ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Giovannini, Alessandro; Ioannou, Demosthenes; Stracca, Livio

Research Report

Public and private risk sharing: Friends or foes? The interplay between different forms of risk sharing

ECB Occasional Paper, No. 295

Provided in Cooperation with:
European Central Bank (ECB)

Suggested Citation: Giovannini, Alessandro; Ioannou, Demosthenes; Stracca, Livio (2022) : Public and private risk sharing: Friends or foes? The interplay between different forms of risk sharing, ECB Occasional Paper, No. 295, ISBN 978-92-899-4849-4, European Central Bank (ECB), Frankfurt a. M., https://doi.org/10.2866/126627

This Version is available at:
https://hdl.handle.net/10419/268039

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

EUROPEAN CENTRAL BANK

EUROSYSTEM

Occasional Paper Series

Alessandro Giovannini,
Demosthenes Ioannou, Livio Stracca

Public and private risk sharing: friends or foes?

The interplay between different forms of risk sharing

No 295 / June 2022

Disclaimer: This paper should not be reported as representing the views of the European Central Bank (ECB). The views expressed are those of the authors and do not necessarily reflect those of the ECB.

Contents

Abstract **2**

Non-technical summary **3**

1 Introduction **5**

2 Defining and classifying risk sharing: private vs. public, ex ante vs. ex post **8**

Box 1 Takeaways from a simple empirical test on the level of risk sharing 8

Box 2 Measuring risk sharing and its limitations 10

3 Private and public risk-sharing channels **13**

3.1 Private risk-sharing channels 13

Box 3 Comparing empirical findings on the importance of risk-sharing channels in the euro area and the United States 14

3.2 Public risk-sharing channels 16

Box 4 The role of euro area financial assistance instruments in shock absorption through risk sharing 17

4 Substitutes or complements? **22**

5 A simple model of private/public risk-sharing complementarity **26**

5.1 A simple model of cross-border risk sharing 26

5.2 Model simulations 28

Conclusions from the model simulations 36

6 Conclusions and policy implications **37**

References **39**

Abstract

Well-functioning risk-sharing arrangements are essential for the shock absorbing capacity and resilience of an economy, even more so for countries in a monetary union where the single monetary policy is unable to address asymmetric shocks. The common shocks that euro area member states have been facing over the past years are just that: common. Yet their impacts are far from equal across countries, implying that risk sharing remains an important issue. This paper discusses the different forms and channels of risk sharing and reviews the main arguments in favour and against the development of different forms of public and private risk sharing in the euro area, focusing in particular on whether they act as complements or substitutes. It proposes a stylised theoretical model of a monetary union to test the complementarity or substitutability between public and private risk sharing. While the model calibration finds that substitutability prevails, the model also contains an interesting complementarity whereby a central fiscal capacity makes private risk sharing more efficient, especially in crisis times. Our findings are relevant for the ongoing policy discussion on EMU deepening as the provision of public risk sharing as well as the overall degree of risk sharing are still comparatively low in the euro area.

JEL codes: C23, E62, G11, G15.

Keywords: Risk sharing, Economic and Monetary Union, monetary union.

Non-technical summary

Well-functioning economic risk-sharing arrangements are essential for the shock-absorbing capacity and resilience of an economy in general, and a monetary union in particular. The financial crisis more than a decade ago brought to the fore the issue of risk sharing among the member states of Economic and Monetary Union (EMU).

With the unprecedented shock of the COVID-19 pandemic and Russia's war in Ukraine, the debate has acquired additional relevance. Indeed, the common shocks that euro area member states have been facing over the past years are just that: common. Yet their impacts are far from equal across countries, implying that risk sharing remains an important issue.

Risk sharing has been at the core of every major debate about how to "deepen" EMU over the past ten years. On the one hand, the completion of the banking union and the capital markets union has been seen as the main channel to increase private risk sharing. On the other hand, the creation of a fiscal capacity in the euro area has been viewed as the key tool to ensure that public risk sharing can correctly operate.

We first provide a clear definition of public and private risk sharing, looking also at those public channels that are not often discussed in the literature. If private risk sharing is found to be both in theory and in practice the main shock absorber in the euro area, its interaction with public risk sharing has not been fully investigated. The existing literature tends to focus most on highlighting the substitution effects between private and public risk-sharing channels. Yet, it is important to look also at the extent to which private risk sharing can work without an adequate degree of public risk sharing. From this perspective, public risk sharing complements private risk sharing.

Our analysis thus discusses the possible substitutability or complementarity between different public and private risk-sharing channels. We also develop a basic model focusing specifically on this point. We illustrate that, if private risk-sharing arrangements are not fully developed (i.e. equity market integration is limited and risk sharing through debt is also difficult), a central fiscal capacity can play a useful function in improving risk sharing. Specifically, we identify one main channel of substitutability and one main channel of complementarity. The substitutability channel, which appears to be the largest one, relates to the fact that a central fiscal capacity reduces the borrowing needs. At the same time, a central fiscal capacity also makes private borrowing more convenient, thereby allowing private risk sharing to operate more effectively.

In other words, we document that for private risk sharing to be maintained and flourish, it needs to be complemented by public risk-sharing arrangements: if public institutions and resources reassure markets of a minimum level of shock absorption, market participants might be more willing and better able to act when a shock hits the economy. As a second line of defence, especially against severe shocks or crises, public risk sharing may need to complement private risk sharing.

These findings could thus inform the future policy discussion on EMU deepening, also taking into account the innovative fiscal tools at the EU level established in response to the COVID-19 crisis and the need for dealing with the asymmetric shock generated by Russia's war in Ukraine.

1 Introduction

"[…] to tackle future cyclical crises, the two layers of protection against shocks – the diversification of risk through the private financial system on the one hand, and public countercyclical support through national budgets and the fiscal capacity of the EU budget on the other – need to interact in a complete and efficient manner."

Mario Draghi, 15 December 2018

Well-functioning risk-sharing arrangements are essential for the shock-absorbing capacity and resilience of an economy. Full risk sharing – in the traditional sense of consumption smoothing – implies that consumption across jurisdictions (states, regions and countries) should be insensitive to purely local income and wealth fluctuations, and should move proportionally if its relative price is equalised.[1]

For countries in a monetary union, where the single monetary policy is unable to address asymmetric shocks, risk sharing is particularly important. Reducing volatility of consumption in those countries via risk sharing should provide welfare gains for those countries hit by specific shocks, but also for the monetary union as a whole, by facilitating macroeconomic adjustment, averting crises and reducing in the long run regional divergences.[2]

The global financial crisis of 2007-09, and its mutation and magnification into a sovereign debt crisis in some euro area countries, brought to the fore the issue of risk sharing across the member states of Economic and Monetary Union (EMU) in particular.[3] The issue of risk sharing in the monetary union, and the respective roles of public and private risk sharing, have since then come to be at the heart of the policy debate on "deepening", or "completing", EMU.[4] As Furceri and

---

1 See, for instance, Canova and Ravn (1996).

2 While the presence of well-functioning risk-sharing arrangements can prevent cyclical divergences from turning into structural divergence, risk sharing is not per se a tool for promoting convergence. On the one hand, the divergence of economic activity across states, regions and countries provides an opportunity for integrated areas to share risk in order to smooth their consumption: that is, consumers in integrated economies benefit from output divergence. On the other hand, risk sharing can only counteract cyclical shocks, i.e. cannot ensure convergence towards similar levels of GDP per capita across states, regions and countries. A possible exception to this is the indirect contribution that appropriate levels of risk sharing can make to a better management of the business cycle across a monetary union. If risk sharing can help to adjust to cyclical shocks better, this presumably can also help to structurally adjust over time to better be able to achieve cross-regional income convergence.

3 The early risk-sharing literature of the 1990s was oriented towards international risk sharing (Cole and Obstfeld, 1991; Obstfeld 1994), but was also pursued with an eye towards European integration and monetary union (Atkeson and Bayoumi, 1993; Persson and Tabellini, 1996). The debate is linked to the seminal work on Optimum Currency Area (OCA) theory, with Mundell (1961) and Kenen (1969) highlighting early on the need for both public and private risk sharing.

4 Following the key policy reports by the Four Presidents (in 2012) and the Five Presidents (in 2015) proposing the completion of EMU under the headings of a fiscal union, financial union (banking union and capital markets union), economic union and political union, a set of French and German economists made a proposal to combine risk-sharing and "risk-reducing" elements to complete EMU (CEPR Policy Insight No 91). This contribution was debated by other academics and brought together in Pisani-Ferry and Zettelmeyer (2019). Central bankers have also expressed views in this regard, e.g. on the role of a complete financial union in shock absorption by the President of the Deutsche Bundesbank and the Governor of the Banque de France (Weidmann and Villeroy de Galhau, 2019).

Zdzienicka (2015) have pointed out, "the stability of a monetary union depends on the capacity to deal with idiosyncratic shocks affecting its member countries in the absence of independent national monetary policies."

With the sudden and unprecedented shock of the COVID-19 pandemic, the debate has acquired additional relevance for European policymakers, given the resulting asymmetric effects across the euro area economy. While the COVID-19 pandemic represents a symmetric shock in the first instance, its economic consequences are proving to be asymmetric across Europe, for example in the labour market (Torrejón Pérez et al., 2020), depending on various epidemiological factors and national mitigation strategies. This is also shown to be the case when looking at major plague episodes from the past millennium, after which some regions recovered quickly, while others suffered prolonged economic damage (Alfani, 2020). Tentative evidence seems to suggest that risk sharing in the euro area has been resilient throughout the COVID-19 crisis (Giovannini et al., 2021).

The impact of the war in Ukraine poses an additional challenge given its heterogenous impact on European countries. After the pandemic, the Russian invasion of Ukraine is yet another external economic shock with asymmetric consequences across Europe (Redeker, 2022). European countries are also heterogeneously affected by, for example, the implementation of sanctions, such as those imposed on Russia, or their degree of dependence on various energy sources (McWilliams et al., 2022). Indeed, the common shocks that euro area member states have been facing over the past years are just that: common. Yet their impacts are far from equal across countries, ensuring that risk sharing remains an important issue.

This paper focuses specifically on the interaction – and in particular the complementarity or substitutability – of public and private risk sharing to stabilise and enhance the economic performance of EMU. The literature is relatively consensual on the need for risk sharing, especially in monetary unions. However, it is relatively inconclusive on the matter of complementarity of public and private risk sharing, and there are in theory two main possibilities as regards this interaction. The one is that, in the presence of efficient markets, private risk sharing acts as the main shock absorber in the economy, with little or no role for public risk sharing.[5] The other is that public risk sharing is an essential element in the shock-absorbing defences of the economy, in its own right and/or in order to complement the role of private risk sharing. In the terminology of the EMU completion debate, the key questions that arise are to what extent can the development of private risk sharing (i.e. the financial market union composed of a banking union and a capital markets union (CMU)) substitute for fiscal union or public risk sharing, and how much of that fiscal union is necessary to act as a backstop to the financial market union?.

To investigate the interaction of private and public risk sharing, the paper defines, discusses and models the interaction between private and public risk

[5] For example, this is the perspective taken by observers who emphasise the strong role that private risk sharing plays in the US economy (Jones, 2016). On this premise, some policymakers recommend that the euro area should focus on completing the banking union and capital markets union and leave aside any further development of the fiscal union dimension in EMU (Heijdra et al., 2018).

sharing. Section 1 defines more clearly public and private risk sharing, and looks at the relationship between risk sharing and shock absorption as well as the notion of ex ante and ex post risk sharing. Section 2 then addresses one by one the commonly identified risk-sharing channels. In doing so, we shed additional light on the existing and necessary risk sharing that is prevalent through monetary union per se, that is, the operation of the single currency and its infrastructure. Section 3 discusses the possible substitutability or complementarity between different public and private risk-sharing channels. In Section 4, we develop a very stylised model to better understand the complementarity or substitutability between public risk-sharing channels, on the one hand, and private risk-sharing channels, on the other. The model identifies one main channel of substitutability and one main channel of complementarity; in the model calibration, the first prevails, but it is important to note that at least the theoretical possibility of complementarity exists. The main substitutability channel is that public risk sharing (intended as a central fiscal capacity) reduces the need for agents to borrow from the other country, dampening net foreign debt. On the other hand, a central fiscal capacity also reduces the financial frictions associated with foreign debt, making private external borrowing more convenient. In this sense, the model also identifies a key channel of complementarity between public and private risk sharing. Although this is not strictly speaking part of the model, which is solved at second order with perturbation methods, one can speculate that this complementarity is particularly relevant for removing tail risks, i.e. when the central capacity provides a backstop to private borrowing and lending.

Overall, both the existing literature and the model presented in this paper suggest that the private and public risk-sharing channels can also act in a complementary manner. In particular, recent theoretical literature suggests that if public institutions reassure markets of a minimum level of shock absorption, market participants might be more willing and better able to act when a shock hits the economy. This is also confirmed by the model simulations that identify a channel of complementarity whereby higher provision of public insurance – e.g. via a central fiscal capacity – reduces financial frictions and hence makes private debt less costly and more efficient, even though it is less in demand. The relevance of public channels as backup for private channels to operate appears particularly relevant when it comes to discussing the incompleteness of the EMU architecture and the need for completing the banking union and strengthening the capital markets union.

2 Defining and classifying risk sharing: private vs. public, ex ante vs. ex post

Risk sharing is a variably, and sometimes vaguely, defined concept. The most commonly used metric for measuring risk sharing is to assess consumption smoothing. Under the assumption of complete financial markets, perfect risk sharing implies consumption growth rates in all countries being equal to the growth rate of world consumption and consumption growth of individual countries being orthogonal to other factors (Kalemli-Özcan et al., 2014). In such terms, economic agents aim at insulating their consumption streams from country-specific fluctuations in the business cycle; in other words, they try to "smooth out" changes in their consumption resulting from economic shocks (Cimadomo et al., 2020).

Box 1

Takeaways from a simple empirical test on the level of risk sharing

We conduct a simple empirical test to compare risk sharing in the euro area and in the United States. In particular, we conduct a residual analysis for the period 2000-18 by plotting the (cross-sectional) correlation of the residuals from regressing consumption in the 19 euro area (EA) countries and the 52 US federal states:

$$\Delta \log C_{it} = \alpha_i + \lambda_t + \varepsilon_{it}^{c}$$

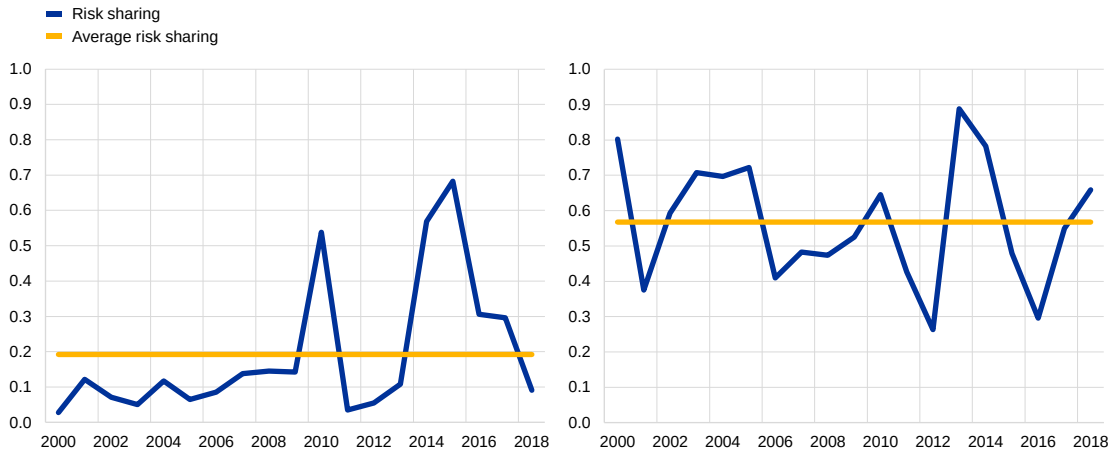
$$\Delta \log Y_{it} = \alpha_i + \lambda_t + \varepsilon_{it}^{y}$$

Risk sharing could be computed as the pairwise correlation coefficients of the residuals ε_{it}^{c} and ε_{it}^{y}.

Chart 1.1

Risk sharing in the EA19 and US52, 2000-18

Risk sharing in the EA19 (left) and US52 (right)



Sources: Eurostat, OECD and authors' calculations.
Notes: We have inverted the scale to show risk sharing rising on the y-axis: perfect risk sharing is thus indicated here by 1 and no risk sharing by 0 on a 0 to 1

scale; or, the higher the degree of correlation between residuals, the lower the risk sharing on the y-axis. The yellow horizontal lines show the simple average over the period 2000-18.

Given that the correlation of the residuals is on average high in the euro area, this indicates low risk sharing over most of the period 2000-18. This suggests a lack of notable decoupling of consumption from growth on average. This is in contrast to developments among US states where risk sharing remains much more elevated on average and is only lower than in the euro area around 2010 and 2015.

Although defining risk sharing in terms of consumption smoothing has limitations, it lends itself relatively easily to empirical assessment of the extent of risk sharing. These empirical assessments started with the seminal paper by Asdrubali et al. (1996). Their methodology, as the authors acknowledge, brings together a line of literature pertaining to the work of French and Poterba (1991), Atkeson and Bayoumi (1993) and van Wincoop (1994) on the shock-absorption capacity of cross-regional asset ownership.

The extent to which risk sharing is found to be effective is most commonly measured in the literature by the extent to which country-specific shocks are absorbed (or not as the case may be). Shock absorption is in turn measured in its simplest form as the difference between output fluctuations and income or consumption fluctuations. However, the same amount of risk sharing may be driven by the role played by different shock-absorption channels. These channels can be classified according to their nature (private vs. public) or their functioning in terms of avoiding or minimising shocks (ex ante vs. ex post).

Depending on the nature of cross-regional asset ownership, risk sharing can occur via private or public channels. If such cross-regional asset ownership is private, this is considered to be private risk sharing. For risk sharing to work through geographical diversification, financial integration would need to be deep and include specific types of financial flows, especially debt and equity foreign assets. By contrast, if the shock-absorption capacity emanates from the use of public resources, such as cross-regional ownership financed by public means, or the federal fiscal (tax/transfer) systems of certain economies (e.g. in the United States, Germany and Canada), or the existence of crisis management mechanisms such as the European Stability Mechanism (ESM) in the euro area, then this is considered public risk sharing. These channels of risk sharing are analysed in more detail in Section 2.

While in most cases risk-sharing channels are either only public or only private, in some cases the distinction may be less clear. This is, for instance, the case with the so-called savings (or credit) channel. This lack of clarity may lead to bias in estimates of risk sharing due to the empirical methodology employed (see Box 2). To better understand this problem, it is helpful to look at how risk-sharing channels work and to classify them also as ex ante or ex post forms.

Box 2
Measuring risk sharing and its limitations

The conceptual framework for measuring the degree of shock absorption through an estimation of the degree of consumption smoothing is used in the seminal paper by Asdrubali et al. (1996). This methodology has created a rich strand in the literature. It enables the decomposition of the cross-sectional variance in gross state product and the measurement of risk sharing in response to gross domestic product (GDP) shocks. The approach uses national accounting data and disaggregates (national) GDP or gross state product in the case of the US states into:

- national (state) income (NI), i.e. GDP + net factor income. This includes dividend, interest and rental income payments across country (state) borders;
- net national (state) disposable income (NNDI), i.e. GDP + net factor income + net federal flows. The latter includes federal taxes and transfers in mature federations (like the United States) or other cross-border public transfers;
- and total national (state) consumption (C+G).

$$GDP = \frac{GDP}{NI}\frac{NI}{NNDI}\frac{NNDI}{(C+G)}(C+G)$$

From these aggregates, various channels are identified through which GDP shocks are smoothed, whereby: GDP-NI = international income transfers (factor income flows); NI-NNDI = net international taxes and transfers; NNDI-(C+G) = total (private and public) net saving. By taking logs and differences, four panel regressions are estimated. After an exogenous GDP shock, stabilisation is achieved through the adjustment of net factor income if NI remains unchanged. If NI varies and NNDI remains constant, stabilisation is achieved through international transfers. If NNDI varies and total consumption remains constant, stabilisation is achieved through net saving. Finally, shocks are not totally stabilised if total consumption fluctuates.

While the standard approach proposed by Asdrubali et al. (1996) has important advantages, especially as regards empirical measurement, it has notable limitations to be considered when assessing its results. In particular, it may not measure, at least directly: (i) any ex ante risk sharing that does not materialise (hence, not visible in the national accounts) to smoothen consumption as output falls; (ii) the fact that the channel that captures the net federal flow also captures other elements as it contains the so-called secondary incomes (e.g. taxes on production and imports, external aid provided by governments) and does not distinguish between interstate risk sharing (within a federation) or international risk sharing (among fiscally independent countries); (iii) the role played by population movement, durable goods consumption and changes in prices; and (iv) the full range of public resources that are pooled by public authorities through cross-border or centralised operations not running via a federal tax/transfer system, and equally, if not more importantly, through the establishment of an institutional framework. The latter is, in some cases, considerably well-developed to ensure the efficient functioning of the other channels (for example, market infrastructures, supervisory bodies, backstops or other institutional arrangements). While some of these limitations are explicitly acknowledged by the authors in this seminal paper (e.g. the role of migration, the role of other federal functions, the international dimension of risk sharing), they have not been sufficiently highlighted in the empirical studies that have followed.

Some of these limitations may have increased in relevance in recent years due to the changes in the structure of the (euro area) economy. Due to the limitations in fully capturing the role played by the public sector and by the institutional framework, which is analysed in this paper, the methodology may suffer from some limitations in capturing the increasing role played by intra-state migration. Looking at the European experience, the importance of migration as an adjustment factor in response to both regional and country-specific labour demand shocks since the early 1990s appears to have been increasing (Beyer and Smets, 2015). It has been estimated that between 1970 and 2013, labour mobility absorbed about 25% of an asymmetric shock within one year, with movements in response to shocks having almost doubled since the introduction of the euro (Arpaia et al., 2016). Moreover, over the years, the evolution of primary and secondary income channels[6] has changed considerably, especially in crisis times. For instance, as documented by Lane (2015) and Avdjiev et al. (2018), the primary income component has played a substantial role in impacting the current account balance of several developed countries.

According to the standard literature, countries or regions can pool their risks ex ante or ex post. For instance, they could exchange claims to their output (e.g. via equity or through fiscal transfer arrangements); since the output claims are exchanged before uncertainty is resolved, this is so-called ex ante risk sharing. Agents can further smooth their consumption through the sale or purchase of foreign assets or through borrowing and lending. Since this entails that current income is already observed and uncertainty about outputs is already resolved, this is called the ex post channel of risk sharing (Becker and Hoffmann, 2003). Such a difference is particularly important for the degree of effectiveness of risk sharing as the willingness of agents to enter into such a transaction may very much depend on the types and frequency of shocks economies are exposed to and on the presence of other institutional factors at play when the shock materialises.[7]

Efficient ex ante risk-sharing channels (especially public ones) may have an impact on the amount of overall risk sharing actually observed in the data. In other words, there may be ex ante forms which in the end do not become visible in the analysis of a shock absorption using the methodology developed by Asdrubali et al. (1996). This could be the case especially where public risk sharing takes the form of institutional and regulatory frameworks, or public backstops to private ventures with the aim of maintaining financial stability in times of crisis. These factors may affect the allocation of private portfolios without however being counted under the standard methodologies discussed above as risk-sharing mechanisms. In addition,

6 According to the sixth edition of the International Monetary Fund's Balance of Payments Manual (IMF, 2013), primary income includes income associated with the production process (compensation of employees, taxes and subsidies on products and production) and income associated with the ownership of financial and other non-produced assets (property income, investment income). Secondary income includes personal transfers (workers' remittances) and other current transfers (current taxes on income, wealth, etc., social contributions, social benefits, net non-life insurance premiums, non-life insurance claims, current international cooperation, and miscellaneous current transfers).

7 IMF staff (Allard et al., 2013) argue that ex ante risk sharing (e.g. rainy-day fund) is more efficient and effective than ex post risk sharing (e.g. supranational financial assistance provided by the International Monetary Fund or the European Stability Mechanism).

they may or may not act as direct shock absorbers even though they may play a role in absorbing a shock.

A key issue therefore is how to identify the role played by resources committed ex ante which, however, do not appear in the data ex post. In particular, to correctly identify the role of public resources these either need to be broadly defined, or it may not be possible to cover the full spectrum of risk sharing that may be at play when a shock materialises. In other words, the availability or pooling of public resources that are aimed at creating the broader institutional framework and ensure the provision of private risk sharing should also be counted as being or contributing to public risk sharing. For example, the assignment of resources to a robust centralised institutional framework of lawmakers, or more widely an additional level of governance, that produces the legal and governance framework and certainty for the operation of a single market and an economic and monetary union with the appropriate capabilities is also part of risk-sharing arrangements.[8] The starting point in this line of argumentation has been formulated most strongly recently and in theoretical terms by Farhi and Werning (2017) who "show that even if financial markets are complete, privately optimal risk sharing is constrained inefficient. A role emerges for government intervention in risk sharing both to guarantee its existence and to influence its operation. The constrained efficient risk-sharing arrangement can be implemented by contingent transfers within a fiscal union." Finally, one should also not neglect the importance of public channels in an even broader sense, i.e. by incorporating the presence of public goods such as internal and external security in the absence of which and at the limit private risk sharing breaks down or is absent altogether. These arguments are sometimes presented in the literature as the willingness of investors to commit to cross-border investments depending on the "quality of the institutional framework", which is found to be a key – if not the key – determining factor (see Section 3.2 below). The most concrete example relevant to the euro area during the financial crisis and manifesting itself in economic and financial turbulence was arguably concentrated in those countries that had a lower level of institutional quality (Baldwin and Giavazzi, 2015).

[8] The importance of this should not be underestimated, especially when it comes to the debate on EMU. The idea that taxpayer resources may be pooled for the purposes of public risk sharing then also implies the need to still adhere in one way or another to the general precept of "no taxation without representation", thus requiring appropriate governance, accountability and legitimacy structures that limit the potential for a political or even existential crisis following an economic one, echoing the political union elements envisaged in the Five Presidents' Report and analysed at greater length elsewhere. For a recent discussion showing the pertinence of such arrangements given the interplay between the financial crisis and the political ramifications in Europe highlighting the need to complete the euro area as an economy and polity, see Macchiarelli et al. (2020).

3 Private and public risk-sharing channels

Before looking into the interlinkages between public and private risk sharing, it is important to have a clear definition of the main channels at play. Ideally, in a well-functioning, market-based economy, market participants' decisions would be absorbing economic shocks to the extent possible; public resources would ensure that such private risk sharing acts as efficiently and effectively as possible in order to minimise public intervention, with public risk sharing being ready to act only to cover risks not bearable by the private sector. This section goes first through (mainly) private risk-sharing channels and then turns to public risk-sharing channels. Box 3 compares the empirical findings on the importance of risk-sharing channels in the euro area, and compares them with the US experience.

3.1 Private risk-sharing channels

The literature identifies at least four main private risk-sharing channels. These are the capital channel, the savings (or credit) channel, the price channel and labour mobility, and are reviewed in this sub-section.

Integrated capital markets can smooth the impact of an asymmetric shock on income in a country. In particular, to the extent that capital income continues to co-move with the aggregate output of the union, capital markets can play an important role in providing an ex ante shock-absorption channel. This channel is almost entirely a private channel, as it operates via factor income flows, depreciation of capital, and corporate saving (retained earnings). Fratzscher and Imbs (2007) show that international consumption risk sharing is significantly improved by capital flows, especially portfolio investment.

International credit markets for savings and borrowing smooth the impact of shocks on consumption through the continued supply of credit. This is one of the strongest channels of risk sharing, especially for the euro area. As pointed out by Sørensen and Yosha (1998), 25% of shocks to GDP in the period 1981-90 were smoothed, mainly via cross-border lending and borrowing. Ballabriga and Villegas-Sánchez (2017) underline that, since the introduction of the euro, risk sharing has remained incipient and has been dominated by plain borrowing via the credit channel, while financial integration has not contributed to risk sharing via the capital channel. These results are consistent with Alcidi et al. (2017) and ECB (2017, 2019).

While the savings channel is very often classified as a private channel, it also includes non-negligible public elements. Savings are either provided by private (households and firms) or public agents. Both private and public savings (and then budgetary surpluses and deficits) can help to absorb the fall in consumption.[9] Public agents comprise national governments, on the one hand, and international financial

[9] It could be argued, moreover, that durable goods purchases can also be thought of as a saving vehicle that can be used to smooth consumption.

assistance from, among others, the International Monetary Fund (IMF) and EU/euro area mechanisms (e.g. the European Financial Stability Facility (EFSF), the European Financial Stabilisation Mechanism (EFSM) and the European Stability Mechanism (ESM)), on the other. Notably, the euro area financial assistance mechanisms are commonly seen in the literature as part of the savings channel as the loan facilities are essentially a centralised form of government lending through borrowing in financial markets. The risk sharing is ex post (triggered through higher credit demand in countries adversely affected by a shock) and is further discussed in Box 3.

In addition, research has proposed a price channel that acts as a risk-sharing mechanism, and arguably also as an indirect shock absorber. Asdrubali and Kim (2004) show that the real exchange rate (as well as the nominal rate) appears to work against the stabilisation of output shocks due to a sluggishness in price adjustment. Corsetti et al. (2011) show that for many OECD countries, especially at business cycle and lower frequencies, tradable prices tend to appreciate when domestic consumption demand rises relative to the rest of the world. This points not only to sizeable country-specific macroeconomic risk associated with non-tradable price adjustment, but also to a negative contribution of tradable prices to global pooling of such risk. This channel is not usually addressed in the risk-sharing literature (Hartmann et al., 2016), but has been estimated on the basis of the Asdrubali et al. (1996) framework in the ECB's Financial Integration Report (ECB, 2016 and 2017).

Last, but not least, labour mobility can and does also play a role in acting as a risk-sharing mechanism. Mundell (1961) was among the first to argue that the mobility of workers constitutes an important stabilising mechanism in a monetary union. Perhaps surprisingly, most of the risk-sharing literature has found a very small role for labour mobility as a stabilisation mechanism in response to temporary, asymmetric shocks (Alcidi and Thirion, 2016). At the same time, some of the literature has found that the mobility response to unemployment shocks increased with the crisis in Europe so as to almost catch up with the response observed in the United States (Jauer et al., 2014; Arpaia et al., 2016; Beyer and Smets, 2015). Despite the relevance of this channel, it has not been explicitly estimated on the basis of the Asdrubali et al. (1996) framework. Nevertheless, it should be noted that some of its effects (e.g. workers' remittances, compensation of foreign employees, social contributions, social benefits of foreign workers) are captured by this framework as part of the primary and secondary income (see Box 2).

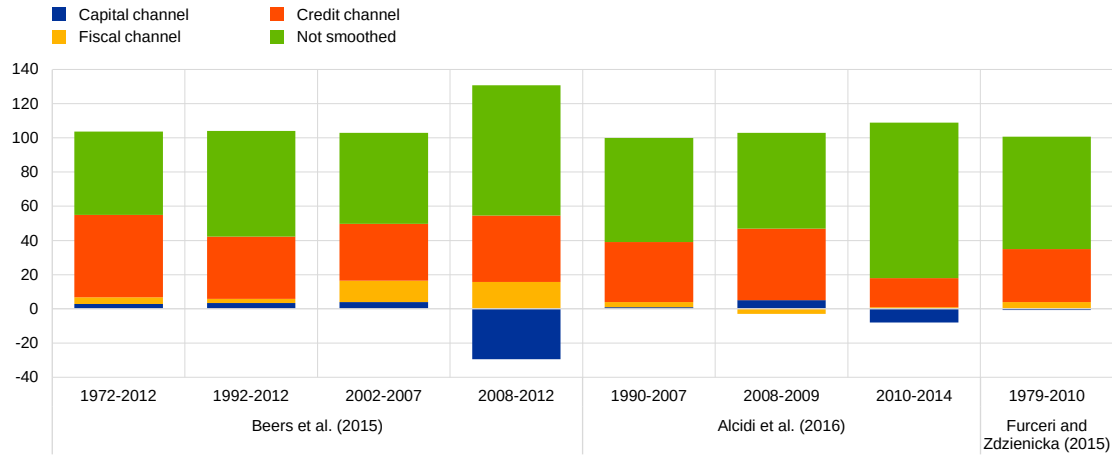
Box 3

Comparing empirical findings on the importance of risk-sharing channels in the euro area and the United States

This box reviews the main findings coming from the empirical literature on the degree of importance of risk-sharing channels in the euro area. The results are summarised in Chart 3.1, which shows that a large portion of shocks remain unsmoothed in the euro area. This portion is much larger than in mature federations like the United States, which is also discussed in the box.

Chart 3.1

Findings from the empirical literature on the degree of importance of risk-sharing channels in the euro area



Source: Authors' analysis on the basis of Van Beers et al. (2014), Alcidi et al. (2017) and Furceri and Zdzienicka (2015).

The credit channel (hence cross-border saving and borrowing) is the most important risk-sharing channel in the euro area. There is broad agreement in the literature – Van Beers et al. (2014), Milano and Reichlin (2017) and Furceri and Zdzienicka (2015) – that around 30-40% of shocks were smoothed through the savings channel during the crisis in the late 2000s and early 2010s. Alcidi et al. (2017) have similar results, but find that this channel was severally impaired during the period 2010-14.

The shock absorption provided by the capital channel (via factor income) is very limited and even acted as a shock amplifier according to some analyses. According to Milano (2017), factor income from capital smoothed only 2% of shocks between 2007 and 2014, while capital depreciation amplified shocks by 12%. Alcidi and Thirion (2017) have similar results. The results from Van Beers et al. (2014) for the years 2008 to 2012 suggest an even more negative role for capital markets (-29.4%), which is explained by the home bias towards domestic assets (financial fragmentation) and capital depreciation. Impediments to asset trade explain the limited gains through the capital markets channel (Cole and Obstfeld, 1991).

Fiscal transfers did not have any significant effect in the euro area in the 2010s. Alcidi et al. (2017) and Furceri and Zdzienicka (2015) find that fiscal transfers were able to smooth less than 5% of the shocks. Nevertheless, Van Beers et al. (2014) suggest that the smoothing by fiscal transfers appears to have increased over the past decades (to about 15% in 2008-12), but this effect is not statistically significant. This may suggest that the institutional developments brought by the creation of the EFSF/EFSM/ESM have not contributed to strengthening this channel. It should be recalled, in fact, that these instruments provide support via loans to governments and hence mainly operate via the credit channel (see Box 4 for a more detailed discussion). It remains to be seen to what extent the different approach taken by the Next Generation EU (NGEU) initiative of 2021, with its greater emphasis on grants as opposed to loans and the EU budget raising its borrowing capacity in financial markets, will alter the respective contributions of the various channels.

Risk sharing in this sense seems to have reacted notably during the financial and sovereign debt crisis of the euro area from 2008 onwards. Two peaks are visible in 2010 and 2015, after which risk sharing returns to levels that are lower than in the United States. In more detail, peaks in risk sharing are seen in periods following the crisis episodes of 2008 (global financial crisis) and 2010-12 (euro area sovereign debt crisis). They may therefore reflect the policy steps taken in reaction to these specific episodes, which however appear to have been short-lived given the fallback of risk sharing to low levels after each reaction to these episodes. Risk sharing also seems to fluctuate in the United States in a more stable manner around the long-term average.

Overall, the absorption capacity of the euro area was, and remains, significantly weaker than in the United States. Between 2007 and 2014, 69% of shocks in the euro area remained unsmoothed, according to Milano (2017). The estimate of Van Beers et al. (2014) for 2008 to 2012 is even higher at 76%. They notably point out that the extent of unsmoothed shocks has also increased over time, up from 49% for the period from 1972 to 2012. By contrast, in the United States, capital markets smoothed 22% of shocks between 2007 and 2014 and fiscal transfers another 22%. Savings accounted for 15%, which is less than in the euro area but still significant.

It should be noted that these estimates may not take (fully) into account the type of ex ante public risk sharing discussed in Section 2 above. The latter may take, for example, the form of existing institutional and governance arrangements that help to avert or reduce economic shocks that impact consumption. On the fair assumption that the United States is a much more developed economic and monetary union than the euro area in terms of governance structures pertaining to financial, fiscal, economic and political arrangements supporting the US monetary union, this would imply a (potentially significantly) greater degree of public risk sharing in the United States compared with the EU, which these estimates do not (fully) pick up.

3.2 Public risk-sharing channels

Public risk sharing pertains to the sharing of risks by taxpayers across sectors or geographical compartments (regions, states or countries). While public risk sharing is hard to correctly capture as it may take various forms, it is a crucial channel. In the risk-sharing framework, public resources and institutions are important for several reasons. First, they directly contribute to smoothing shocks via the use of fiscal resources. Second, they contribute to and lay the foundations for the efficient allocation of capital and credit by private actors, through the operation of e.g. the banking system and capital markets. These elements are discussed here.

One common form is that of taxation and transfers across regions/states of a fiscal federation. This is common to mature federations like the United States and it is associated with a federal/common budget which, through taxation and transfers, helps to smooth income and consumption in different geographical and sectoral parts of the economy. The way in which such a budget can operate in order to absorb asymmetric shocks varies and may aim, for example, to sustain public investment levels, or provide unemployment (re)insurance. Enders and Vespermann (2021) show that, with some limitations, a European unemployment benefit scheme, for example, can provide risk sharing by stabilizing relative consumption as well as

unemployment differentials in a monetary union.[10] Their analysis shows, however, that such an insurance scheme is inefficient following supply shocks, since the cross-country transfer is spent to a large extent on relatively inefficiently produced goods in the receiving countries, creating a trade-off between allocative efficiency and consumption. Still, this trade-off does not exist after demand shocks, and hence the optimal scheme should be active only after specific shocks. An example of a programme that acts like an unemployment insurance scheme to some extent has been implemented in practice in the EU in the form of the SURE instrument adopted in 2020.[11] Federal budgets often entail also common debt issuance, which may also be thought of as ex ante risk sharing into the future depending on the intended use of the funds raised.[12]

The use of fiscal resources when a shock hits the economy is the public risk-sharing channel primarily investigated by the empirical literature. For instance, it is investigated by Sala-i-Martin and Sachs (1992) and Athanasoulis and van Wincoop (1998). They look at the US experience in the period 1970-80 and find that the federal government absorbed between one-third and one-half of the initial shock. Bayoumi and Masson (1995) disentangle the risk-sharing component from the permanent redistribution effects and find that in the United States the risk-sharing effect of net transfers (federal taxes and transfers) amounts to around 30%. These results are in contrast to a more recent analysis by Poghosyan et al. (2014), who look at the role of net fiscal transfers only, in Australia, Canada and the United States. They find that fiscal transfers at the central level have little effect in terms of risk sharing. In the case of the euro area, the properly defined public transfers are very limited given that the cross-border flows of public authorities have mainly taken the form of cross-border official loans via the euro area financial assistance instruments like the ESM and the EFSF, which are discussed in Box 4, and thereby appear under the savings channel.

Box 4

The role of euro area financial assistance instruments in shock absorption through risk sharing

From an institutional perspective, the role of the euro area financial assistance instruments in shock absorption is of particular interest. They work through the savings channel, which is composed of both private and public savings. Private savings consist of savings from households

[10] See also Roeger and Vogel (2017) who analyse the impact of automatic horizontal fiscal transfers on risk sharing and consumption smoothing in a 2-country DSGE model of monetary union.

[11] The Support to mitigate Unemployment Risks in an Emergency (SURE) instrument does not, however, entail centrally administered direct fiscal transfers but rather up to 100bn euro in loans to EU member state governments with the purpose of supporting their unemployment benefit expenditures.

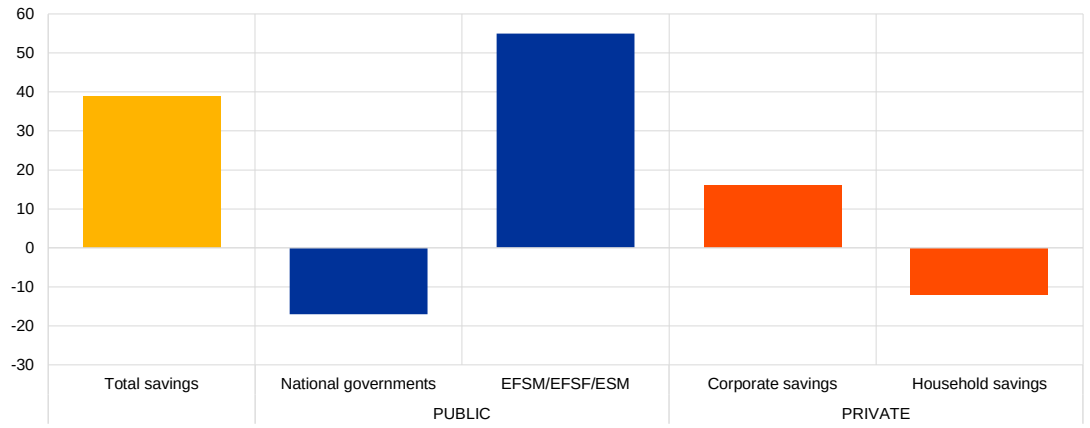
[12] One may note that cross-border public risk sharing may be additional to significant within-border shock-absorption mechanisms such as the fiscal automatic stabilisers of state budgets in a union of states. As Alcidi et al. (2017) point out: “Despite the absence of a centralised EA stabiliser, the automatic stabilisers in the euro area bring about a larger degree of insurance against asymmetric shocks (about 20%) than that provided by the US federal budget (11%).” While they do not report on any contribution that state-level automatic stabilisers may play in the United States (even if they are expected to be smaller than those of euro area countries), it is important to keep in mind that the shock-absorption capacity of a monetary union may not rely purely on cross-border risk sharing (unless risk sharing is defined in the broadest sense), but may depend on other shock-absorption mechanisms. Therefore, other policy tools that are not related to (cross-border) risk sharing may nevertheless provide shock absorption.

and firms which may also become available cross-border through banking sector lending activities and financial integration. Public savings comprise net borrowing of national governments from markets, and in the case of the euro area, the euro area lending mechanisms. Milano and Reichlin (2017) point out that the combined amount of risk sharing provided through this channel in the euro area was 28% for 1999-2014 and 38% for 2007-14.

Chart 4.1

Public and private savings' contributions to shock absorption in the euro area in the period 2007-14

(percentages)



Source: Authors' elaboration on Milano and Reichlin (2017).

While borrowing in markets by private actors and national governments is an important shock absorber, especially in the euro area, it may not work in crisis times. Furceri and Zdzienicka (2015) show that the savings channel is weak in absorbing unanticipated, permanent and severe shocks. Credit markets typically collapse in crises. Governments and private actors in the shocked country would need to borrow larger amounts than they can obtain. The bigger the shock, the lower the shock absorption through credit markets (Furceri and Zdzienicka, 2015). This was shown to be the case with the global financial crisis and ensuing euro area crisis when financial fragmentation and the absence of public risk-sharing arrangements reduced the shock-absorption capacity of the savings channel either because of a fall in private savings being backstopped or complemented by public savings, or a lack of public savings substituting for private savings (Buti and Carnot, 2018).

The introduction of euro area/EU financial assistance instruments in 2010-12 improved the shock-absorption capacity of the savings channel, but not equally for all euro area countries. Cimadomo et al. (2020) show that between 2002 and 2017, shock absorption between "core" and "periphery" countries increased from about 30% to 60%, mostly due to a higher degree of financial integration, as reflected mainly in cross-border portfolio holdings of corporate and government bonds, and with an important role played by official loans to distressed governments in the aftermath of the crisis. Milano and Reichlin (2017) broadly agree with this finding, but also show that constrained and limited net national government borrowing from the market during the crisis by the "periphery" countries significantly amplified the asymmetric shock in countries under financial assistance. This negative impact on shock-absorption capacity thus took away most of the shock absorption of official assistance from the EFSF, EFSM and ESM and left a total of 77% of shocks unsmoothed in the periphery, compared with only 26% unsmoothed shocks in the core.

The aforementioned distinction between ex ante and ex post risk sharing is particularly relevant when it comes to fiscal transfers across regions. Public resources may be used ex post to deal with the impact of a shock only after private risk sharing (e.g. through the credit or capital markets channel) has failed to deal with it or has been exhausted through abrupt market fluctuations, and/or the withdrawal of economic agents from their previous portfolio positions has taken place. But fiscal transfers can also be made available ex ante. For instance, they can be used to ensure financial stability via the establishment of backstops to privately operated forms of risk sharing: this is the case of a bank resolution fund or a deposit insurance scheme operating at central/federal level. These examples are mentioned here given their direct relevance to the ongoing debate on the deepening of EMU, either because they have been proposed as possibilities, or because they have recently been or are being implemented. For example, euro area authorities have decided that the ESM should act as a fiscal backstop to the bank-funded Single Resolution Fund (SRF), which itself is a form of private risk sharing meant to provide intertemporally a private backstop.[13]

In a monetary union, public risk sharing can also take place through the sharing of a single currency. A single currency needs to perform all its functions, fully, at all times and anywhere within the monetary union. This implies among other things that the necessary infrastructure is available to ensure such full convertibility of the currency, including through an integrated payment and settlement system such as the real-time gross settlement system of the Eurosystem (TARGET[14] and its successor TARGET2) in the euro area or Fedwire in the United States. Since the ECB conducts a single monetary policy aimed at ensuring broadly similar monetary conditions across participating countries, net private capital outflows are to some extent "automatically" compensated for by the actions of the central bank and specifically by the provision of central bank liquidity to banks which at the same time may also offset capital inflows or outflows via the central banking system. This in turn is reflected in TARGET balances[15].

It follows that the Eurosystem's TARGET exhibits properties of public risk sharing which derives from the fact that the single currency needs to be available under the same conditions across the monetary union. As Bindseil and Winkler (2012) put it: "The unlimited and unconditional character of TARGET2 balances is at the very heart of monetary union. The ability of banks to transfer deposits across national central banks constitutes the genuine single currency. Imposing a limit to

---

13 Alcidi et al. (2017) also point to the implications of differently arranged (semi-)fiscally (con)federal systems. These may have different implications both for the respective contributions of public and private risk-sharing arrangements as well as the type of shock that these address: "To some extent, this is attributable to the higher degree of market-based risk sharing in the US and to the existence of other public institutions enhancing financial stability and private risk sharing in the US. Yet we show that US federal fiscal policy appears to be primarily a stabiliser of US-wide shocks, rather than idiosyncratic shocks."

14 TARGET stands for Trans-European Automated Real-time Gross settlement Express Transfer system.

15 If there are financing gaps in the euro area arising from net capital outflows and trade deficits, these may to a certain degree be balanced by TARGET(2). In other words, the existence of the infrastructure that goes hand in hand with a single currency can play a role in terms of absorbing asymmetric shocks since it means that the unavailability of international reserves, which is usually the key problem in a balance of payments crisis, is in theory not a policy concern (Corsetti et al., 2017).

such transfers and thus making those transfers impossible would de facto imply a reintroduction of two currencies with presumably different prices, marking the end of monetary union." Given the implications of this for the transfer of liquidity and capital across regions or countries in the monetary union, the existence of TARGET may have implications for risk sharing and the shock-absorbing capacity of countries in the monetary union.

The risk-sharing properties of the TARGET balances during the last financial crisis have been carefully investigated. Their role as a public risk-sharing tool has been shown to be active in particular in the case of sudden and large financing gaps, so-called "sudden (capital) stops" (Lane and Milesi-Ferretti, 2011).[16] While the absence of a formal balance of payments constraint did not rule out altogether the vulnerability to sudden stops in market financing (Corsetti et al., 2017), the availability of TARGET mitigated the collapse in output and consumption, when some euro area countries experienced sudden stops during the crisis (Fagan and McNelis, 2020[17], and Hristov et al., 2019[18]). Despite the positive role played by TARGET balances in absorbing (within the euro area) a part of the (asymmetric) shock faced during the 2010-12 crisis, they did not act as a full backstop to the withdrawal of private risk-sharing arrangements as the crisis intensified. The impact was therefore arguably smaller, or more concentrated, but not absent.

The distinction between shock absorption at any given point in time and overall welfare gains also suggests that there is a potential extension of the risk-sharing and shock-absorbing capacity of the single currency itself. This could happen via its impact on foreign exchange volatility, as the euro has not only led to vanishing nominal exchange rate volatility within the euro area, but this reduction in volatility has also been transferred to the euro exchange rate against third-country currencies (Morales-Zumaquero and Sosvilla-Rivero, 2011). Moreover, the fact that the euro is the second most important official reserve currency in the world has led to the reduction of term premia for (at least some) euro area sovereign debt (ECB, 2019). We do not address these aspects further here, but they show the relevance of broadening the perspective on the role of public policies as risk-sharing/shock-absorbing devices.

Moreover, public institutions in a broader sense can play an important role in enhancing the risk-sharing properties enjoyed by a given country. Fratzscher and Imbs (2007) argue that it is the extent of poor institutions in conjunction with the

---

16 This distinction is particularly relevant as Eisenschmidt et al. (forthcoming) argue, by analysing the evolution of TARGET balances during three phases (pre-crisis, global financial and sovereign debt crises, and the ECB's asset purchase programme (APP) period), that the underlying drivers of the TARGET balances differed markedly. In other words, TARGET balances may be driven by different events over time, even if excess liquidity is always the end-driver of these balances.

17 At the same time, the authors corroborate the view of Merler and Pisani-Ferry (2012) that the existence of TARGET – while providing a shock-absorbing effect in times of sudden stop – also means that it is easier than outside of a monetary union to create sudden stops in the first place. Fagan and McNelis thus find that from a welfare perspective, TARGET financing results in only a small welfare gain in the country affected by a sudden stop. The intuition is that TARGET exacerbates the tendency towards over-borrowing and lower precautionary saving, leading to an increased incidence of sudden-stop episodes.

18 They also point out that the entire period of 2008-14 was one of unconventional monetary policy. Moreover, they argue, by conducting a counterfactual analysis, that "if there were regular settlement" of the accumulated uneven TARGET2 positions "by transferring valuable assets", economic activity in the core countries receiving those transfers would have been higher.

degree of openness to international markets that reduce risk sharing. They show that consumption risk is less diversified in countries where the quality of institutions is weaker. Similarly, Balli and Pierucci (2020) find that the quality of institutions and risk sharing are significantly interrelated among OECD members. This link operates mostly through the credit market channel whereby investors tend to shy away from cross-border investments in regions where the quality of institutions is poor.

Finally, it could be argued that the overall political commitment to the institutions of the monetary union has an impact on the degree of risk sharing. The sovereign debt crisis showed that a strong political commitment to the euro and the deepening of EMU can be very powerful instruments to counteract “breakdown risk”, which can lead to sudden stops in cross-border private flows. These considerations link to the discussion in Section 2 in that ex ante public risk sharing taking the form of appropriate institutions and governance structures may not be visible in standard estimations of public risk sharing, while the quality of these arrangements is also important in achieving in the first place and maintaining shock-absorbing private risk-sharing conditions.

4 Substitutes or complements?

The more clearly defined nature of public and private risk sharing above provides a basis for discussing in more depth the key issue here of the interlinkages between them. While there is consensus that private risk sharing is, or should be, the main contributor to the ability of an economy, and especially a monetary union, to absorb shocks, opinions differ on the extent to which public risk sharing is necessary to complement such private risk sharing, either by "backstopping" private risk sharing (so enhancing the capacity of private risk sharing to absorb a given shock), or acting to absorb shocks itself (as a substitute in case the capacity of private risk sharing is reduced). The key question here is whether public and private risk sharing are necessary complements and, if so, to what degree. What degree of public risk sharing is necessary for private risk sharing to emerge and be sustained so as to efficiently absorb major shocks (and even crises)? Alternatively, if private and public risk sharing are near perfect substitutes, can private risk sharing ensure by itself greater shock absorption in the economy, thereby reducing (or even eliminating) the necessity for public risk sharing?

A better understanding of these interlinkages is particularly relevant for the euro area. In particular, the debate emerged during the financial and sovereign debt crises about if and to what degree EMU witnessed an enormous amount of financial (both banking and capital markets) fragmentation and a retrenching of liquidity and capital behind national borders because of an absence of appropriate euro area insurance mechanisms and/or shock-absorption and crisis management policies and frameworks (see ECB, 2016).

Whether private risk sharing can substitute for public risk sharing has led to a controversial debate not just in the policy arena, but also in the relevant literature. Two separate dimensions of this debate are worth highlighting. First, some authors test measures of public and private risk sharing competitively to find out which one is more effective as a shock absorber in a currency union. This debate addresses the issue of whether policymakers should pursue (more) banking and capital markets union, on the one hand, or a fiscal union, on the other. A second and more recent discussion goes beyond treating public and private risk sharing as substitutes and analyses instead the complementarity between the two forms of risk sharing. This literature claims that full risk sharing is impossible to achieve with private measures only, as the effectiveness of private measures partly depends on the extent of public risk sharing. In the absence of significant common fiscal resources in the euro area, private risk sharing is currently by far the most important cross-border risk-sharing shock absorber, but can still not provide an adequate shock-absorption capacity. Policymakers should thus consider how to ensure that a financial market union is developed hand in hand with a fiscal (and more political) union.

From an empirical point of view, the literature on the interaction between public and private risk sharing has limitations. These limitations mainly derive

from the limits associated with the essentially static set-up proposed by Asdrubali et al. (1996) and analysed in Box 1, in the sense that the risk-sharing measure is mainly computed as a weighted average of cross-sectional regressions. To overcome this limitation, Asdrubali and Kim (2004) use a dynamic and simultaneous econometric model. By tracing the impulse responses of all variables, they examine whether each risk-sharing channel is a substitute or a complement for the others. Looking at the US experience, their results suggest that while shocks to fiscal and credit channels elicit no response from capital markets, shocks to capital markets affecting cross-state income flows crowd out the credit channel almost completely. The fact that capital markets and fiscal risk sharing are not complements, but substitutes, is confirmed by the authors also by looking at 23 OECD and 15 EU countries. Finally, they find that a shock to fiscal stabilisers would be expected to crowd out the credit market channel (in the OECD as a whole, but not in the United States). Alcidi and Thirion (2017) and, more recently, Asdrubali et al. (2018) confirm these findings. In particular, they find that the credit market channel tends to offset shocks to other risk-sharing channels. In general, they conclude that once a channel is hit by a shock, the remaining channels either do not react or react negatively, meaning in this last case that the channels act to a certain degree as substitutes.

The complementarity between public and private risk sharing seems to have a stronger relevance in bad times, when private channels tend to collapse. Buti and Carnot (2018) among others acknowledge the possibility that public and private risk sharing may be substitutes in good times, but make a clear case for the backstop argument in bad times. In their view, financial and fiscal unions may be substitutes as shock absorbers in normal times, but need each other in bad times. In other words, in times of acute market stress, the shock-absorption function of the financial union will depend on the existence of a credible and effective central fiscal capacity. Specifically, they point to evidence that private markets behave procyclically when left entirely on their own, especially in the EMU set-up. In other words, the credit channel for smoothing shocks froze during the euro area crisis and actually worked in reverse. They thus point to the possibility that public risk sharing in the form of “a fiscal risk-sharing tool can actually foster risk reduction by preventing excessive market volatility and full-blown financial crises”. In more detail, Furceri and Zdzienicka (2015) show that private risk sharing works much less effectively in bad times than in good times. They test for different constellations of bad times, such as symmetric and asymmetric shocks, sudden and deep shocks or less sudden but more persistent ones. They conclude that market-based insurance tends to be suboptimal in currency unions as private agents do not internalise the macroeconomic stabilisation effects of the portfolio choices. By focusing specifically on bad economic times, they thus provide empirical evidence that credit markets tend to freeze up during downturns and, in some cases, contribute to amplifying shocks. They show that especially in severe, persistent and unanticipated recessions or crises (like the one in the euro area around 2010), domestic fiscal policy cannot fully offset output shocks due to the fact that the amounts of credit that some governments and citizens need cannot be obtained. These findings point to the need for relatively small contributions of public risk sharing in order to ensure that private risk sharing performs its function appropriately not only in good times but more importantly also in bad times, whether these are in the form of a symmetric or

asymmetric shock, a sudden and deep shock or a less deep and more persistent shock.

Moreover, the respective roles of public and private risk sharing, and possibly their complementarity or substitutability, may also change (significantly) over time. With regard to pre-unification Germany, Hepp and von Hagen (2013) show that only about 19% of a shock was smoothed by private factor markets, while 50% was smoothed by the German government sector, and a further 17% was smoothed through credit markets. In the same study, the authors find that for the post-unification period from 1995 to 2006, the relative importance of the smoothing channels in Germany changed and factor markets contributed around 50.5% to consumption smoothing. The government sector's role was diminished, but remained economically significant, smoothing around 10% of a shock. This suggests that private and public channels possibly interact in ways that are hard to capture just by looking at national accounts data as usually done in the literature.

Overall, the empirical macroeconomic approaches do not seem to allow for fully investigating the way in which complementarity or substitutability between public and private risk sharing actually works. There may therefore be benefits from finding alternative ways to disentangle the various channels through which the two may be complementing each other, and therefore departing from the Asdrubali et al. (1996) methodology and zooming in on specific ways in which the channels interact.[19]

A different theoretical perspective, analysing specifically the interaction of public and private risk-sharing contracts, may have merits. The aim would be to examine to what degree public risk sharing is there to ensure on the one hand the appropriate degree of private risk sharing, and on the other hand to complement private risk sharing by performing appropriate functions in its own right. Using a comparative perspective, we thus consider in the next section, and in the parlance of the current debate on EMU deepening[20] and the Four Presidents' Report and Five Presidents' Report[21], the extent to which the banking union and the capital markets union in EMU should evolve and how much of a fiscal union (but also political union as this also commands resources) is needed to complement or back these up.

The relevance of public channels as backup for private channels to operate appears particularly relevant when it comes to discussing the functioning of the banking union. For instance, foreign ownership of domestic banks results in de facto transfers from abroad when a crisis hits (Gros and Belke, 2014). Against this background, some authors have argued more broadly that "a monetary union does not need a fiscal union to work" (Jones, 2016), but instead a fully fledged banking union. Jones considers financial institutions more important for restoring investor confidence than fiscal institutions. Notably, while different views on the need for a

---

19 G. Tabellini hints at this in "Risk sharing and market discipline: Finding the right mix", VoxEU.org, 16 July 2018.

20 A key recent policy contribution is that of the 7+7 French and German economists, which was preceded by a series of short articles related to risk sharing and risk reduction in the VoxEU column.

21 And more recently the European Commission's proposals linked to all of the aforementioned unions, for example, the reflections of 31 May 2017, the October 2017 proposals for completing banking union and the 6 December 2017 package of proposals on fiscal and economic unions.

fiscal union are represented in the literature, it is uncontested between both sides of the debate that the shock-absorption capacity of the banking union and the capital markets union in their current forms falls short of realising its full potential.

These findings are in line with recent research which suggests that concentrating risk-sharing arrangements in one single channel results in constrained-inefficient shock absorption. Farhi and Werning (2017) make a theoretical case for fiscal insurance as a necessary complement to private risk sharing. A market failure exists in that private agents do not purchase efficient amounts of private insurance, as they do not internalise the positive externalities from the macroeconomic stabilisation effects of their portfolio choices. If public institutions reassure markets of a minimum level of shock absorption, the latter might be more willing to provide more insurance through private risk sharing. Fiscal insurance through, for instance, a safe asset could provide an effective response to this market failure and lead to a larger extent of private risk sharing (Farhi and Werning, 2017). While it is broadly accepted that private risk sharing remains constrained without at least some form of public risk sharing in place, the literature is inconclusive with regard to the extent of public risk sharing that is needed, especially for the euro area. For instance, while some consider a fiscal backstop to the banking union sufficient (Gros and Belke, 2014), others see the need for a fully fledged fiscal union (Furceri and Zdzienicka, 2015), and many others are located in-between (Jones, 2016).[22]

The design and use of public risk sharing to ensure the efficient functioning of private risk sharing is of course in practice a much more complicated and economy-specific exercise. For example, public risk sharing may be deemed more necessary to backstop the functioning of the banking system rather than capital markets if the financing of the economy is more bank-based than capital market-based, as is the case in Europe (as opposed to the United States). Public risk sharing may in the end have to be used to ensure the continuing shock-absorption capacity of private risk sharing, but it can also be designed in such a way that it is fiscally neutral over the business cycle. While this may not necessarily mean that it is cost-free in net present value terms (although one can attempt to ensure also this), it implies that it can be economically efficient. Another design feature of public risk sharing is that it needs to ensure the continued functioning of private risk sharing without, to the extent possible, creating moral hazard for private agents seeking to share their risks in the belief that if their portfolio diversification does not protect them from an adverse shock, then public risk sharing will compensate for that.[23]

---

[22] This evident crossover between public and private risk sharing is also underlined by Schelkle (2017) who argues that, in fact, the Federal Deposit Insurance Corporation performs the role of a fiscal backstop for state budgets in a systemic crisis in the United States.

[23] Here the debate sometimes takes the form of the extent to which “bail-in” of private assets might be necessary before public assets are used to absorb shocks. Also, some authors argue that bail-in is essentially a form of risk sharing, as it redistributes savings from creditors to debtors (see Ioannou and Schäfer, 2017). It could, therefore, be functionally equivalent to transfers from public surplus to public deficit countries through the savings channel (e.g. Sandbu, 2017). This fairly recent proposition has not yet been tested empirically. The magnitude of this effect is likely to be contingent on a high degree of financial integration: the more bail-inable assets are held domestically, the less these losses are spread interspatially and the smaller the cross-border risk-sharing effect.

5 A simple model of private/public risk-sharing complementarity

In this section, we introduce a two-country stylised model to conceptualise the channels of possible complementarity (or substitutability) between private and public risk sharing. We introduce country-specific productivity shocks where something prevents efficient risk sharing through equity contracts. We assume that risk sharing can only be done through a debt contract, which is subject to a collateral constraint, the tightness of which is itself a function of the country-specific as well as common shocks. Indeed, there is already a literature suggesting that debt flows are intrinsically procyclical (ECB, 2016; Covas and Den Haan, 2011).

There are several papers that focus on the role of nominal rigidities and optimal monetary policy in a currency union in the presence of financing frictions similar to those which we impose in our model. Bhattarai et al. (2015) and Hjortsoe (2016), for example, assume only non-contingent bonds trade; Farhi and Werning (2017) also have this assumption in one calibrated version of the model. Dmitriev and Hoddenbagh (2019) assume wage rigidities and focus on optimal fiscal transfers in a monetary union. Some of these contributions (notably Kehoe and Pastorino, 2017) focus on the substitution between private and public risk sharing rather than on the complementarity that is our focus here. Farhi and Werning (2017) emphasise that international risk sharing may be inefficient even with complete markets, since agents do not internalise the macroeconomic stability effects of risk sharing, and only value their own consumption smoothing. This argument also resonates with that of Celentani et al. (2004), who show in a two-region model with perfect capital markets that decentralised risk sharing is suboptimal because the two fiscal authorities want to manipulate the terms of trade to their advantage. Beyond being aimed at analysing complementarity, our model abstracts from nominal rigidities and can be thought of as having a longer-term horizon/frequency than these papers.

5.1 A simple model of cross-border risk sharing

The model is a two-country endowment economy as, for example, in Rabitsch et al. (2015) with flexible prices (a "real model"). There are two countries, Home and Foreign, and two goods, both tradable. Preferences with regard to consumption are characterised by home bias, but there is no home bias for assets. Home and Foreign consumers can hold equity contracts, which gives them ownership of Home or Foreign output, as well as debt contracts. We later introduce a central fiscal capacity with the ability to tax consumers from one country and make transfers to the other country conditional on the realisation of a shock; we refer to this as public risk sharing, while private risk sharing is accomplished through equity and debt contracts.

We assume that citizens in two countries of equal mass receive an endowment y (Lucas tree) that is subject to both specific and common shocks. For each country i, we assume:

$$y_{it} = y_i + \epsilon_{it} + v_t$$

where ϵ is a country-specific shock (uncorrelated between countries) and v is a common shock. Shocks are normally distributed and autocorrelated with parameters ρ_ϵ and ρ_v. The prices of respectively domestic and foreign output, y_H and y_F, are P_H and P_F, implying that $S = \frac{P_H}{P_F}$ is the terms of trade.

Consumers in both countries have a log utility function defined based on a consumption basket featuring home bias and non-unitary elasticity of substitution. The consumption bundle is defined by the CES (constant elasticity of substitution) aggregator:

$$c = \left[(1-\gamma)^{\frac{1}{\eta}} c_H^{\left(\frac{\eta-1}{\eta}\right)} + \gamma c_F^{\left(\frac{\eta-1}{\eta}\right)}\right]^{\left(\frac{\eta}{\eta-1}\right)}$$

where η is the elasticity of substitution between domestic and foreign goods, γ is the weight of imported goods in production, and c_h and c_f are respectively the domestic and foreign-produced goods consumed by the Home resident. As a consequence, the domestic price level is defined as:

$$P = \left[(1-\gamma)P_h^{(1-\eta)} + \gamma^{\frac{1}{\eta}} P_f^{(1-\eta)}\right]^{\left(\frac{1}{(1-\eta)}\right)}$$

and analogously for the foreign consumer.

The budget constraint reads, for the domestic consumer (specified in real terms):

$$\frac{P_h c_h}{P} + \frac{P_f c_f}{P} + \frac{R(-1)D(-1)}{P(-1)} + \left(\frac{\kappa}{2}\right)\left(\frac{D}{P}\right)^2 = \left(1 - \frac{\chi}{2}\right) y_H \frac{P_H}{P} + \frac{\chi}{2} y_F \frac{P_F}{P} + \frac{D}{P} + T_t$$

where on the left side we report the use of resources (consumption and paying back nominal debt D) and on the right side the sources: domestic and foreign output depending on the respective holdings measured by the χ parameter, debt (in real terms), and a (net) transfer T_t from the central fiscal authority that will be specified further below.[24] Note that the Home consumer also pays a small cost for holding debt, $\left(\frac{\kappa}{2}\right)\left(\frac{D}{P}\right)^2$, which is necessary to close the open economy model as well known from, e.g., Schmitt-Grohe and Uribe (2003). Apart from this cost, which only applies to the Home consumer, all conditions for Foreign are the mirror image of those for Home; for example, real debt enters with the opposite sign, hence can be interpreted as a net foreign asset position.

The parameter χ is key in this model and measures the distance from full equity risk sharing. Because in this model there is no home bias for assets, full risk

[24] The debt contract should be intended for the Home country as a whole, including all debt liabilities vs. foreigners, both public and private. In this sense, we do not distinguish between private and public debt *within* countries.

sharing (χ=1) is optimal if domestic and foreign output are hit by shocks with the same volatility, which we assume here. Therefore, the Home (Foreign) residents will want to hold Home and Foreign outputs in equal shares. Values of χ smaller than 1 denote a lack of complete equity market integration and can be interpreted as a measure of the distance from a full CMU or, more generally, a financial union.

5.2 Model simulations

The focus of this analysis is not to provide empirically realistic simulations but to build on plausible values for the standard parameters, to be interpreted in a qualitative fashion. We set the home bias in consumption, γ, at 0.25; the parameter of international substitution, η, at 3; and the cost of holding debt, κ , at 0.02.[25] The time preference parameter is set at 0.995. We will show impulse responses to a 10% idiosyncratic shock to Home output with a persistence parameter of 0.75.

One crucial variable in the model simulations is the risk sharing, which we compute as the difference between the ratio between the domestic and foreign Lagrange multiplier of the budget constraint and the real exchange rate. This is in line with previous contributions such as Hjortsoe (2016). A positive value of this variable indicates that the domestic consumers consume too little after a negative domestic productivity shock compared with a full risk-sharing situation.

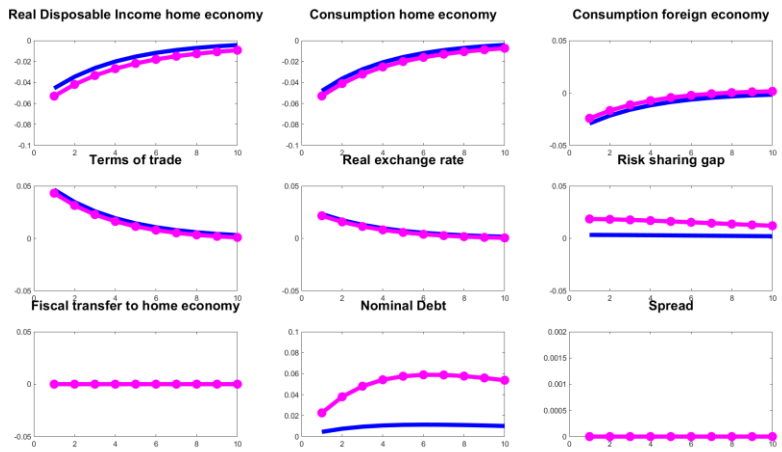
Risk sharing with equity and debt

To set the stage, Figure 1 compares risk sharing with χ=1 (blue lines) and χ=0.1 (magenta lines), namely with imperfect risk sharing through equity, after a temporary contraction of Home output by 10%. First note that, due to a fall in the supply of Home output, the Home terms of trade and real exchange rate appreciate, which already provides some (but not full) risk sharing. In the calibration with full market integration, the risk-sharing gap (computed as the difference between the relative Lagrange multiplier of the budget constraint and the real exchange rate, as in Hjortsoe, 2016) is very close to zero, and debt accumulation is marginal. However, debt accumulation is a good substitute for equity market integration when χ=0.1, as the risk-sharing gap is still small and close to the market integration case, due to a larger accumulation of debt. In other words, cross-border privately held equity and debt are close substitutes in this framework where there is no public risk sharing and all debt is equally costly.

[25] Note that with the CES aggregator and the non-unit elasticity of substitution we are not in the Cole-Obstfeld special case where movements in the terms of trade provide full risk sharing irrespective of asset markets. The full model specification and the Matlab programs used to do the simulations are available from the authors on request.

Figure 1

Equity and debt contracts have a similar effect on risk sharing in the absence of other frictions



Notes: Impulse responses to a 10% reduction in Home output. The blue solid lines refer to the baseline calibration with full equity market integration ($\chi = 1$) and the magenta dotted lines to a calibration with limited equity market integration ($\chi = 0.1$). The risk-sharing gap is the difference between the ratio of Home and Foreign marginal utility of consumption and the real exchange rate; a positive value indicates that Home consumption is inefficiently low compared with Foreign consumption.

Risk sharing with a debt-dependent interest rate

In Figure 1, we see that private debt is a good substitute for equity market integration in the absence of financial frictions. Here we introduce some "sand in the wheels" of private debt by making the interest rate on debt dependent on the level of debt. In particular, it is the ratio between debt and a collateral value that determines the spread for debt in excess of the risk-free rate. This brings the model closer to the conditions of multi-regional monetary unions where debt is issued also at regional level and the debt level of regions and interest on these debts may differ, sometimes significantly.

Specifically, the interest rate on debt is given by the sum of the risk-free rate (equal to the inverse of time preference) and a spread that is a function of the debt level in relation to a measure of net worth. The specification is as follows:

$$R = \frac{1}{\beta} + \zeta E_t \frac{D_t}{\left(1 - \frac{\chi}{2}\right) P_{H,t+1} y_{H,t+1} + \left(\frac{\chi}{2}\right) P_{F,t+1} y_{F,t+1} + T_{\{t+1\}}}$$

where in the calibration we set ζ=0.04, implying that a 1% increase in debt results in a 4 basis point increase in the risk premium. The intuition of this specification, which is similar to several previous contributions in the literature, is that the *future expected nominal resources* of the Home borrower influence its repayment capacity, hence the risk premium to be paid to the lender. The quantity in the denominator can be seen as a collateral value for the Foreign lender. Note that the latter will value this collateral value after discounting it at the Foreign price level; therefore, the real exchange rate indirectly also enters into the determination of the spread. Differently from many specifications in the literature, we assume here that it is the *future* value

of the collateral that enters into the determination of the interest rate spread today, which is reasonable because debt contracts are one-period and possible default happens after the debt contract is finalised at time *t*. Note that the quantity in the denominator can also be interpreted as a measure of future net worth of the Home consumer.

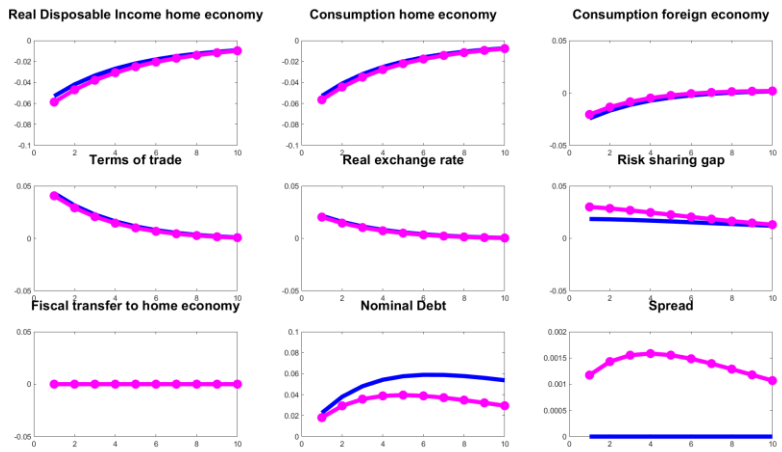
The existence of this financial friction potentially limits the role of debt as a substitute for equity as a channel of risk sharing. To get a sense of the calibration quantitatively, it implies that the interest rate on debt increases by 400 basis points when the debt-to-income ratio increases from 0 to 100%.

Also note that we specify the elasticity of the spread with reference to the Home consumer because this is who wants to borrow after a contraction of the Home output and imperfect equity risk sharing (χ<1). The same condition would apply to the foreign consumer for a shock to Foreign output, but it is computationally more difficult to impose both costs simultaneously.

In Figure 2, we replicate the case of χ=0.1 (imperfect equity risk sharing) in the case where debt pays just the risk-free interest rate (blue lines) and with interest elastic debt (magenta lines). With interest rate elastic debt, debt accumulation is smaller, and the risk-sharing gap is larger than in the absence of frictions, although the differences are quantitatively small. In principle, therefore, a debt elastic interest rate on debt makes risk sharing through debt less efficient and a poorer substitute for equity market integration.

Figure 2

Debt contracts with interest elastic debt also provide adequate risk sharing



Notes: Impulse responses to a 10% reduction in Home output. The blue solid lines refer to the baseline calibration with limited equity market integration and a risk-free cost of debt and the magenta dotted lines to a calibration with a debt elastic interest rate. The risk-sharing gap is the difference between the ratio of Home and Foreign marginal utility of consumption and the real exchange rate; a positive value indicates that Home consumption is inefficiently low compared with Foreign consumption.

A central fiscal capacity

Limited equity market integration and financial frictions on debt call for a role for a central fiscal authority that can tax citizens of one country and transfer to those in the other country, while respecting medium-term budget neutrality, and on the assumption that the aim is to maintain consumption smoothing broadly and evenly across the two countries. This is what we explore in this section.

Operationally, we assume that with the central capacity the Home consumer receives a transfer equal to $\theta\varepsilon_{Ht}$ which is taxed from the F consumer; we assume θ<1. In this way, θ measures the amount of public risk sharing in this model; there is no public risk sharing if θ=0, while there is full risk sharing with θ=1.[26] Note that the long-term sustainability of the central capacity is ensured by construction, due to the stationarity of the shock process on which it is based.[27]

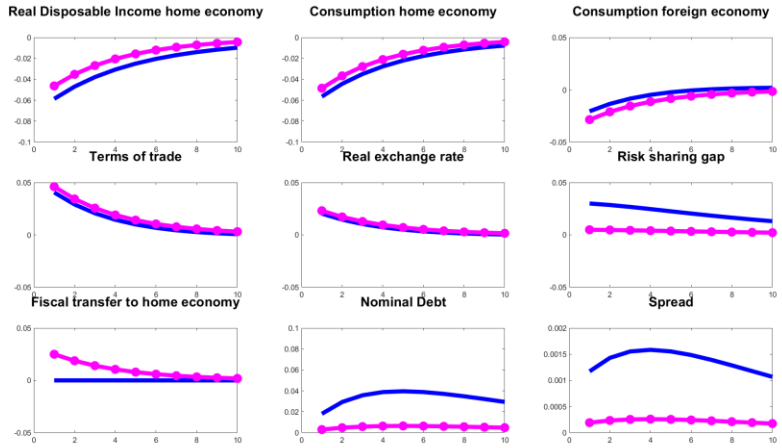
Figure 3 reports impulse responses from the customary fall in Home output by 10%, with interest elastic debt, without the central capacity (blue lines) and with it (magenta lines), assuming $\theta = 0.25$. Clearly, risk sharing is much improved with the central capacity, as indicated by the flat value of the risk-sharing gap. Although private debt accumulation is smaller with the central capacity, its marginal cost is lower, due to the reduction in the spread. In this framework, there is an element of complementarity between private and public risk sharing: loosely speaking, the public backstop prevents a flaring-up of financial frictions in the model.

[26] Note that this is not strictly true because there are movements in the terms of trade that provide some insurance to the Home consumer, so a full transfer from the public sector may actually *overdo* risk sharing. Indeed, in a calibration with $\theta = 1$ we find that it is the *Foreign* consumer who borrows after a negative Home output shock.

[27] An interesting extension of this setting could be a situation where the central capacity is unsure about the stationarity of the shock in real time. Also note that if the two countries experience a shock in the same (e.g. negative) direction, we assume that the fiscal capacity will need to pay a transfer according to the net effect of the idiosyncratic shocks. In other words, the country that is hit harder by the negative shock receives the net transfer.

Figure 3

A fiscal transfer from a central capacity improves risk sharing

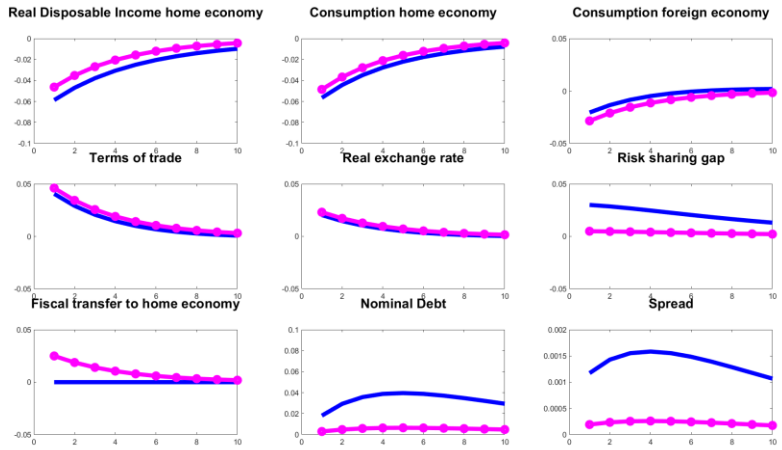


Notes: Impulse responses to a 10% reduction in Home output. The blue solid lines refer to the calibration with a debt elastic interest rate and the magenta dotted lines to a calibration with public risk sharing from a central fiscal capacity. The risk-sharing gap is the difference between the ratio of Home and Foreign marginal utility of consumption and the real exchange rate; a positive value indicates that Home consumption is inefficiently low compared with Foreign consumption.

The spread-reducing role of the fiscal transfer comes through two channels. First, due to the transfer itself less private debt is needed, which compresses the spread (*debt-reducing channel*). Second, the transfer is part of the collateral value that is the denominator of the spread: the fiscal transfer temporarily increases net worth and makes the borrower less risky for private debt (*collateral channel*). To shed light on the relative importance of these two channels, in Figure 3a we switch off the second channel by removing the fiscal transfer from the collateral value. As results are very similar to those in Figure 3, we conclude that the first channel is the quantitatively more important one.

Figure 3a

A fiscal transfer from a central capacity provides better risk sharing even if the transfer does not enter into the collateral



Notes: Impulse responses to a 10% reduction in Home output. The figure reports the same information as in Figure 3, but we have excluded the transfer from the central capacity in the specification used to determine the risk premium on private debt.

A non-linear version of a debt elastic spread

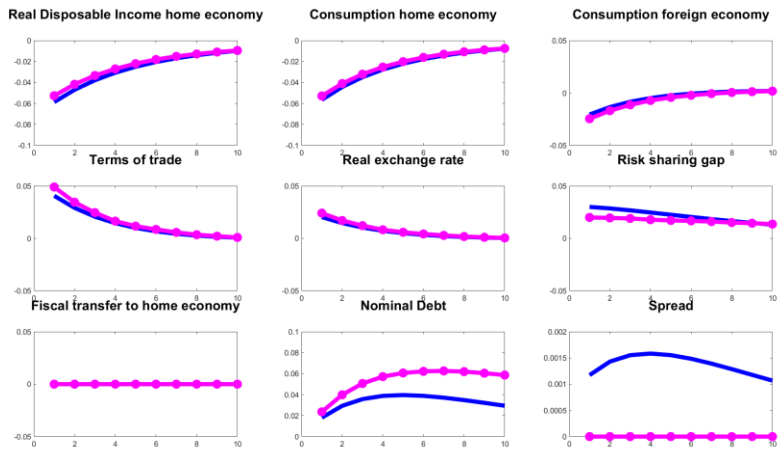
While Figure 3 provides the central result of our model, it is useful to consider a couple of interesting variants. In Figures 4 and 4a, we consider an alternative specification with a perhaps more empirically plausible *non-linear* relationship between the interest rate spread and the debt ratio. Intuitively, this can be thought of as a "sudden stop" specification, where small increases in debt do not result in a large spread, but a large increase leads to unsustainable levels and a skyrocketing level of the spread, similar to what would happen in a debt crisis.

We specify this idea with a quadratic form of the spread, where the latter is a quadratic function of the same debt ratio. In this specification, a rise in the debt ratio by 10% only elicits a rise in the spread by 40 basis points. However, a rise in the debt ratio by 20% is now associated with a 176 basis point increase, not an 80 basis point increase.

Because of the non-linearity, results may be different depending on the *size of the shock*; hence in Figures 4 and 4a we report impulse responses for a fall in Home output by respectively 10% and 25%. As in Figure 3, the blue lines report the non-linear calibration without a fiscal capacity, the magenta lines the non-linear calibration with the fiscal capacity, with $\theta = 0.25$. By construction, the risk-sharing gap is larger with non-linear interest rate elasticity for the larger shock; therefore, in this case the fiscal capacity is more helpful when the shock is large and almost irrelevant when the shock is small.

Figure 4

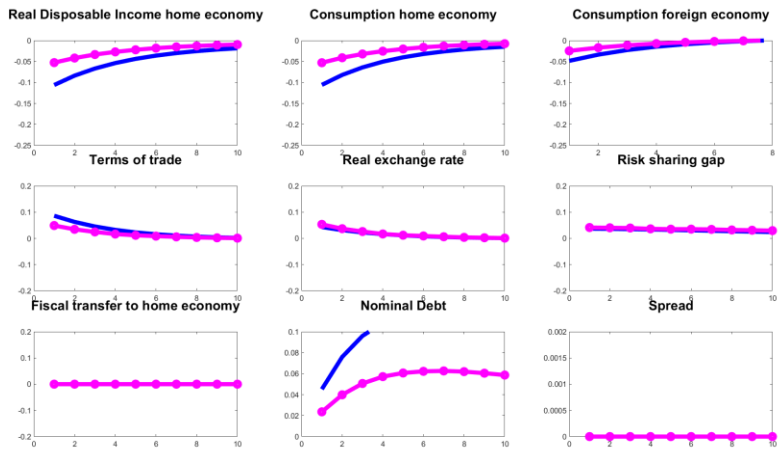
A non-linear (convex) specification of the risk premium on private debt reduces private risk sharing



Notes: Impulse responses to a 10% reduction in Home output. The blue solid lines refer to the calibration with a linear debt elastic interest rate and the magenta dotted lines to a calibration with non-linear (convex) elasticity of the risk premium on debt. The risk-sharing gap is the difference between the ratio of Home and Foreign marginal utility of consumption and the real exchange rate; a positive value indicates that Home consumption is inefficiently low compared with Foreign consumption.

Figure 4a

A non-linear (convex) specification of the risk premium on private debt reduces private risk sharing – larger shock



Notes: Impulse responses to a 20% reduction in Home output. The figure reports the same information as in Figure 4, but with a larger shock to Home output (20% rather than 10%).

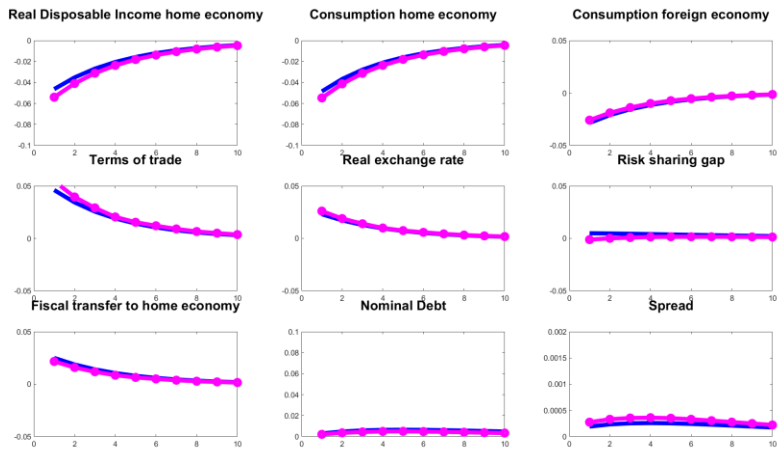
The central fiscal capacity as a backstop

In the previous discussion we assumed a central fiscal capacity behaving in a linear manner, but this is not the only conceivable specification of this function. An alternative and potentially interesting role is one in which the central capacity reacts little to small shocks, but strongly to large idiosyncratic shocks. The simulation that we illustrated in Figure 4a suggests precisely this design of the central facility, which could be labelled as a “backstop”.

In Figures 5 and 5a, therefore, we compare the standard linear specification of the fiscal rule (blue lines) with the non-linear specification of the spread (the same as Figures 4 and 4a) with a quadratic specification of the fiscal transfer (magenta lines). In this latter specification, the fiscal transfer is only 1% (rather than 2.5% in the linear specification) after a 10% fall in Home output, but it is 7.5% (rather than 5%) after a 20% contraction. Figure 5 reports the impulse responses for the small shock (10%) and Figure 5a for the large shock (20%). The results illustrate that, not surprisingly, while the non-linear fiscal rule is not as helpful for keeping the risk-sharing gap low after the 10% shock, it works better for the large shock, where it achieves a sizeable reduction in the risk-sharing gap.

Figure 5

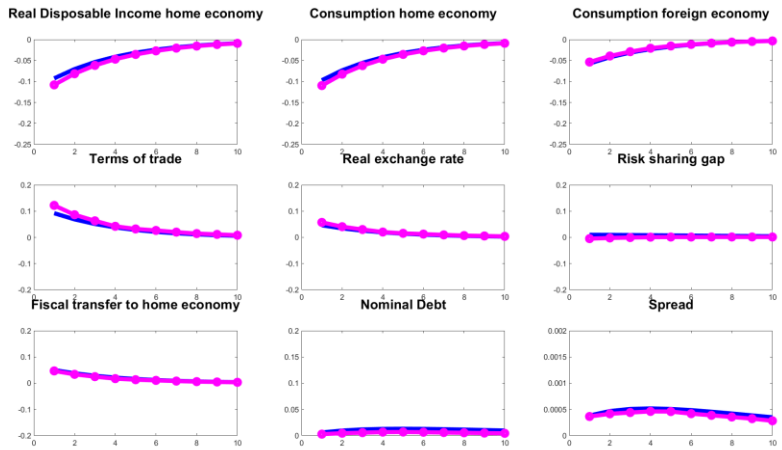
A non-linear public risk sharing does not improve risk sharing for smaller shocks to Home output



Notes: Impulse responses to a 10% reduction in Home output. The blue solid lines refer to the calibration with non-linear elasticity of the risk premium on debt and a linear fiscal rule and the magenta dotted lines to a calibration of the same model replacing the linear fiscal rule with a non-linear public risk sharing. The risk-sharing gap is the difference between the ratio of Home and Foreign marginal utility of consumption and the real exchange rate; a positive value indicates that Home consumption is inefficiently low compared with Foreign consumption.

Figure 5a

A non-linear public risk sharing is more helpful with a larger shock to Home output



Notes: Impulse responses to a 20% reduction in Home output. The figure reports the same information as in Figure 5, but with a larger shock to Home output (20% rather than 10%).

A signal extraction problem for the central fiscal capacity

So far, we have assumed that the central fiscal policymaker (say in Brussels or Washington) is omniscient in teasing out idiosyncratic shocks, which is not realistic. Therefore, we provide an alternative calibration where the central capacity may confuse common and Home-specific shocks because it faces a signal extraction problem. While we do not report the results of this calibration for brevity, the

qualitative message is that the signal extraction problem significantly reduces the risk-sharing gap stabilising properties of the fiscal capacity, because the fiscal transfers are less correlated to the "true" country-specific shock. Making labour endogenous also reduces the benefits of risk sharing, as households respond more to endowment shocks than in the baseline model.

Conclusions from the model simulations

The model has the main objective to assist us in thinking about the substitutability or complementarity of private and public risk sharing in a consistent and rigorous way, rather than to provide empirically realistic messages. The model can be extended in several directions, and provides some useful insights and a good basis to bring this discussion forward.

If equity market integration is limited and risk sharing through debt is costly because the interest rate cost reflects the level of debt in relation to a measure of net worth, a central fiscal capacity can perform a useful function in improving risk sharing in our stylised two-country model. The central capacity should, however, not "overdo" it, because some risk sharing is already provided by movements in the terms of trade. The model also illustrates two non-linear specifications, where either financial frictions have a "sudden stop" specification (small increase in the spread for smaller reductions in Home output, but very large increase for larger contractions in output), or the fiscal capacity itself behaves in a non-linear way (little reaction to small shocks, large reaction to large shocks). While in the model public and private risk sharing are mainly substitutes, a channel of complementarity is identified whereby higher provision of public insurance reduces financial frictions and hence makes private debt less costly and more efficient, even though it is less in demand.

Among the possible extensions of the model, two are particularly promising. First, the central capacity could be faced with a number of signal extraction problems (we have already illustrated one calibration of this type). Second, one could expand on the "backstop" idea and specify the complementarity in a setting where the size of the shock is uncertain in real time. Public risk sharing could be specified as a "first loss" or guarantee against a particularly large negative shock, whereas private debt markets continue to perform their function if the shock is of normal size. This could be seen as a "securitisation view" of the private/public risk-sharing complementarity.

6 Conclusions and policy implications

The crux of the debate about the ways to complete EMU is about the role of public and private risk sharing and their interaction. While the need for both public and private risk sharing in a monetary union is generally undisputed, the degree of each and their substitutability or complementarity is a matter of considerable debate as regards EMU in particular, which is a young and still visibly integrating monetary union. To the extent that this integration is the outcome of conscious economic policy decisions based on theoretical and empirical evidence about the necessity of these two components of risk sharing, optimising the mixture of public and private risk sharing will remain an important topic for both researchers and policymakers.

The actual extent of public and private risk sharing that is pursued in EMU is however likely not to be the result of purely economic considerations. On the one hand, public risk sharing depends on the willingness of voters and taxpayers to share their tax income across borders. On the other hand, savers need to be able to hold equity and debt across borders without frictions and to be also equally informed and confident enough to place their savings in other euro area and EU jurisdictions than their "home" ones. For this to happen in practice, institutional, regulatory and market conditions need to develop adequately in the shape of a financial market union composed of a capital markets union and a banking union, and a fiscal union of adequate depth.

This paper provides an overview of the nature of public and private risk sharing and the channels through which they operate in EMU. Existing empirical evidence based mainly on a national accounts decomposition of shock absorption is brought together to show that public risk sharing remains low in the euro area and arguably too low to be meaningful as a shock absorber in itself and to provide the necessary backstop to private risk sharing. Private risk sharing is found to be both in theory and in practice the main shock absorber in advanced economies.

A number of interesting questions arise from the existing literature, which are highly relevant for the EMU policymaking debate. The existing literature tends to focus most on highlighting the substitution effects between private and public risk-sharing channels. Yet, some contributions tend to look also at the extent to which private risk sharing can work without an adequate degree of public risk sharing. From this perspective, public risk sharing complements private risk sharing. We inform this discussion by developing a two-country, two-tradable goods theoretical model with country-specific endowment shocks where something prevents efficient risk sharing through equity contracts. In practice, the "Home" country would be equivalent to one EMU member state, and the "Foreign" country equivalent to another EMU member state. As for the frictions impeding private risk sharing, these would be the remaining institutional shortcomings and regulatory barriers that EU economic agents face in owning equity and/or debt under the same conditions across the EU Single Market and EMU.

The model presented has the main objective to allow us to think about the substitutability or complementarity of private and public risk sharing in a consistent and rigorous way, rather than to provide empirically realistic messages. It illustrates that, if equity market integration is limited and risk sharing through debt is costly because the interest rate cost reflects the level of debt in relation to a measure of net worth, a central fiscal capacity can perform a useful function in improving risk sharing in our stylised two-country model. Specifically, the model identifies one main channel of substitutability and one main channel of complementarity. The main substitutability channel relates to the fact that a central fiscal capacity reduces the need for agents to borrow from the other country, dampening the accumulation of net foreign debt. On the other hand, a central fiscal capacity also reduces the financial frictions associated with foreign debt, making private external borrowing more convenient. While in the model public and private risk sharing are mainly substitutes in the model calibration, it is notable that the model identifies at least the theoretical case of complementarity whereby higher provision of public insurance reduces financial frictions and hence makes private debt less costly and more efficient, even though it is less in demand.

Looking ahead, the EU response to the COVID-19 crisis has clearly shown the possibility to increase public risk sharing at the European level. The establishment of new and innovative fiscal tools at the EU level – like Next Generation EU (NGEU) and Support to mitigate Unemployment Risks in an Emergency (SURE) – represents an important milestone in public risk-sharing arrangements in the European Union. They will therefore also be an interesting case study to assess the interaction between public and private risk sharing and help EU authorities to better design risk-sharing frameworks.

References

Acharya, V.V. and Steffen, S. (2017), "The Importance of a Banking Union and a Fiscal Union for a Capital Markets Union", European Commission Discussion Paper No 062.

Afonso, A. and Furceri, D. (2008), "EMU enlargement, stabilization costs and insurance mechanisms", *Journal of International Money and Finance*, Vol. 27(2), pp. 169-187.

Alcidi, C., D'Imperio, P. and Thirion, G. (2017), "Risk-sharing and Consumption-smoothing Patterns in the US and the Euro Area: A comprehensive comparison", CEPS Working Document No 2017/04, Centre for European Policy Studies.

Alcidi, C. and Thirion, G. (2016), "Assessing the Euro Area's Shock-Absorption Capacity: Risk sharing, consumption smoothing and fiscal policy", CEPS Special Report No 146, Centre for European Policy Studies, September.

Alcidi, C. and Thirion, G. (2017), "Fiscal Risk Sharing and Resilience to Shocks: Lessons for the euro area from the US", CEPS Working Document No 2017/07, Centre for European Policy Studies, May.

Alfani, G. (2020), "Pandemics and asymmetric shocks: Lessons from the history of plagues", VoxEU.org, 9 April.

Allard, C., Brooks, P.K., Bluedorn, J.C., Bornhorst, F., Christopherson, K., Ohnsorge, F. and Poghosyan, T. (2013), "Toward a Fiscal Union for the Euro Area", IMF Staff Discussion Note No 13-09, September.

Arpaia, A., Kiss, A., Palvolgyi, B. and Turrini, A. (2016), "Labour mobility and labour market adjustment in the EU", *IZA Journal of Migration*, Vol. 5(21), pp. 1-21.

Asdrubali, P. and Kim, S. (2004), "Dynamic risk sharing in the United States and Europe", *Journal of Monetary Economics*, Vol. 51(4), pp. 809-836.

Asdrubali, P., Kim, S., Pericoli, F. and Poncela, P. (2018), "New Risk Sharing Channels in OECD Countries: a Heterogeneous Panel VAR," Working Papers 2018-13, Joint Research Centre, European Commission (Ispra site).

Asdrubali, P., Sørensen, B.E. and Yosha, O. (1996), "Channels of Interstate Risk Sharing: United States 1963-1990", *Quarterly Journal of Economics*, Vol. 111(4), pp. 1081-1110.

Athanasoulis, S. and van Wincoop, E. (1998), "Risksharing in the United States: what have financial markets and fiscal federalism accomplished?", New York Federal Reserve Bank Research Papers, No 08, April.

Atkeson, A. and Bayoumi, T. (1993), "Do Private Capital Markets Insure Regional Risk? Evidence from the United States and Europe", *Open Economies Review*, Vol. 4(3), pp. 303-324.

Avdjiev, S., Everett, M., Lane, P.R. and Shin, H.S. (2018), "Tracking the international footprints of global firms", *BIS Quarterly Review*, March.

Baldwin, R. and Giavazzi, F. (2015), "The Eurozone Crisis – A Consensus View of the Causes and a Few Possible Solutions", A VoxEU.org Book, Centre for Economic Policy Research Press.

Ballabriga, F. and Villegas-Sánchez, C. (2017), "Specialization, Risk Sharing and the Euro", *Journal of Common Market Studies*, Vol. 55(6), pp. 1380-1397.

Balli, F. and Pierucci, E. (2020), "Risk Sharing and Institutional Quality: Evidence from OECD and Emerging Economies", *Scottish Journal of Political Economy*, Vol. 67(1), pp. 53-71.

Bargain, O., Dolls, M., Fuest, C., Neumann, D., Peichl, A., Pestel, N. and Siegloch, S. (2012), "Fiscal Union in Europe? Redistributive and Stabilising Effects of an EU Tax-Benefit System", IZA Discussion Paper No 6585, Institut zur Zukunft der Arbeit.

Bayoumi, T. and Klein, M.W. (1997), "A Provincial View of Economic Integration", *IMF Staff Papers*, Vol. 44(4), pp. 534-556.

Bayoumi, T. and Masson, P.R. (1995), "Fiscal flows in the United States and Canada: Lessons for monetary union in Europe", *European Economic Review*, Vol. 39(2), pp. 253-274.

Bénassy-Quéré, A., Brunnermeier, M., Enderlein, H., Farhi, E., Fuest, C., Gourinchas, P.O., Martin, P., Pisani-Ferry, J., Rey, H., Schnabel, I. and Véron, N. (2018), "Reconciling risk sharing with market discipline: A constructive approach to euro area reform", CEPR Policy Insight No 91, Centre for Economic Policy Research.

Beyer, R.C.M. and Smets, F. (2015), "Labour market adjustments and migration in Europe and the United States: how different?", *Economic Policy*, Vol. 30(84), pp. 643-682.

Bhattarai, S., Lee, J.W. and Park, W.Y. (2015), "Optimal monetary policy in a currency union with interest rate spreads", *Journal of International Economics*, Vol. 96(2), pp. 375-397.

Bindseil, U. and Winkler, A. (2012), "Dual liquidity crises under alternative monetary frameworks: a financial accounts perspective", ECB Working Paper No 1478.

Buti, M. and Carnot, N. (2018), "The case for a central fiscal capacity in EMU", VoxEU.org, 7 December.

Buti, M., Leandor, J. and Nikolov, P. (2016), "Smoothing economic shocks in the Eurozone: the untapped potential of the financial union", VoxEU.org, 25 August.

Canova, F. and Ravn, M. (1996), "International consumption risk-sharing", *International Economic Review*, Vol. 37(3), pp. 573-601.

Carnot, N., Kizior, M. and Mourre, G. (2017), "Fiscal stabilisation in the euro area: A simulation exercise", CEB Working Paper No 17/025, Université Libre de Bruxelles.

Celentani, M., Conde-Ruiz, J.I. and Desmet, K. (2004), "Endogenous policy leads to inefficient risk sharing", *Review of Economic Dynamics*, Vol. 7(3), pp. 758-787.

Cimadomo, J., Ciminelli, G., Furtuna, O. and Giuliodori, M. (2020), "Private and public risk sharing in the euro area", *European Economic Review*, Vol. 121, January.

Cimadomo, J., Hauptmeier, S., Palazzo, A. and Popov, A. (2018), "Risk sharing in the euro area", *Economic Bulletin*, Issue 3, ECB.

Cœuré, B. (2012), "Risk-sharing in EMU: before, during and after the crisis", speech at the inaugural conference "European crisis: historical parallels and economic lessons", Julis-Rabinowitz Center for Public Policy and Finance, Princeton University, 20 April.

Cole, H.L. and Obstfeld, M. (1991), "Commodity trade and international risk sharing", *Journal of Monetary Economics*, Vol. 28(1), pp. 3-24.

Constâncio, V. (2016), "Risk Sharing and Macroprudential Policy in an Ambitious Capital Markets Union", speech at the Joint conference of the European Commission and European Central Bank on European Financial Integration and Stability, Frankfurt am Main, 25 April.

Corsetti, G., Dedola, L. and Leduc, S. (2008), "International Risk Sharing and the Transmission of Productivity Shocks", *Review of Economic Studies*, Vol. 75(2), pp. 443-473.

Corsetti, G., Dedola, L. and Viani, F. (2011), "Traded and Nontraded Goods Prices, and International Risk Sharing: An Empirical Investigation", NBER Working Paper No 17501, National Bureau of Economic Research, October.

Corsetti, G., Erce, A. and Uy, T. (2017), "Official Sector Lending Strategies During the Euro Area Crisis", CEPR Discussion Paper No 12228, Centre for Economic Policy Research.

Covas, F. and Den Haan, W.J. (2011), "The Cyclical Behavior of Debt and Equity Finance", *American Economic Review*, Vol. 101(2), pp. 877-899.

Darvas, Z. and Schoenmaker, D. (2017), "Institutional investors and home bias in Europe's Capital Markets Union", Bruegel Working Paper No 2017/02.

Demyanyk, Y.S., Ostergaard, C. and Sørensen, B.E. (2008), "Risk sharing and portfolio allocation in EMU", European Commission Economic Papers No 334.

Dmitriev, M. and Hoddenbagh, J. (2019), "Optimal fiscal transfers in a monetary union", *Journal of International Economics*, Vol. 117, pp. 91-108.

Draghi, M. (2018), "Europe and the euro 20 years on", speech by Mario Draghi, President of the European Central Bank, at Laurea Honoris Causa in Economics by University of Sant'Anna, Pisa, December.

Draghi, M. (2018), "Risk-reducing and risk-sharing in our Monetary Union", speech by Mario Draghi, President of the European Central Bank, at the European University Institute, Florence, May.

Draghi, M. (2014), "Stability and Prosperity in Monetary Union", speech by Mario Draghi, President of the European Central Bank, at the University of Helsinki, Helsinki, November.

ECB (2019), "The international role of the euro", June.

ECB (2017), "Financial integration in Europe", May.

ECB (2016), "Financial integration in Europe", April.

Enders, Z. and Vespermann, D. (2021), Cross-Country Unemployment Insurance, Transfers, and Trade-Offs in International Risk Sharing. CESifo Working Papers, Nr. 8965, March.

Eisenschmidt, J., Kedan, D. and Schmitz, M. (forthcoming 2022), TARGET-ing price stability in the euro area: analysing twenty years of TARGET balances, ECB Working Paper Series.

Fagan, G. and McNelis, P. (2020), "Sudden stops in the Euro Area: Does monetary union matter?", *Journal of International Money and Finance*, Vol. 108, November.

Fagan, G. and McNelis, P. (2014), "Target balances and macroeconomic adjustment to sudden stops in the euro area", IIIS Discussion Paper No 465, Institute for International Integration Studies.

Farhi, E. and Werning, I. (2017), "Fiscal Unions", *American Economic Review*, Vol. 107(12), pp. 3788-3834.

Feld, L. (2018), "Whither a fiscal capacity in EMU", VoxEU.org, 31 July.

Ferrari, A. and Rogantini Picco, A. (2016), "International Risk Sharing in the EMU", European Stability Mechanism Working Paper No 17.

Fratzscher, M. and Imbs, J. (2007), "Risk sharing, finance and institutions in international portfolios", ECB Working Paper No 826.

French, K.R. and Poterba, J.M. (1991), "Investor Diversification and International Equity Markets", *American Economic Review*, Vol. 81(2), pp. 222-226.

Furceri, D. and Zdzienicka, A. (2015), "The euro area crisis: Need for a supranational fiscal risk sharing mechanism?", *Open Economies Review*, Vol. 26(4), pp. 683-710.

Garber, P. (1998), "Notes on the Role of TARGET in a Stage III Crisis", NBER Working Paper No 6619, National Bureau of Economic Research.

Giovannini, A., Horn, C.-W. and Mongelli, F.P. (2021), "An early view on euro area risk-sharing during the COVID-19 crisis", VoxEU.org, 10 January.

Gros, D. and Belke, A. (2014), "Banking Union as a Shock Absorber – Lessons for the eurozone from the US", Centre for European Policy Studies.

Hartmann, P. (2016), "Cross-border Financial Risk Sharing in the Euro Area", presentation at the SUERF-EIB Annual Economics Conference, 17 November, Luxembourg.

Heijdra, M., Aarden, T., Hanson, J. and van Dijk, T. (2018), "A more stable EMU does not require a central fiscal capacity", VoxEU.org, 30 November.

Hepp, R. and von Hagen, J. (2013), "Interstate risk sharing in Germany 1970-2006", *Oxford Economic Papers*, Vol. 65(1), pp. 1-24.

Hjortsoe, I. (2016), "Imbalances and fiscal policy in a monetary union", *Journal of International Economics*, Vol. 102, pp. 225-241.

Hristov, N., Hülsewig, O. and Wollmershäuser, T. (2019), "Capital flows in the euro area and TARGET2 balances", Deutsche Bundesbank Discussion Paper No 24/2019.

International Monetary Fund (2013), "Sixth Edition of the IMF's Balance of Payments and International Investment Position Manual (BPM6)", November.

Ioannou, D. and Schäfer, D. (2017), "Risk sharing in EMU: key insights from a literature review", SUERF Policy Note, Issue No 21, November.

Jauer, J., Liebig, T., Martin, J.P. and Puhani, P.A. (2014), "Migration as an Adjustment Mechanism in the Crisis? A Comparison of Europe and the United States", OECD Social, Employment and Migration Working Paper No 155, Organisation for Economic Co-operation and Development.

Jones, E. (2016), "Financial Markets Matter More than Fiscal Institutions for the Success of the Euro", *The International Spectator*, Vol. 51(4), pp. 29-39.

Juncker J-C. (2015), "Completing Europe's Economic and Monetary Union", (Five Presidents' Report), Report by the Presidents of the European Commission, European Parliament, European Council, Eurogroup, and ECB, European Commission, Brussels, 22 June.

Kalemli-Özcan, Ș., Luttini, E. and Sørensen, B. (2014), "Debt Crises and Risk Sharing: The Role of Markets versus Sovereigns", NBER Working Paper No 19914, National Bureau of Economic Research.

Kalemli-Özcan, Ș., Manganelli, S., Papaioannou, E. and Peydró, J.L. (2008), "Financial integration, macroeconomic volatility and risk sharing: the role of the monetary union", in Mackowiak, B., Mongelli, F.P., Noblet, G. and Smets, F. (eds.), "The Euro at Ten – Lessons and Challenges", Fifth ECB Central Banking Conference, pp. 116-155.

Kalemli-Özcan, Ş., Reinhart, C. and Rogoff, K. (2016), "Sovereign Debt and Financial Crises: Theory and Historical Evidence", *Journal of the European Economic Association*, Vol. 14(1), pp. 1-6.

Kehoe, P.J. and Pastorino, E. (2017), "Fiscal unions redux", *Economic Theory*, Vol. 64(4), pp. 741-776.

Kenen, P. (1969), "The Theory of Optimum Currency Areas: An Eclectic View", in Mundell, R.A. and Swoboda, A.K. (eds)., "Monetary Problems of the International Economy", Vol. 45(3), pp. 41-60.

Lagarde, C. (2018), "A Compass to Prosperity: The Next Steps of Euro Area Economic Integration", speech at the German Institute for Economic Research, Berlin, 26 March.

Lane, P.R. (2015), "A Financial Perspective on the UK Current Account Deficit", *National Institute Economic Review*, Vol. 234(1), pp. F67-F72.

Lane, P.R. and Milesi Ferretti, G. M. (2011), "External Adjustment and the Global Crisis", *NBER Working Paper Series*, No 17352, August.

Lewis, K. (1996), "What Can Explain the Apparent Lack of International Consumption Risk-sharing?", *Journal of Political Economy*, Vol. 104(2), pp. 267-297.

Macchiarelli, C., Monti, M., Wiesner, C. and Diessner, S. (2020), "The European Central Bank between the Financial Crisis and Populisms", Palgrave Macmillan.

McWilliams, B, G Sgaravatti, S Tagliapietra, and G Zachmann (2022) "Preparing for the first winter without Russian gas", *Blog Post*, Bruegel, 28 February.

Mendoza, E.G. (2010), "Sudden Stops, Financial Crises, and Leverage", *American Economic Review*, Vol. 100(5), pp. 1941-1966.

Merler, S. and Pisani-Ferry, J. (2012), "Sudden stops in the euro area", *Bruegel Policy Contribution*, Issue 2012(6), pp. 1-13.

Milano, V. (2017), "Risk Sharing in the Euro Zone: the Role of European Institutions", CeLEG Working Paper No 01/17, Center for Labor and Economic Growth.

Milano, V. and Reichlin, P. (2017), "Risk sharing across the US and EMU: The role of public institutions", LUISS School of European Political Economy, Policy Brief.

Morales-Zumaquero, A. and Sosvilla-Rivero, S. (2011), "The euro and the volatility of exchange rates", *Applied Financial Economics*, Vol. 21(17), pp. 1235-1253.

Mundell, R.A. (1961), "A Theory of Optimum Currency Areas", *American Economic Review*, Vol. 51(4), pp. 657-665.

Obstfeld, M. (1994), "Risk-Taking, Global Diversification, and Growth", *American Economic Review*, Vol. 84(5), pp. 1310-1329.

Persson, T. and Tabellini, G. (1996), "Federal Fiscal Constitutions: Risk Sharing and Moral Hazard", *Econometrica: Journal of the Econometric Society*, Vol. 64(3), pp. 623-646.

Pisani-Ferry, J. and Zettelmeyer, J. (eds.) (2019), "Risk Sharing Plus Market Discipline: A New Paradigm for Euro Area Reform? A Debate", A VoxEU.org Book, Centre for Economic Policy Research Press.

Poghosyan, T., Senhadji, A. and Cottarelli, A. (2014), "The role of fiscal transfers in smoothing regional shocks", in Cottarelli, C. and Guerguil, M., "Designing a European Fiscal Union: Lessons from the Experience of Fiscal Federations?", International Monetary Fund, Washington, D.C.

Rabitsch, K., Stepanchuk, S. and Serhiy, K. (2015), "International portfolios: A comparison of solution methods", *Journal of International Economics*, Vol. 97(2), pp. 404-422.

Redeker, N. (2022), "Same shock, different effects EU member states' exposure to the economic consequences of Putin's war", *Policy Brief,* Jacques Delors Centre.

Roeger, W. and Vogel L. (2017), "Horizontal Transfers and Consumption Smoothing in a Monetary Union". Journal of Economics and Statistics 237 (3), pp. 275–294.

Sala-i-Martin, X. and Sachs, J. (1992), "Fiscal federalism and optimum currency areas: Evidence for Europe from the United States", CEPR Discussion Paper No 632, Centre for Economic Policy Research.

Sandbu, M. (2017), "Banking union will transform Europe's politics", Financial Times, 25 July.

Schelkle, W. (2017), "Hamilton's Paradox Revisited: Alternative Lessons from US History", CEPS Working Document No 2017/10, Centre for European Policy Studies.

Schmitt-Grohe, S. and Uribe, M. (2003), "Closing small open economy models", *Journal of International Economics*, Vol. 61(1), pp. 163-185.

Sørensen, B. and Yosha, O. (1998), "International risk sharing and European monetary unification", *Journal of International Economics*, Vol. 45(2), pp. 211-238.

Torrejón Pérez, S., Fana, M., González-Vázquez, I. and Fernández-Macías, E. (2020), "The asymmetric impact of COVID-19 confinement measures on EU labour markets", VoxEU.org, 9 May.

Van Beers, N., Bijlsma, M. and Zwart, G. (2014), "Cross-country insurance mechanisms in currency unions: an empirical assessment", Bruegel Working Paper No 2014/04.

Van Rompuy, H. (2012), "Towards a genuine Economic and Monetary Union", (Four Presidents' report), Report by the Presidents of the European Council, European Commission, Eurogroup and the ECB, European Council, Brussels, 26 June.

van Wincoop, E. (1994), "Welfare gains from international risksharing", *Journal of Monetary Economics*, Vol. 34(2), pp. 175-200.

Weidmann, J. and Villeroy de Galhau, F. (2019), "Auf dem Weg zu einer echten Kapitalmarktunion", Frankfurter Allgemeine Zeitung, 3 April.

Acknowledgements
We are grateful to Hannah Engljaehringer for excellent research assistance, and for comments by Hans-Joachim Klöckers, Jean-Francois Jamet, Johannes Lindner, Jacopo Cimadomo, Massimo Ferrari, Gernot Müller and Zeno Enders, and participants of an internal seminar held at the ECB and of a workshop on risk sharing held at the Aristotle University of Thessaloniki on 29 October 2021. The views expressed are ours and are not necessarily shared by the European Central Bank.

Alessandro Giovannini
European Central Bank, Frankfurt am Main, Germany; email: alessandro.giovannini@ecb.europa.eu

Demosthenes Ioannou
European Central Bank, Frankfurt am Main, Germany; email: demosthenes.ioannou@ecb.europa.eu

Livio Stracca
European Central Bank, Frankfurt am Main, Germany; email: livio.stracca@ecb.europa.eu

© European Central Bank, 2022

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

All rights reserved. Any reproduction, publication and reprint in the form of a different publication, whether printed or produced electronically, in whole or in part, is permitted only with the explicit written authorisation of the ECB or the authors.

This paper can be downloaded without charge from the ECB website, from the Social Science Research Network electronic library or from RePEc: Research Papers in Economics. Information on all of the papers published in the ECB Occasional Paper Series can be found on the ECB's website.

PDF ISBN 978-92-899-4849-4, ISSN 1725-6534, doi:10.2866/126627, QB-AQ-21-038-EN-N