011
Negative 95-99	0.717***	-0.251**	0.344**	0.577***	-0.044
Positive 00-07	0.007	0.078	0.208	0.320***	-0.063
Negative 00-07	0.073	0.038	0.19	0.618***	-0.378**
Positive 08-09	0.112	0.124	-0.407	0.165	-0.382
Negative 08-09	0.620***	-0.417***	0.179	0.317***	-0.116
Positive 10-14	0.521***	-0.067	0.34	0.491***	0.204
Negative 10-14	-0.084	0.163**	-0.065	0.342***	-0.318***

Table 2: Positive and negative shocks, Periphery vs Core

	Government	Household	Corporations	Domestic absorption	External absorption
Positive Periphery	0.12	0.043	0.112	0.301***	-0.065
Negative Periphery	0.190***	-0.08	0.059	0.404***	-0.269***
Positive Core	0.233***	0.117*	0.300***	0.366***	0.154**
Negative Core	0.401***	0.008	0.293***	0.495***	0.025

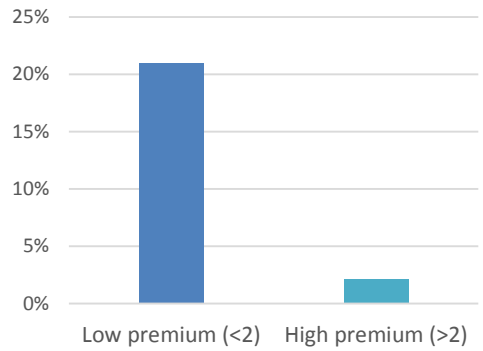
In contrast to the public sector, private consumption smoothing (columns 2 and 3 of the two tables), which is largely driven by corporations' saving patterns, is generally greater during upturns, except over the 2007-08 period, which was characterised by a large dis-smoothing effect of household savings in countries experiencing a negative shock, possibly reflecting precautionary saving behaviours or a lack of access to credit during the financial crisis. In terms of private consumption smoothing, the core countries smooth out about 30% of positive and negative shocks against 5-10% in the periphery.

The results displayed in columns 4 and 5 of the two tables indicate that domestic absorption is larger during downturns than upturns, except in 2009-13, and appears to be of comparable magnitude in the core and periphery, ranging between 30 and 50% of output shocks. Conversely, external financing seems to be more favourable to consumption smoothing for positive shocks. In the core, international net inflows smoothed out 15% of positive shocks, for only about 3% during downturns. In the periphery the effect is insignificant during positive shocks and turns significantly negative during downturns, dis-smoothing about 25% of negative output shocks.

In order to examine the impact of the limited access to financial markets on government consumption smoothing, Figure 11 reports the estimates of government smoothing, distinguishing between periods of low-risk premium (below 2%) and high-risk premium (above 2%). The choice of the threshold is admittedly arbitrary but proves to accurately capture the episodes of acute financial stress and funding access limitations.[47] The fact that the amount of shock smoothed by government budgets is lower during financial crises is consistent with the fact that a number of euro area governments had to implement consolidation policies as a result of losing access to international credit markets.

[47] Robustness checks were performed with 1 and 1.5% risk premia, yielding largely similar results. We stick to the 2% as it best captures the periods of intense financial stress in the periphery countries during different phases of the sovereign crisis.

Figure 11: Government and markets: sovereign risk premium and risk sharing



5 Conclusions

This paper examines the role of intertemporal risk sharing – or consumption smoothing – in absorbing the impact of asymmetric shocks in the euro area. It attempts to disentangle the role of international and domestic absorption through net savings, and that of governments from the private sector.

Our baseline results confirm the findings in the literature that in the EA net savings constitute the main smoothing mechanism, while the degree of income risk sharing through factor income continues to fall short of the levels observed in accomplished federations like the US.

This paper enriches previous empirical studies by decomposing the contribution to consumption smoothing into government, household and corporate net savings. We show that, on average, government saving, namely fiscal policy, plays the largest role in smoothing consumption. Corporate saving provides stable smoothing as well, absorbing about 20% of a GDP shock, but this fell drastically during the sovereign debt crisis period of 2010-14. As argued in Alcidi et al. (2017), this may be explained by the persistence of the shock, indeed corporates do not retain earning for more than 2 years. Personal saving appears to play a very limited role over all periods, even yielding amplification of the shocks rather than absorption, as during the 2008-09 financial crisis.

By considering the role of net savings in core countries relative to the periphery, we find that core countries significantly outperform the periphery across the four time periods under consideration. The gap is most evident after 2010, when consumption smoothing in the peripheral countries nearly falls to zero, driven by fiscal consolidation. By contrast, this has remained high in the core countries, which signals cautionary budgetary policies and hence no contribution to sustain demand in the euro area.

Secondly, we distinguish between the degree of consumption smoothing that is achieved through access to international markets from that resulting from adjustment in domestic investment decisions. This distinction is important in the debate over the benefits of financial integration in the euro area. Indeed, the ‘net savings’ channel is often fully associated with international credit markets, while it also embeds a domestic adjustment mechanism. We find that, in contrast to what is sometimes assumed, consumption smoothing is almost entirely achieved domestically, namely via pro-cyclical domestic investment absorption.

We then match the external component of savings with international financial flows as measured by the balance of payment statistics, and measure the smoothing role of the different components of the financing part of the balance of payment. We find that only in the core countries do foreign debt holdings seem to have some smoothing properties, likely reflecting banks’ capacity to channel excess

liquidity to other countries. By contrast, in the periphery, since the creation of the euro the external exposure has tended to amplify the effect of output shock on consumption rather than providing additional absorption.

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