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Research Report

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BoF Economics Review, No. 6/2019

Provided in Cooperation with:
Bank of Finland, Helsinki

Suggested Citation: Nikolov, Plamen; Pasimeni, Paolo (2019) : Fiscal Stabilization in the United States: Lessons for Monetary Unions, BoF Economics Review, No. 6/2019, Bank of Finland, Helsinki,
https://nbn-resolving.de/urn:nbn:fi:bof-201909121461

This Version is available at:
https://hdl.handle.net/10419/212999

Bank of Finland

BoF Economics Review

6 • 2019

Fiscal Stabilization in the United States: Lessons for Monetary Unions

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Abstract

The debate about the use of fiscal instruments for macroeconomic stabilization has regained prominence in the aftermath of the Great Recession, and the experience of a monetary union equipped with fiscal shock absorbers, such as the United States, has often been a reference. This paper enhances our knowledge about the degree of macroeconomic stabilization achieved in the United States through the federal budget, providing a detailed breakdown of the different channels. In particular, we investigate the relative importance and stabilization impact of the federal system of unemployment benefits and of its extension as a response to the Great Recession. The analysis shows that in the United States, corporate income taxes collected at the federal level are the single-most efficient instrument for providing stabilization, given that even with a smaller size than other instruments they can provide important effects, mainly against common shocks. On the other hand, Social Security benefits and personal income taxes have a greater role in stabilizing asymmetric shocks. A federal system of unemployment insurance, then, can play an important stabilization role, in particular when enhanced by a discretionary program of extended benefits in the event of a large shock, like the Great Recession.

Keywords: Monetary Union, Macroeconomic Stabilization, Fiscal Policy, Monetary Policy
JEL codes: E63; F36; F41; F45

We are grateful to Antonio Afonso, Pierfederico Asdrubali, Roel Beetsma, Joerg Bibow, Erik Canton, Elizabeth Dunn, Athena Kalyva, Eric Meyermans, Filippo Pericoli, Pilar Poncela, Bent Sorensen, Borek Vasicek, Jan in 't Veld and Marcin Zogala for their useful comments; while retaining responsibility for any remaining error or omission. We also acknowledge excellent statistical assistance by Christos Zavos.

[1] *The views expressed are the authors' alone and cannot be attributed to the European Commission.*

1. Introduction

The interaction between monetary, fiscal, and structural policies determines the way the economy grows and responds to cyclical fluctuations and shocks; an appropriate macroeconomic policy mix is crucial to ensure growth and stability. The coordination of macroeconomic policies is in general the task of a central government in most federal systems, where stabilization and redistribution typically operate at a federal level, while allocation is often partly decentralized (Musgrave 1959; Escolano et al. 2014).

Beyond the important role of monetary and structural policies, the focus of this work is on fiscal stabilization, in particular it tries to disentangle the role of fiscal policy conducted at the federal level in stabilizing the economy by studying the case of the United States. In the US, monetary policy is conducted at the federal level by the Federal Reserve; structural policies are determined to some extent at the federal level, but also at the state and local levels; and fiscal policies are conducted at federal, state, and local levels. Nevertheless, the largest capacity for conducting fiscal policy to stabilize the economy is at the federal level.

The literature on fiscal stabilization and risk sharing in the US developed to provide a reference in view of the establishment of the European Monetary Union (EMU), for example Sachs and Sala-i-Martin (1992), Von Hagen (1992), and Bayoumi and Masson (1995) proposed different approaches to quantify the role of fiscal transfers in the US for redistribution and risk sharing and to draw lessons for the forthcoming EMU.

It is worth highlighting, nevertheless, the specific features of the EMU as a monetary union that does not represent a single country or a political union, thus where the option of fiscal transfers is necessarily constrained. The EMU has a different setup from the US, without common fiscal instruments for macroeconomic stabilization (Nikolov 2016; Bibow 2019). While monetary policy is fully centralized at the common level, fiscal policies remain entirely national, without a common fiscal capacity, in an unprecedented divergence between the main monetary and fiscal authorities (Goodhart 1998).

The analysis of fiscal stabilization in the US is especially relevant because of this specific element of the EMU architecture – centralized monetary policy vs. de-centralized fiscal policy. The budget of the European Union (EU) is small in comparison to the sum of the national budgets; it accounts for roughly 1 percent of the EU's GDP, and it mainly performs an allocative function. On average, 80 percent of the budget returns to the member states, and recent estimates show that its net redistributive and stabilization impact is much lower than in the United States (Pasimeni and Riso 2016).

Proposals[2] for the future of the EMU contain provisions for a euro area–wide fiscal stabilization function to be developed over the longer term. In view of these provisions, it is useful to study how stabilization works in the United States - as an example of a monetary union of a federal country, comprising 50 states. This paper enhances our knowledge about the actual macroeconomic stabilization performed by fiscal instruments in the US, providing a detailed breakdown of the channels of fiscal stabilization and risk sharing through the US federal budget.

The analysis helps draw some insights from the experience of a monetary union equipped with fiscal shock absorbers, which can be useful for reflecting on the future of the EMU. In particular, we investigate the relative importance and stabilization impact of the federal system of unemployment benefits and of its extension as a response to the Great Recession. In doing so, we acknowledge the institutional differences between a federal state, such as the US, and a supranational entity, such as the EMU.

The paper is structured as follows: the next section discusses the problem of macroeconomic stabilization in supranational entities and reviews the literature on this topic; section 3 briefly illustrates how fiscal stabilization works in the US and in the EMU. Sections 4 and 5 present our empirical strategy for estimating the role of budgetary items for fiscal stabilization of consumption in the US and the results thereof, in particular the role of intertemporal and interstate stabilization through the federal budget. Section 6 elaborates on the role of the emergency unemployment compensation enacted in response to the crisis. The last section concludes.

[2] *Juncker et al. (2015), European Commission (2017b), and European Commission (2017c).*

2. Macroeconomic Stabilization and the way it is addressed in the literature

The mitigation of the impact of macroeconomic shocks in supranational economic systems refers to two different functions: intertemporal and interregional stabilization. The first can be described as stabilization of symmetric shocks or common fluctuations, and the second as insurance (or risk sharing) against idiosyncratic shocks or, to be more precise, shocks having asymmetric consequences regardless of their original nature. The first is stabilization across time; the second is stabilization across space.

In monetary unions where exchange rate flexibility is not available as an automatic stabilizer, the need for macroeconomic stabilization is even greater. Such need is actually inversely proportional to the degree of business cycle synchronization among participating countries (Feldstein 1997), as Afonso and Furceri (2008) show in terms of unsmoothed macroeconomic shocks to GDP.

Market mechanisms are often called to play a key stabilizing role through improved mobility of factors: capital and labor (Mundell 1973; Eichengreen 1992).[3] On top of them, specific structural and fiscal policies at the national or state level can further enhance the capacity of the system to absorb macroeconomic shocks. Nevertheless, in federal states there is a public channel providing macroeconomic stabilization through a common fiscal capacity.

Market mechanisms allowing for greater mobility of capital consist of the so-called capital market channel, the credit market channel, and the cross-border labor compensation channel, and they can provide sufficient stabilization to the extent they are stable and efficient in the allocation of resources. There is indeed evidence that in the US, for instance, they provide a great degree of stabilization (Nikolov 2016), which is nevertheless supported by public mechanisms for stabilization, such as the federal budget.

The experience of the Great Recession, unfortunately, proved that the amount of risk sharing provided by markets remains generally inadequate (Berger, Dell'Ariccia, Obstfeld 2018). In the US, exceptional fiscal measures were necessary to complement market mechanisms and stabilize the economy. In the EMU, markets contracted and exacerbated the procyclical trend, and the ability to smooth the shock was rather reduced because private risk sharing did not play a stabilizing role. Ferrari and Rogantini-Picco (2016) even found "a decrease in risk sharing over the period following the introduction of the Euro." Furceri and Zdzienicka (2015) found that the degree of risk sharing in the EMU falls sharply in severe downturns; just when it is needed most, the increased inability to smooth output shocks is driven by the lack of consumption smoothing provided by private saving via the credit channel, and this is particularly true for severe downturns that are persistent and unanticipated.

Labor mobility is another market mechanism that improves the stabilization capacity of the system. Several studies found similar rates of mobility between the US and EU (Molloy, Smith, and Wozniak 2011), with a significant increase in the EMU in recent years (Dao, Furceri, and Louhgani 2014). Recent research suggests that it is unlikely that cross-country migration flows will become a key driver of labor market adjustment after large shocks in the EMU (Draghi 2014), given that the regional adjustment process in Europe is already not that different from the one in the US, once controlling for country-specific factors (Beyer and Smets 2015).

Other policy instruments that can perform stabilization in a monetary union are a common monetary policy and national or state-level fiscal and structural policies. A common monetary policy can provide a first response to stabilize the economy in the event of shocks affecting the whole area, acting through the interest rate. Problems arise when the interest rate is close to the zero lower bound. In those cases, further reductions in nominal interest rates to reach equilibrium between aggregate demand and supply may be difficult; so-called "unconventional" tools are needed, but the more they are used, the lower the returns they provide

[3] Mundell (1973) and Eichengreen (1992) had suggested that a monetary union among countries keeping their fiscal autonomy could potentially compensate for the lack of a common fiscal capacity through the so-called "private insurance channel," brought forward by financial integration.

(Blanchard, Cerutti, and Summers 2015), as the recent experience shows. Moreover, a common monetary policy cannot react to individual country shocks (Berger, Dell'Ariccia, and Obstfeld 2018). [4]

Structural reforms help correct the structural reasons for the asymmetries in a monetary union. In particular flexibility in product and labor markets play an important role for adjustment. However, they cannot replace the effectiveness and the speed of the exchange rate mechanism in absorbing idiosyncratic shocks and reducing asymmetries (Friedman 1953; Meade 1957). Moreover they have important short-term costs (Eggertsson, Ferrero, and Rao 2014), particularly when implemented during negative cyclical conditions (OECD 2015) when monetary policy is already constrained (Vogel 2014), posing a drag on aggregate demand (Duval and Furceri 2017).

National fiscal policies do also play a stabilization role and, given the size of national budgets compared with the common one in the EU, they are particularly important. Recent analyses (European Commission 2017a) show that the direct stabilization effects are relatively sizeable in the EU, with roughly one-third of the income absorbed by the national tax and benefit system following a shock to market income. Nevertheless, if shocks are large enough, national fiscal policies can be forced by market pressure to behave pro-cyclically, limiting their capacity to stabilize.

The case for a common fiscal instrument for macroeconomic stabilization in the EMU has long been discussed (Kenen 1969; European Commission 1975, 1977, 1989; Eichengreen, Obstfeld, and Spaventa 1990; Forni and Reichlin 2001), and its relevance highlighted for both the case of asymmetric and common shocks (De Grauwe 2013; Bibow 2019). The economic rationale for common fiscal instruments for macroeconomic stabilization in a monetary union stems from the limits to market mechanisms and other instruments. These limits apply both in cases of intertemporal stabilization of common shocks and interregional stabilization of asymmetric shocks. The reason why the two objectives of intertemporal and interregional stabilization are to be considered together is that we can think of a trade-off in the use of instruments to achieve each of them or, to be more precise, there is a trade-off in the "non-use" of a fiscal instrument for these two functions.

The less a monetary union relies on a fiscal capacity for risk sharing and insurance against idiosyncratic shocks and the more it relies on improving the adjustment capacity at the national level through structural reforms and prudent fiscal policies, the stronger the deflationary pressure that develops on the area (OECD 2015; Duval and Furceri 2017), thus the stronger the pressure on monetary policy to counteract such deflationary pressure as it reaches the zero lower bound; this leads to a greater need to use a fiscal instrument for intertemporal stabilization to free the system from the deflationary pressure (Corsetti et al 2019). And vice versa. The more the system pushes monetary policy toward its limits to achieve intertemporal stabilization without active support by fiscal policy, the lower the capacity to sustain all countries and free them from a deflationary pressure (Corsetti et al 2019). This results in higher short-term costs of structural reforms and fiscal consolidation (Eggertsson, Ferrero, and Rao 2014; OECD 2015), lower effectiveness, and a greater need to compensate through a fiscal instrument for interregional stabilization. In other words, common instruments for fiscal stabilization cannot be ruled out in both functions, and the less we use them for intertemporal stabilization, the more we will have to use them for interregional stabilization.

A single fiscal instrument could also address both issues and perform both functions, but it should then include two legs: a basic arrangement for cross-country risk sharing, and a debt-issuing possibility for intertemporal stabilization, (see Demertzis and Wolff 2016 for the steps and prerequisites for a common fiscal capacity in the EMU). The US federal budget operates in this way by addressing both objectives, and the US system of unemployment insurance (UI) is an example of an instrument that operates on both fronts, with its mixed system of states' responsibility in normal times and extended and emergency benefits provided by the federal system (financed through borrowing) in times of crisis.

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[4] A common monetary policy, of course, is not completely detached from country-specific developments; however, its action has, by definition, an impact on the whole area. Heterogeneous national situations, then, translate into asymmetric impacts of a single monetary policy.

3. Fiscal stabilization in the EMU and in the US

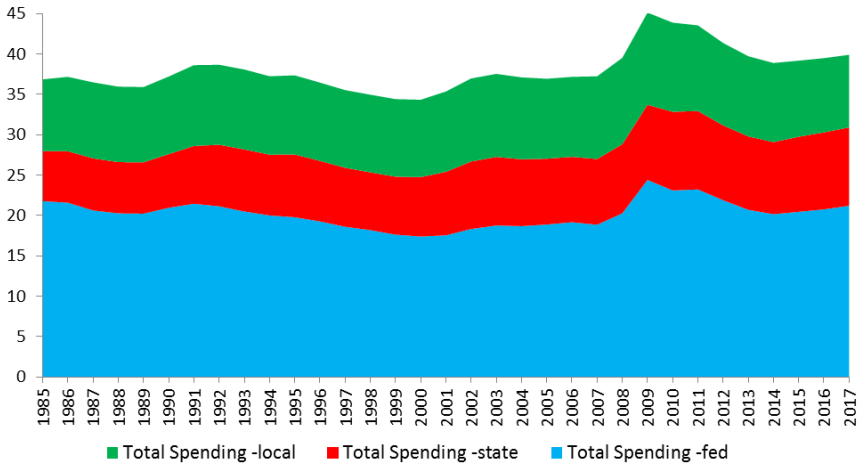
Fiscal stabilization in the EMU is so far entrusted to the individual member states, with non-negligible effects (European Commission 2017a); nevertheless, stabilizing large shocks for the whole of the EMU through an appropriate aggregate fiscal stance requires a high degree of coordination, which has so far proved difficult. Leaving the formation of the aggregate fiscal stance as a sum of national fiscal policies may lead to a suboptimal aggregate stance (Hamada 1985), with a high probability of recreating imbalances. The fact that supportive monetary policy makes some fiscal space at the national level does not solve this coordination problem, and may instead lead to further distortions or misallocation.

The economic governance in the EMU has been considerably revised in the recent years, with a view to achieving better coordination; however, the challenge has proved remarkable. The reason can be found in the key feature that differentiates the EU finances from those of other federations: the "reverse vertical fiscal imbalance." The reverse vertical fiscal imbalance means that most of the central budget is so far dependent on upward transfers from the member-state level toward the top level, contrary to what usually happens in federations (Escolano et al. 2014). This provides an unstable framework for any form of common budgetary capacity.

In other words, it is extremely difficult for a central budgetary authority, which has only subsidiary budgetary powers (within the limits set by the lower level), to credibly enforce limits on the budgetary powers of that lower level. The necessary maneuvering room for fiscal policies cannot be credibly removed from the national level if the supranational one is not equipped to take it over. A fiscal counterpart to the common monetary authority could play the role of providing a coordinated and targeted fiscal impulse, minimizing distortions and maximizing impacts. There is recent evidence that the business cycles of euro area countries are increasingly correlated (Campos, Fidrmuc, and Korhonen 2017; Martínez-Martin, Saiz, and Stoevsky 2018), while the amplitude of the cycles differs. This implies that the need for stabilization of common shocks is becoming more pressing than the need for stabilization of asymmetric ones.

The US instead, as a federal system, has a considerable federal budget, which represents, on average, 20 percent of GDP, and is the main source of public expenditures in the multilevel governance of the federation. The EMU has no specific budget; it is a subset of the EU, whose budget, as a matter of comparison, represents only 1 percent of GDP.

Figure 1: Government Expenditures per Level of Government in the US (percent of GDP, 1985–2017)



Source: US Census Bureau.

The US federal government, unlike the EU, has the possibility to run deficits and borrow. Another important characteristic that differentiates the US system from the EU is that it allows for a higher degree of "cross-border" flows between states, particularly during large recessions.[5] These two characteristics—common borrowing capacity and cross-border transfers—strongly determine the stabilization capacity of the US system.

Overall, the stabilization capacity of the federal budget in the US is much larger than in the EU. Feyrer and Sacerdote (2013) found that, on average, between 1996 and 2011, a one-dollar shock to state income in the US is offset by a $0.20 fiscal response at the federal level; this response occurs entirely through the tax system. Pasimeni and Riso (2018) found that the same effect in the EU is thirty times smaller, given the limited size and the rigidity of the EU budget.

The US federal government has the power to collect taxes directly, something the EU cannot do[6]; it also gives direct transfers to states and individuals under several programs—from personal and corporate income taxes, to Social Security, and grants to and taxes from states. We will try to assess the net stabilization impact of these federal transfers in order to understand their relevance as fiscal stabilizers. In particular, we will try to estimate the relative importance of the federal system of unemployment insurance, and of its extension implemented to counteract the biggest recent shock, the Great Recession.

[5] As D'Apice (2015) describes: "Cross-border flows in the US (…) amounted to 1.5 percent of US GDP on average between 1980 and 2005, and increased to 9 percent over 2009 and 2010. Importantly, the post-crisis increase (2009–10) of net inflows was financed entirely by borrowing at the federal level. During normal times (1980–2005), instead, it was the size and structure of the federal budget that determine the magnitude of cross-border flows. These happen automatically and almost invisibly through the federal tax and spending system."

[6] Revenues of the EU budget consist mainly of a national contribution that member states pay based on their gross national income (GNI), whereby each country transfers a standard percentage of its GNI to the EU. Other resources are based on the value-added tax (VAT), whereby a uniform rate of 0.3 percent is levied on the harmonized VAT base of each member state, but member states collect them and send to the EU. Then there are customs duties on imports from outside the EU and sugar levies; member states keep 25 percent of the amount as collection costs.

4. Empirical analysis of the US fiscal risk sharing channels

4.1 Methodology

In what follows, our analysis estimates the relative importance of the different federal-to-state-government risk sharing channels in the US. The methodological approach follows Asdrubali, Sorensen, and Yosha (1996) and makes use of a further breakdown of the data available from Nikolov (2016).[7]

We begin with the general Asdrubali, Sorensen, and Yosha (1996) specification. They propose a series of regressions of the following balancing items to estimate the relative importance of several risk sharing channels, namely: gross state product (GSP); gross state in-come (GSI); gross state disposable income (GSDI); and state consumption (SC), both private and public.

Starting from the identity $GSP = \frac{GSP}{GSI} * \frac{GSI}{GSDI} * \frac{GSDI}{SC} * SC$ it is easy to show that a relationship $1 = \beta_{fi} + \beta_{tr} + \beta_s + \beta_u$ exists[8] where the beta terms are the estimates of the panel regression coefficients in:

$$\Delta logGSP_t^i - \Delta logGSI_t^i = \mu_{fi,t} + \beta_{fi} * \Delta logGSP_t^i + u_{fi,t}^i \quad (1)$$

$$\Delta logGSI_t^i - \Delta logGSDI_t^i = \mu_{tr,t} + \beta_{tr} * \Delta logGSP_t^i + u_{tr,t}^i \quad (2)$$

$$\Delta logGSDI_t^i - \Delta logSC_t^i = \mu_{s,t} + \beta_s * \Delta logGSP_t^i + u_{s,t}^i \quad (3)$$

$$\Delta logSC_t^i = \mu_{u,t} + \beta_u * \Delta logGSP_t^i + u_{u,t}^i \quad (4)$$

The difference operator represents annual change; thus the degree of risk sharing is measured in terms of a change of each variable from the previous period.[9] All variables are in constant prices and in log per capita terms.

The difference in the balancing items in equation (1) is due to the elements that represent smoothing of shocks to output as it is transformed into income, i.e., net factor income from abroad, such as dividends, rents, and wages earned abroad but spent at home. The difference in the balancing items in equation (2) is due to the elements that represent smoothing of shocks to income as it is transformed into disposable income, i.e., different fiscal elements such as income taxes and social support. The difference between disposable income and consumption that appears in equation (3) is savings or borrowing. All these elements on the

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[7] Poghosyan, Sehadji, and Cottarelli (2016) give a useful overview of the empirical approaches to studying the role of fiscal transfers in the US and other federations, especially as regards the distinction between the role of fiscal policy for redistribution and for insurance against common or idiosyncratic shocks. Our paper falls in the strand of literature that empirically measures the amount of income and consumption smoothing due to insurance (risk sharing) mechanisms, started by Asdrubali, Sorensen, and Yosha (1996). It therefore has a more narrow focus than Poghosyan, Sehadji, and Cottarelli (2016), as it does not deal with the redistributive properties of fiscal policy.

[8] This can be seen by taking natural logs and first difference and then multiplying both sides of $GSP = \frac{GSP}{GSI} * \frac{GSI}{GSDI} * \frac{GSDI}{SC} * SC$ by $\Delta logGSP$ and taking expectations to arrive at a decomposition of the cross-sectional variance in $\Delta logGSP$, to a series of covariance terms between $\Delta logGSP$ and each of $\Delta logGSP - \Delta logGSI$, $\Delta logGSI - \Delta logGSDI$, $\Delta logGSDI - \Delta logSC$, and finally $\Delta logSC$. Dividing both sides by the variance in $\Delta logGSP$ gives $1 = \beta_{fi} + \beta_{tr} + \beta_s + \beta_u$ where the beta terms are the estimates of the panel regression coefficients in equations (1) to (4).

[9] Within this panel setting, the betas are weighted averages of estimates of year-by-year cross-sectional regressions. The weights use the difference between each state's GSP and the average GSP across the 50 states in each period. Years when cross-state variation in GSP was bigger are given more weight in the calculation of the risk sharing coefficients.

left side of equations (1) to (3) are regressed on changes of output. Finally, in equation (4), the change in consumption is regressed on the change in output to measure the part of the output shock that is directly passed on to consumption and thus not smoothed.

The cross-sectional dimension of the panels in the regressions described above represents the 50 US states (indexed by *i*); the beta terms are interpreted as the relative weights of cross-border risk sharing due to net factor income, fiscal transfers, savings, and borrowings on credit markets respectively; and *u* represents the error terms. The betas are not restricted to sum up to one, thus unsmoothing by a particular channel is allowed.

When the time fixed effects (μ) are excluded, the beta coefficients measure the amount of smoothing of both asymmetric shocks and shocks that are common to all 50 US states simultaneously. That is to say that the time fixed effects that are part of the original Asdrubali, Sorensen, and Yosha (1996) methodology pick up all changes in the variables that are common to all 50 states at the same time in a given period. When these time fixed effects are excluded, such common responses are picked up by the beta coefficients.

Next, when we include time fixed effects (μ), the beta coefficients show the amount of an asymmetric shock (i.e., the response in each state that is distinct to it and not shared with all other 49 states) that is being smoothed by each channel. This detail is important, because we can calculate the difference in the coefficients between the regressions with and without time fixed effects in order to estimate the capacity to stabilize common shocks.[10]

In addition to regression (2), through which we can estimate the overall risk sharing and stabilization impact of federal transfers on consumption, we use data that allow us to further detail the different channels of fiscal stabilization in the US federal budget by estimating the following set of regressions for different *X*s:

$$\Delta log GSI_t^i - \Delta log(GSI_t^i \pm X_t^i) = \mu_{x,t} + \beta_x * \Delta log GSP_t^i + u_{x,t}^i \qquad (5)$$

where *X* represents a different federal-to-state revenue or an expenditure item: a Social Security tax paid by state residents to the federal Social Security administration enters with a negative sign, while Social Security receipts received by state residents from the federal government enter with a positive sign. Note that if all revenue and expenditure items are added and subtracted from gross state income, the balance represents gross state disposable income and equation (5) becomes equivalent to equation (2). This stems from the nature of the construction and calculation of the national account items used, shown below, which together create the difference between GSI and GSDI and not by an explicit constraint.

The set of regressions in equation (5) evaluates the stabilizing impact of the following items separately, so in each of the regressions in equation (5) *X* represents one of the following:

- Federal personal income taxes paid;
- Federal corporate income taxes paid;
- Social Security contributions paid;
- Social Security benefits received;
- Federal grants to states;
- Medical benefits from the federal government;
- Supplementary income from the federal government;
- Federal excise taxes paid;

[10] Note that we use the results from the regression, which exclude the time fixed effects, only together with the results of the regression that explicitly account for responses to shocks that are common to all 50 states (the specification with time fixed effects). Tests for the joint significance of the time fixed effects indicate that they are jointly different from zero. The difference between the two estimates gives us the response to common shocks.

- Other federal transfers received (this includes a multitude of items as detailed below); and
- All other taxes and transfers including federal unemployment benefits received.

Federal grants to states include a variety of items, such as medical assistance, and housing and educational programs, as well as money distributed by the Federal Highway Trust Fund that funds road constructions. It is worth noting that the primary objective of these federal-to-state aid programs is not the short-term stabilization of income and consumption, but longer-term convergence goals, yet these programs may also have a stabilization role. In accordance with Asdrubali, Sorensen, and Yosha (1996), medical benefits do not include Medicaid, which is administered by the states.

Supplementary income includes Supplemental Security Income (SSI) benefits to low-income people who are either aged 65 or older, visually impaired, or disabled. It also includes the Supplemental Nutrition Assistance Program (SNAP), also known as food stamps, and income maintenance benefits such as Temporary Assistance for Needy Families (TANF) and others.

"Other federal transfers received" include a multitude of diverse government support programs.[11] One of them, which is of particular interest, is the Federal Additional Compensation for Unemployment; this extended benefit unemployment program was, as an exception, funded at 100 percent by the federal government, according to the provisions of the American Recovery and Reinvestment Act (ARRA) of 2009. Unfortunately, personal transfer receipts that resulted from it are not available separately and are grouped together with other items in the category "all other taxes and transfers," which includes unemployment compensation for federal employees.

The time period of the regressions is between 1998 and 2014. Estimation is with the Prais-Winsten procedure, which is a form of feasible generalized least squares (FGLS) with panel-corrected standard errors. This estimation method assumes that the disturbances are heteroskedastic and there is first-order autocorrelation within panels with a common autocorrelation coefficient.[12] Such estimation is well suited for panels with relatively large cross-sections and relative short time periods, as discussed in Hepp and von Hagen (2013). Our appendix provides details on the tests performed in order to detect heteroskedasticity and autocorrelation among errors and motivates the choice of the estimation technique.

4.2. Data

The data on gross state product and consumption at the state level are available from the US Bureau of Economic Analysis (BEA). On the other hand, we have to construct the data for income and disposable income (i.e., income after all receipts and outlays vis-à-vis the federal government) in each state. We follow the approach used in Asdrubali, Sorensen, and Yosha (1996), attributing to the state level the same share of those revenue and expenditure items that are only available at the US level.[13]

The observations of the main cross-state risk sharing balancing items—which are GSP, GSI, and GSDI, plus SC (both private and public)—for the 50 US states come from various sources and are calculated in the following way.

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[11] Other federal transfers received consists largely of Bureau of Indian Affairs payments; Alaska Permanent Fund dividend payments; compensation of survivors of public safety officers; compensation of victims of crime; disaster relief payments; compensation for Japanese internment; the ARRA-funded Federal Additional Compensation for unemployment, COBRA premium reductions, and the economic recovery lump sum payment; and other special payments to individuals.

[12] We have tried estimating the regressions assuming panel-specific autocorrelation coefficients as a robustness check. The results do not differ significantly.

[13] See "Appendix: Data Construction" in Asdrubali, Sorensen, and Yosha (1996) and the subsection "Data" for more information.

The BEA publishes data for the annual gross domestic product by state, as well as for personal consumption expenditure by state. In order to calculate the public sector consumption by state, we use data for state government expenditure (published as statistics on government finances by the US Census Bureau) minus the state transfers directed by state governments to individuals (which are already measured in personal consumption expenditure).

The calculation of GSI and GSDI—which is the former minus federal-to-state net transfers in the form of taxes, subsidies, or other types of benefits and contributions—closely follows the approach taken in Asdrubali, Sorensen, and Yosha (1996). Gross income by state is defined as residents' earnings (such as wages and rents), plus distributed corporate profits, plus corporate taxes. This is equal to the income approach to GDP for a particular state, i.e., all labor income (such as pretax wages, rents, etc.), all non-retained corporate income (such as earnings before interest, taxes, depreciation, and amortization [EBITDA]), and net factor income generated from across the state border. The calculation of gross state income involves using data on personal income from the BEA, and tax data from the federal government and the US Census Bureau.

GSDI is then GSI plus the net federal-to-state transfers including taxes, federal grants to states, benefits, and contributions measured in personal current transfer receipts. Federal grants to states are available from the US Census Bureau, and all personal taxes, contributions, and transfers are available from the BEA.

5. Intertemporal and interstate stabilization through the federal budget

In the preceding Section, we have presented the full set of risk sharing equations (1) to (4) for the sake of outlining completely the original Asdrubali, Sorensen, and Yosha (1996) methodological framework. Our focus in this paper is equation (2), running a regression based on it gives the amount of stabilization achieved through cross-state fiscal means, i.e. the stabilization properties of the federal budget. The other three equations are interpreted by Asdrubali, Sorensen and Yosha (1996) as risk sharing through cross-state factor income, such as: wages, dividend and rental income earned across state borders (equation (1)); risk sharing by saving and borrowing with the help of financial intermediaries (equation (3)); and part of the shock to output that is not smoothed and is thus directly transferred to consumption (equation (4))[144].

Therefore, the focus of this paper is on the results obtained through running regression (2) and its decomposition in (5). We first estimate the stabilization effect of each channel in response to both kinds of shocks: common and asymmetric. To do so, we run regressions (2) and (5) without time fixed effects.

Table 1 shows the results. About 21 percent of shocks are smoothed through fiscal stabilization (column 1 in table 1), both in terms of interstate risk sharing and intertemporal stabilization, through the operation of the federal budget. This compares with 28 percent in Poghosyan, Senhadji, and Cottarelli (2016: table 4). Alcidi and Thirion (2017) on the other hand find that for the period 1995-2013 around 18 percent of symmetric and asymmetric shocks are absorbed by the federal budget. It is important to note that the main purpose of the federal budget is not to provide macroeconomic stabilization, given that it is designed to perform many other functions, for example it has a redistributive role. However, the structure of its revenues and expenditures also allow for a significant degree of macroeconomic stabilization.

It is interesting to note that federal corporate income taxes, Social Security benefits, and federal grants are the items in the federal budget that provide the highest stabilization potential; see table 1, columns 8, 3, and 2, respectively. These are not the largest items in the federal budget; in particular the corporate income tax is the sixth-largest item, representing only 1.7 percent of GDP, and provides the largest stabilization effect, of about 5 percent.

[14] Results of running regressions (1), (3) and (4) for the period 1998-2014 show that about 35 percent of asymmetric shocks are smoothed through cross-state factor income, while about 31 percent are smoothed through savings and borrowings and about 21 percent remain unsmoothed. These results are generally in line with what is found in Nikolov (2016) for the period 1964-2013.

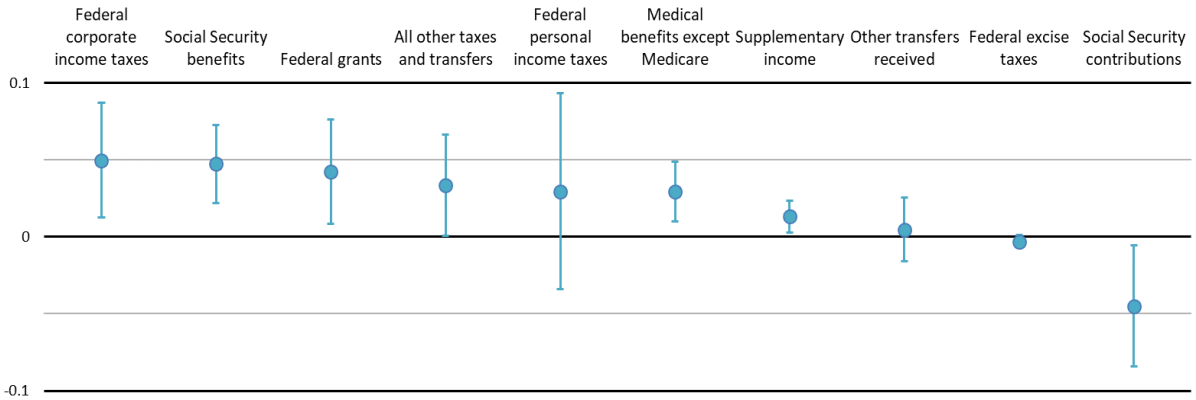
Table 1: Estimated Results without Time Fixed Effects: All Shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total federal to state net transfers	Federal grants to states	Social Security benefits	Medical benefits except Medicare	Supple-mentary income	Other income from federal gov.	Federal personal income taxes	Federal corporate income taxes	Social Se-curity contri-butions	Federal excise taxes	Other fed-eral to state net transfers
Coef.	0.21	0.04	0.05	0.03	0.01	0.00	0.03	0.05	-0.04	0.00	0.03
Std. Err.	0.08	0.02	0.01	0.01	0.01	0.01	0.03	0.02	0.02	0.00	0.02
z	2.81	2.46	3.66	2.97	2.49	0.45	0.91	2.61	-2.24	-1.40	2.01
P>|z|	0.01	0.01	0.00	0.00	0.01	0.65	0.36	0.01	0.03	0.16	0.05
95% Conf.min.	0.06	0.01	0.02	0.01	0.00	-0.02	-0.03	0.01	-0.08	-0.01	0.00
95% Conf.max.	0.36	0.08	0.07	0.05	0.02	0.03	0.09	0.09	-0.01	0.00	0.07
time FE	no	no	no	no	no	no	no	no	no	no	no
No. of obs.	850	850	850	850	850	850	850	850	850	850	850
Wald chi square	7.91	6.06	13.43	8.85	6.19	0.21	0.83	6.83	5.03	1.95	4.03
P> chi square	0.00	0.01	0.00	0.00	0.01	0.65	0.36	0.01	0.02	0.16	0.04

Notes: Prais-Winsten regression, correlated panels corrected standard errors (PCSEs); common AR(1) correlation among panels, 1998–2014, 50 US states.

Figure 2 shows the estimated coefficients of regressions (2) and (5) without time fixed effects, as well as their 95 percent confidence intervals. It is clear from the figure and from the Wald tests reported in table 1 that several items do not contribute to risk sharing when both common and asymmetric shocks are considered. These are other income from the federal government, federal personal income taxes, and federal excise taxes.

Figure 2: Estimated Coefficients without Time Fixed Effects: All Shocks



Source: Own calculations.
Note: The lines represent 95 percent confidence intervals.

We can now move on to estimating the specific risk sharing capacity of these items in the federal budget in the event of asymmetric shocks only by adding the time fixed effects in the

regressions. The results, reported in table 2, indicate that around 10 percent of a shock[15] to the GSP is smoothed through the fiscal channel (column 1, table 2). This result is similar to previous results found by Nikolov (2016) and Alcidi and Thirion (2017), who find about 11 percent of asymmetric shocks smoothed by the federal budget for the period 1980-2013, as well as in Poghosyan, Senhadji, and Cottarelli (2016), who find that risk sharing through fiscal means smooths about 12 percent of an asymmetric shock.

We then estimate the stabilization effect of each fiscal revenue and expenditure item; these are shown in the remaining columns of table 2 and figure 3. They have a varying degree of stabilization capacity. For example, Social Security and medical benefits (except Medicare, which is partially state administered, and its federal portion is included in the category "federal grants to states") smooth between 2 percent and 3 percent of an income shock, despite having not been primarily designed for stabilization purposes. Interestingly, the different degree of stabilization effect is not correlated with the size of the item (in terms of percentage of GDP).

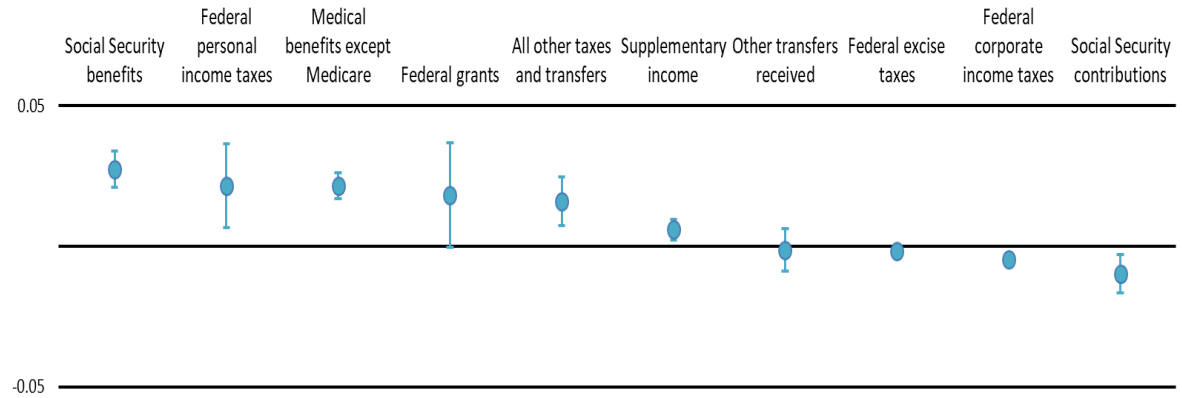
Table 2: Estimated Results with Time Fixed Effects: Asymmetric Shocks Only

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total federal to state net transfers	Federal grants to states	Social Security benefits	Medical benefits except Medicare	Supplementary income	Other income from federal gov.	Federal personal income taxes	Federal corporate income taxes	Social Security contributions	Federal excise taxes	Other federal to state net transfers
Coef.	0.10	0.02	0.03	0.02	0.01	0.00	0.02	0.00	-0.01	0.00	0.02
Std. Err.	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
z	7.09	1.93	8.44	9.03	3.27	-0.33	2.84	-4.72	-2.81	-4.80	3.57
P>|z|	0.00	0.05	0.00	0.00	0.00	0.74	0.00	0.00	0.01	0.00	0.00
95% Conf.min.	0.07	0.00	0.02	0.02	0.00	-0.01	0.01	-0.01	-0.02	0.00	0.01
95% Conf.max.	0.12	0.04	0.03	0.03	0.01	0.01	0.04	0.00	0.00	0.00	0.02
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. of obs.	850	850	850	850	850	850	850	850	850	850	850
Wald chi square	23861.78	5340.88	2754.34	762.54	1041.21	183152.9	7270.74	12251.19	10851.08	464.69	134908
P> chi square	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Prais-Winsten regressions, correlated panels corrected standard errors (PCSEs); common AR(1) correlation among panels, 1998–2014, 50 US states.

[15] *It is important to remember that this result corresponds to interstate risk sharing only and neglects the dimension of intertemporal stabilization.*

Figure 3: Estimated Coefficients with Time Fixed Effects: Asymmetric Shocks Only



Source: Own calculations.
Note: The lines represent 95 percent confidence intervals.

The main items that contribute to year-to-year consumption smoothing after asymmetric shocks to income are Social Security benefits received, medical benefits received, and personal income taxes paid, each smoothing between 2 percent and 3 percent of the output shock. With the exception of personal income taxes, these are not among the largest items in the federal-to-state tax and transfer realm. The combined amount of the risk sharing roles of Social Security benefits received at 2.8 percent and Social Security benefits paid at -1.0 percent is positive, meaning that the Social Security system in the US has a mild positive risk sharing role of 1.8 percent.

The only item that does not contribute to risk sharing after asymmetric shocks is "other income from the federal government" (see footnote 9 for a description of its components). It is noteworthy to mention that the role of the different fiscal items for risk sharing after asymmetric shocks is quantitatively similar to the one found in table II of Asdrubali, Sorensen, and Yosha (1996), even though the time period covered in their paper is between the 1960s and 1990. This is evidence of the relatively stable role of the budgetary items for cross-state stabilization after asymmetric shocks.[16]

The literature that followed the seminal contribution by Asdrubali, Sorensen, and Yosha (1996) focuses on the measurement of interstate risk sharing only, therefore including time fixed effects. Our methodology also follows this strand of literature for the measurement of interstate risk sharing, but in addition we try to estimate intertemporal stabilization by subtracting from the overall coefficient derived above. This methodology has been used by Alcidi and Thirion (2017), see equation (4) on page 3. Regarding the treatment of time fixed effects, we follow Poghosyan, Senhadji, and Cottarelli (2016).[17]

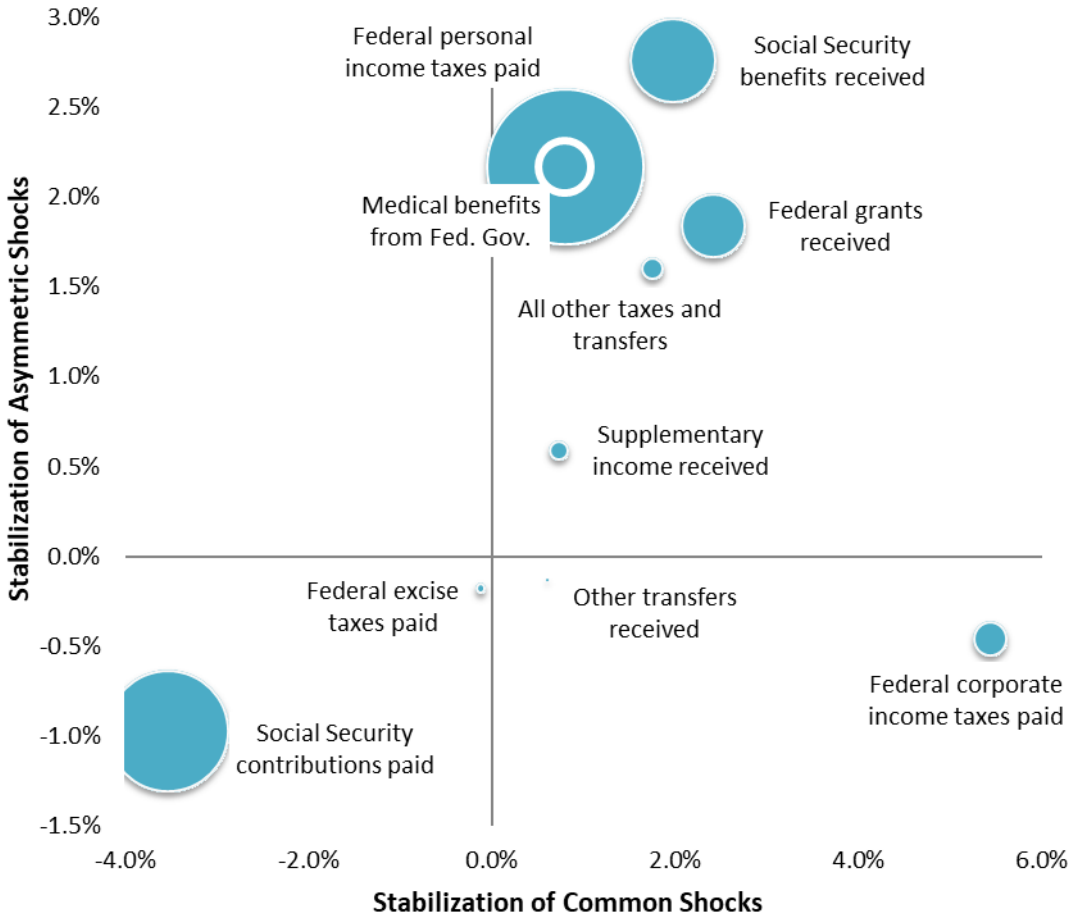
We can now calculate the difference between the estimation, including both common and asymmetric shocks, and one that includes only the smoothing of asymmetric shocks; the results give us the stabilization effect against shocks common to all US states at the same time for each channel. We can then plot the results for the specific stabilization effect of each item in the US federal budget in the case of common and in the case of asymmetric shocks, adding also a third dimension, which is the size of the item in the federal budget.

[16] *Total cross-state fiscal risk sharing in Asdrubali, Sorensen, and Yosha (1996) is 13 percent for 1964–90, while we find it to be 10 percent for 1998–2014.*

[17] *This method provides possibly the best estimation of intertemporal versus cross-sectional stabilization effects, however it is plausible that different channels of risk sharing operate with different time profiles, so that also the intertemporal component may be affected to some extent by cross-sectional risk sharing as a byproduct. Nevertheless, the literature on risk sharing has never studied (so far) the heterogeneity of the different channels in terms of intertemporal spillovers. We are grateful to Pierfederico Asdrubali for this intuition.*

On the horizontal axis, figure 4 shows the intertemporal stabilization effect of each channel against common shocks; the vertical axis shows the amount of interstate risk shared against asymmetric shocks; finally, the size of the points represents the size of each item in the federal budget (as a share of GDP).

Figure 4: Intertemporal and Interstate Stabilization through Fiscal Channels in the US



Source: Own calculations.

We can see how the different items in the US federal budget have different effects in terms of stabilization, and these effects are measured along two dimensions: cross-country stabilization of asymmetric shocks (on the vertical axis) and stabilization of common shocks over time (on the horizontal axis).

The first thing we observe is that the stabilization capacity of each item is not directly related to its size, meaning that even small items can have relevant stabilization effects.

We see that some items stand out for their effect, which is statistically significant along one of the two dimensions. On the one side, Social Security benefits together with federal personal income taxes are the most effective items in the federal budget for providing interstate risk sharing, i.e., stabilization against asymmetric shocks. On the other side, federal corporate income taxes, although quite small in terms of overall size, are the most effective item in the federal budget for providing intertemporal stabilization against common shocks; their small size implies they are also one of the most efficient ways to provide stabilization.

Corporate income taxes are generally collected with longer lags compared with other taxes, as is often observed in several jurisdictions. This fact is indeed consistent with the finding that this item in the federal budget provides sensible stabilization over time, while it is not particularly relevant for cross-country risk sharing.

The net stabilization effect of the Social Security system is positive, when asymmetric shocks are concerned. This can be seen by adding the positive effect of Social Security benefits received, which smooths close to 3 percent of idiosyncratic shocks, and the negative effect of Social Security taxes paid, which has a small dis-smoothing role, adding an additional 1 percent of the output shock to consumption. This is not surprising, as workers might be tempted to consider early retirement after a negative localized shock to income, or to postpone retirement plans in the opposite case. At the same time, Social Security taxes are usually proportional or a fixed sum for a given income bracket above the wage base, so they may not have a stabilization role.

6. The role of emergency unemployment insurance during the Great Recession

6.1 Unemployment insurance in the United States

The US system of unemployment insurance is a joint federal-state program that provides direct support to eligible workers to sustain their income during a spell of unemployment. The overall objectives of the program are: to provide workers who lose their jobs with partial wage replacement, to help maintain purchasing power and provide macroeconomic stabilization, and to prevent dispersal of the trained labor force by promoting reemployment. The only con-dition that the states have to fulfil is to have an unemployment benefit scheme in place, but large differences exist in terms of coverage, replacement rates, and generosity of the bene-fits (Fischer 2017).

Under the Federal Unemployment Tax Act (FUTA), the tax rate on employers is 6 percent on the first $7,000 of each worker's annual wage. However, states that are compliant with all federal rules can lower this rate to a minimum of 0.6 percent, which finances administrative costs and the federal share of the extended benefit program (Whittaker and Isaacs 2016).

The extended benefit program is triggered under specific conditions that are linked to an increase in the unemployment rate above certain thresholds, which provides 13 additional weeks of benefits on top of the standard 26 weeks. There are several layers of extended benefits, each triggered by a higher threshold; some of these extensions are mandatory, others are voluntary for the state.

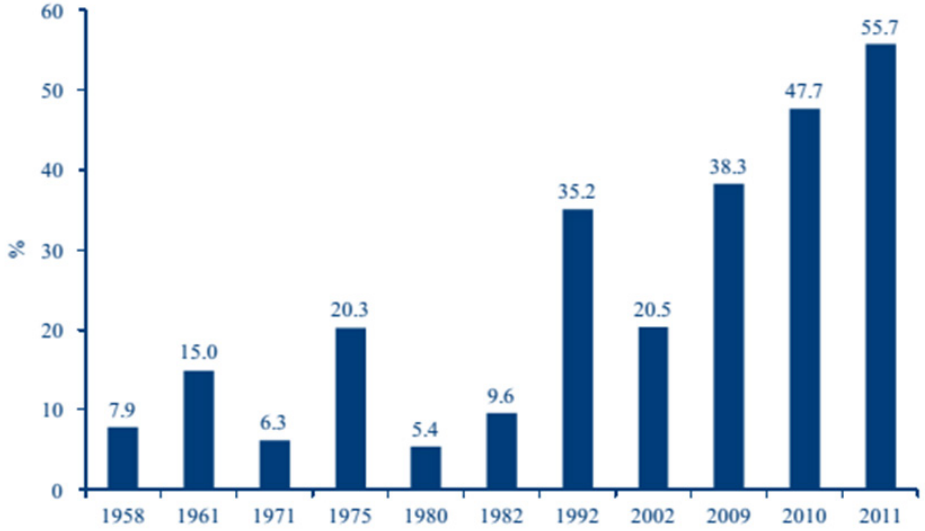
Interestingly, while in principle the extended benefit program is jointly paid for at the state and the federal level, in practice during the deepest recessions the federal level contributes more and the system leads to permanent transfers. As an illustration of this fact, O'Leary (2013) shows that the federal share of the total unemployment benefit cost increases enormously during the deepest recessions. This happens because under the extended benefit program, if a state unemployment benefit scheme is underfunded and cannot afford the full coverage, the state can borrow from the federal level; the borrowing then should be paid back in two years, otherwise the compulsory federal tax rate of 0.6 percent under the FUTA can be increased by 0.03 percent.

As Fischer (2017) notes, this incentive is extremely weak to prevent moral hazard, so that states have a clear preference for keeping the unemployment scheme underfunded by maintaining a low tax rate so as to avoid relocations of companies to other states. This actually leads to the key rationale for having an unemployment scheme at the highest level of govern-ment in a federation: higher mobility of capital than labor implies the likelihood of a race to the bottom among states on corporate tax rates, and either lower standards for protection of the unemployed or structural underfunding.

Vroman (2010) analyzed the stabilization effect of UI in the US during 2007–10 and found that both regular and extended benefits had a multiplier effect of 2.0. The stabilizing effect of the regular UI program estimated by Vroman was about one-tenth of the real GDP shortfall caused by the 2007 recession. For the three separate components of UI, the proportional gap-closing effects of the program during 2008Q3–2010Q2 were as follows: increased regular UI benefits = 0.105; extended benefits = 0.085; and increased UI taxes = –0.007. On average, the UI program closed 0.183 of the gap in real GDP caused by the recession. For this

recession, the UI program has provided stronger stabilization of real output than in many past recessions.

Figure 5: The Federal Share of Total UI Benefit Cost in Previous Recessions and in the Great Recession



Source: O'Leary (2013)

Moreover, during the Great Recession, the US federal government launched an additional program in July 2008, Emergency Unemployment Compensation (EUC08), which ended in December 2013 (Whittaker and Isaacs 2016). This is one of the most relevant discretionary actions taken by the US federal government to counteract the effect of the shock caused by the Great Recession. We will therefore try to assess the net stabilization effect of this program, both in terms of interstate risk sharing and of common intertemporal stabilization.

6.2. The Role of the Emergency Unemployment Compensation (EUC08)

The conventional channels of measuring the degree of risk sharing through federal support to states through personal transfer receipts do not separate out the role of ad hoc measures that were enacted as a response to the Great Recession. In particular, one of the most important policy actions taken by the US federal government to counteract the big shock caused by the Great Recession was the ARRA of 2009. The ARRA mandated full federal support to the extended benefit unemployment program (which is available when a state is experiencing a sharp rise in unemployment); unfortunately data on personal receipts for this particular program are not available.

The US Department of Labor, however, publishes data related to the EUC08 program, which was adopted in July 2008 and expired in December 2013. The EUC08 was a federally funded response to the common crisis shock across all states and as such represents an important instrument for macroeconomic stabilization through fiscal means.

In order to test the impact of the EUC08, we adapt regression (2) in the following way:

$$\Delta logGSI_t^i - \Delta logGSDI_t^i = \beta_{tr} * \Delta logGSP_t^i + \beta_{tri} * \Delta logGSP_t^i * \Delta logCl_t^i + u_{tr,t}^i \qquad (6)$$

where *Cl* represents the number of initial claims made from each state to the EUC08 program each year between 2008 and 2013. In this way, we measure the marginal impact of various cross-state fiscal stabilization items in interaction with the number of unemployed

people who were eligible to benefit from the EUC08 program, which is proxied by the number of successful initial claims per state. The rationale of this approach is to condition the amount of fiscal risk sharing on the degree of hardship that each state suffered as a result of the common shock. Note that regression (6) does not contain time fixed effects and thus measures the impact of common and asymmetric shocks together. In regression (2) we derived the stabilization effect against common shocks only by calculating the difference between the estimated coefficient in this regression and the one in the same regression with time fixed effects.

Table 3 shows the estimated coefficients of regression (6) and, in columns 5 and 6, the difference in coefficients when time fixed effects are included and excluded, so as to measure the fiscal stabilization effect against the common shock. As shown by the results, the total amount of risk sharing through federal-to-state revenue and expenditure items is influenced by the inclusion of an interactive term that captures the need for using the EUC08 program in each state. That interactive term is positive and statistically significant (0.43 in column 4, table 3) while the coefficient of fiscal risk sharing drops by close to 6 percentage points (when the number of initial EUC08 claims is evaluated at its average across 50 states between 2009 and 2013; see column 7, table 3). Note that the marginal effect of federal-to-state net transfers has to be evaluated at a particular level of the number of EUC08 claims that enter regression (6) in interaction with GSP. Therefore, a simple subtraction of the coefficient in column 2 from column 4 will not give the result reported in column 7.

The inclusion of the interactive term picks up the information contained in the number of initial claims to the EUC08 program (a proxy for state needs for additional support). Therefore this suggests that during the years that it was enacted by all fiscal channels, the impact of the emergency unemployment compensation was to change the smoothing of the common and idiosyncratic income shock for the average state by around 6 percentage points, i.e., this is the difference in the marginal impact of the change in GSP on the change of the left-hand side variable in equation (6) with and without interaction.

Table 3: Estimated Stabilization Effect of the Emergency Unemployment Compensation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Total federal to state net transfers	Total federal to state net transfers	Total federal to state net transfers	Total federal to state net transfers	Coefficient difference (2) minus (1)	Coefficient difference (4) minus (3)	Coefficient difference (4) minus (2)
						Evaluated at the average value of the EUC08 claims across 50 states between 2009 and 2013	
Coef.	0.10	0.21	0.10	0.13	0.12	0.05	-0.06
Std. Err.	0.01	0.08	0.01	0.07			
z	7.09	2.81	7.31	1.78			
P>|z|	0.00	0.01	0.00	0.08			
Coef. of the interaction term with EUC08 claims			-0.01	0.43			
Std. Err.			0.03	0.08			
z			-0.23	5.17			
P>|z|			0.82	0.00			
time FE	yes	no	yes	no			
No. of obs.	850	850	850	850			
Wald chi square	23861.78	7.91	24744.48	52.3			
P> chi square	0.00	0.00	0.00	0.00			

Notes: Prais-Winsten regression, correlated panels corrected standard errors (PCSEs); common AR(1) correlation among panels, 1998–2014, 50 US states.

This means that when the role of this crisis-induced policy measure is explicitly taken into account, the contribution of all other fiscal channels of cross-state risk sharing falls by 6 percentage points.

It is also noteworthy that dropping the time fixed effects, which in effect represents measuring total stabilization in response to common shocks and asymmetric shocks together, makes the coefficient change much less when the interactive term is included—5 percentage points versus almost 12 percentage points without the interactive term (see columns 5 and 6, table 3). This is a result of the EUC08 program being oriented toward common shocks, thus the interactive term picks up the response to common shocks and becomes positive and statistically significant (compare the coefficient of the interactive term in columns 3 and 4, table 3). These results prove the effectiveness of an ad hoc, contingent fiscal measure adopted by the US federal government in stabilizing the large common shock of the Great Recession among all 50 US states.

7. Conclusions

This paper shows that the US federal budget allows for several channels of fiscal stabilization, given its flexible structure and its capacity to borrow. In spite of not being designed to primarily perform macroeconomic stabilization, the combined structure of its revenue and expenditure sides allows for a significant degree of stabilization. With an average size of about 20 percent of GDP over the period considered, it is able to stabilize about 21 percent of macroeconomic shocks through its system of federal-to-state net transfers, including interstate stabilization of asymmetric shocks (about 10 percent) and intertemporal stabilization of common shocks (about 11 percent).

Different items in the federal budget have different stabilization properties, independent of their size; for example, the corporate income tax represents a small item in the budget (1.7 percent of GDP), but provides the largest stabilization effect (5 percent of shock smoothed). On the one side, Social Security benefits, federal personal income taxes, and medical benefits from the federal government are the most effective items for interstate risk sharing, i.e., stabilizing against asymmetric shocks; on the other side, federal corporate income taxes are the most effective item for providing intertemporal stabilization against common shocks, and their small size implies they are also one of the most efficient ways to provide stabilization.

The joint federal-state program of unemployment insurance, in spite of being permanently underfinanced in its state-level component and being prone to moral hazard at the state level, was able to provide very significant intertemporal stabilization during the Great Recession, mainly for its capacity to address common shocks.

While keeping in mind the specific features of the EMU, a monetary union where the option of fiscal transfers is constrained by the lack of a political union and the challenge of effectively eliminating moral hazard, this work can inform the policy debate and provide some insights for fiscal integration in monetary unions. To the extent that the experience of an economic and monetary union that is also a full federation and political union (such as the US) can be a reference, these findings suggest that channels of fiscal stabilization through the federal budget are relevant. In particular, there is a case for addressing both common and asymmetric shocks, but the instruments chosen have different impacts on the capacity to address these distinct stabilization needs.

It is worth highlighting that the structure of the federal budget, and in particular the composition of its revenue and expenditure sides, can greatly determine its stabilization capacity. On the revenue side, corporate income taxes collected at the federal level are the single most effective and also most efficient item for providing stabilization, given that even with a smaller size than other items they can provide more important effects, mainly against common shocks. On the expenditure side, the most effective item for achieving stabilization against asymmetric shocks is Social Security benefits. Even a small budget could maximize its stabilization potential by collecting corporate income taxes at the federal level to then pay benefits to individuals in the form of an unemployment benefit. This is consistent with the idea that fiscal capacity can maximize its stabilization effect by bridging the gap between the mobility of capital and the mobility of labor.

If instead a specific and contingent stabilization function is considered, the discretionary program of extended unemployment benefits, mainly funded by the US federal budget and supported by the borrowing capacity of the federal government, proves a powerful example of a timely and effective stabilization instrument.

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APPENDIX I: TESTING THE PANEL DATA ERROR STRUCTURE FOR SERIAL CORRELATION WITHIN PANELS AND HETEROSKEDASTICITY ACROSS PANELS

We run a test for serial correlation in the idiosyncratic errors of the model discussed by Wooldridge (2002). Serial correlation in the disturbances can bias the standard errors and decrease efficiency. Under the null hypothesis of no serial correlation of the errors, the residuals from the regression of the first-differenced variables should have an autocorrelation of –0.5. This implies that the coefficient on the lagged residuals in a regression of the lagged residuals on the current residuals should be –0.5. We perform a Wald test on this hypothesis. The results are shown below.

Table A1: Results of Tests for Serial Correlation of the Errors Following Wooldridge (2002)

regression	F_stat	p_value
Factor income	3.000235	0.0895
Fiscal transfers	449.8988	0.0000
Savings	0.145896	0.7041
Not smoothed	10.19471	0.0025
Federal grants	1.968605	0.1669
Social security benefits	2.85255	0.0976
Medical benefits	2.524541	0.1185
Supplementary income	1.30499	0.2589
Other income	44.77779	0.0000
Federal personal income taxes	77.18298	0.0000
Federal corporate income taxes	0.238738	0.6273
Social security contributions	50.75515	0.0000
Federal excise taxes	12.26415	0.0010
Other federal to state net transfers	45.12367	0.0000

Note: H0: no serial correlation.

As is evident from table A1, there five cases where fiscal breakdown regressions could be run without correction of serial correlation of errors within panels: federal grants, Social Security benefits, medical benefits, supplementary income, and corporate income taxes.

In addition, we also run a test of error variance that is specific for each cross-sectional unit (in our case, each state). There is relatively strong evidence of some form of heteroskedasticity among panels, as the 50 states differ widely in their geographic and socioeconomic characteristics. This is confirmed in the following table, which shows results from a modified Wald statistic for group-wise heteroskedasticity in the residuals.

Table A2: Results of Tests for Heteroskedasticity of the Errors Following Greene (2000)

regression	chi_sq_stat	p_value
Factor income	670.1313	0.0000
Fiscal transfers	4275.108	0.0000
Savings	708.3031	0.0000
Not smoothed	249.0879	0.0000
Federal grants	4823.991	0.0000
Social security benefits	898.968	0.0000
Medical benefits	490.3971	0.0000
Supplementary income	4671.803	0.0000
Other income	76427.39	0.0000
Federal personal income taxes	1682.152	0.0000
Federal corporate income taxes	945.2385	0.0000
Social security contributions	3057.661	0.0000
Federal excise taxes	162.5565	0.0000
Other federal to state net transfers	11882.02	0.0000

Note: H0: homoskedasticity of errors.

In response to the performed test, table A3 shows results from estimations of those regressions in equation (5) that have shown no serial correlation, alternatively assuming serial correlation and no serial correlation among errors in order to compare the results.

Table A3: Estimated Results with Time Fixed Effects: Asymmetric Shocks Only, With and Without Correction of Serial Correlation among Errors

Regression	Federal grants	Federal grants	Social Security benefits	Social Security benefits	Medical benefits	Medical benefits	Supplementary income	Supplementary income	Federal corporate income taxes
Coef.	0.018389	0.018656	0.02758	0.026924	0.021646	0.021588	0.005912	0.005958	-0.0045921
Std.Err.	0.009509	0.009874	0.003268	0.003261	0.002396	0.002394	0.001805	0.001796	0.0009726
z	1.93	1.89	8.44	8.26	9.03	9.02	3.27	3.32	-4.72
P>|z|	0.0531	0.0588	0	0	0	0	0.0011	0.0009	0
N	850	850	850	850	850	850	850	850	850
serial correlation of errors	yes	no	yes	no	yes	no	yes	no	yes
time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
chi2	5340.88	4799.514	2754.344	2642.841	762.5436	757.8176	1041.215	1049.341	12251.186
p> chi sq	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note: Prais-Winsten regressions, correlated panels corrected standard errors (PCSEs), 1998–2014, 50 US states.

Standard errors do not differ dramatically and, as a result, we decided to proceed with all regressions by correcting for autocorrelation of errors.