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Designing a Permanent EU-Wide Stabilization Facility

Abstract

While the EU recovery plan provides a useful step in alleviating the economic effects of the coronavirus crisis and achieving further European integration, a permanent fiscal stabilization capacity dealing with major crises is still missing. Such a EU-wide stabilization function would be in accordance with the subsidiarity principle, enshrined in the Treaty of Maastricht, as the risk-sharing that it provides can only be conducted at the supranational level. We envisage a mechanism to semi-automatically respond to region- and country-specific shocks via a central fiscal stabilization fund (CFSF). A simple model incorporating hysteresis, cross-border externalities and moral hazard, is deployed to illustrate the optimal responses of the CFSF to these shocks. A well-designed CFSF has the potential to improving welfare not only in crisis-hit member countries, but also in the union as a whole.

JEL-Codes: E320, E620, E630.

Keywords: subsidiarity principle, shocks, fiscal stabilization, transfers, European Union, corona.

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I. Introduction

Since its creation, the European Union has faced two shocks extraordinary in scope, magnitude, and repercussions. The Global Financial Crisis (GFC) and the recent Coronavirus Crisis (CC) imposed the most severe tests onto the resilience of the EU. The Union coped with mixed results with both crises – albeit advancing on a learning curve by the second crisis – which exposed the weakest building blocks of the EU architecture, namely, a limited capacity to deal in a timely manner with major exogenous shocks affecting multiple member countries, while relying excessively on a large, indefinite and dysfunctional monetary expansion.

In general, federal and quasi-federal systems, consisting of partly or mostly decentralized fiscal policymaking under a unified monetary regime, need to contain the damage to subnational jurisdictions from major symmetric and asymmetric shocks with commensurate and timely resources. At the same time, it is necessary to design effective safeguards against moral hazard at subnational levels of government and thus avoid the proliferation of free-rider behavior. To this end, the Treaty of Maastricht prescribes the subsidiarity and no-bailout principles, respectively. Yet institutional limitations and ad hoc application of these guiding principles reveal an apparent internal conflict between the two that undermines an effective mechanism to deal with unanticipated EU-wide exogenous shocks.

The purpose of this paper is to learn from the EU experience with the GFC and the CC, with a view to outlining the design of an effective EU-wide central stabilization facility in line with the Treaty of Maastricht.[2] The remainder of this paper is structured as follows. The second section reviews the relevant institutional context in the light of the subsidiarity and no-bailout principles. Against this background, the third and the fourth sections highlight the fitful application of the principles before and during each crisis. The fifth discusses possible lessons derived from the US experience relevant for the EU. Drawing from the EU and US track record, the sixth section explores ingredients for further institution-building to help contain major area-wide exogenous shocks and cyclical fluctuations and to complement a countercyclical discretionary policy stance – in addition to the effect of automatic stabilizers – at the national level. Section seven develops a simple theoretical framework to evaluate the proposal and possible alternatives, as against a stylized baseline for the euro area. The final section concludes the paper.

[2] Establishment of a central countercyclical facility, on the basis of the Treaty's subsidiarity principle, was proposed by Kopits (2017a) in a seminar at Federal Ministry of Finance held October 2014 in Berlin; at the time, Ministry officials responded that implementation of such a facility would have been premature. Similar proposals can be found in European Fiscal Board (2017, 2018), Arnold and others (2018), Buti and Carnot (2018) and Beetsma and others (2021). For further support for a permanent facility, see European Central Bank (2020).

II. Principles and institutions

According to the *principle of subsidiarity*, along with the companion *principle of proportionality*, enshrined in the Treaty of Maastricht (reaffirmed in the Treaties of Amsterdam and Lisbon),[3] each government function should be located at the lowest jurisdiction where it can be performed most efficiently, without externalities to other jurisdictions. Concomitantly, the Union assumes functions with cross-border repercussions, if such functions are exercised in proportion with the objective of each function.

Typically, municipal and local jurisdictions are in charge of police protection, sanitation, and primary education. Most other functions, such as higher education, health care, and social assistance are shared between subnational and national governments. At higher levels, both national and supranational EU authorities have a subsidiary role in designing and enforcing a range of regulatory responsibilities (environment, safety, banking, etc.) with significant externalities. Rather specifically, single-market regulations, including associated mandates (trade policy, competition, and a limited degree of tax harmonization) are delegated to the tutelage of the European Commission. In the areas of foreign affairs and security issues, the Union has been assigned an increasing, albeit still modest, role. Among these functions, the Treaty envisages eventual implementation of common foreign, security, and defense policies.

As regards macroeconomic policies, the EU institutions have had an evolving, yet uneven, set of functions. Notably, the European Central Bank (ECB) is solely responsible for monetary policy within the euro area, which eventually all member countries (except Denmark under the opt-out) are expected to join. In fact, until the GFC, monetary policy has been the single Euro-wide instrument of macroeconomic stabilization to complement the conduct of national fiscal policy, constrained by the Stability and Growth Pact (SGP). Since then, considerable progress has been made toward establishing a macro-prudential framework to ensure financial stability, under the authority of the ECB, consisting of unified banking regulations (including countercyclical capital adequacy ratios), supervision (including periodic stress tests for large commercial banks operating across member countries), and resolution of banks facing insolvency.[4]

[3] The Treaty of Maastricht (Title I, Article B) declares that "The objectives of the Union shall be achieved… while respecting the principle of subsidiarity as defined in Article 3b of the Treaty establishing the European Community." The latter states: "In areas which do not fall within its exclusive competence, the Community shall take action in accordance with the principle of subsidiarity only if and insofar as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore by reason of the scale or effects of the proposed action be better achieved by the Community. Any action by the Community shall not go beyond what is necessary to achieve the objectives of this Treaty."

[4] The development of a common backstop via the European Stability Mechanism – besides its permanent remit as a facility to assist qualifying member countries in the context of a formal adjustment program – during the transitional phase in which the Single Resolution Fund is built up and the development of the

On the fiscal front, there have been relatively minor initiatives toward a common stabilization approach. The various schemes of financial assistance – in the context of a seven-year multiannual financial framework (MFF) – such as grants from the Structural Fund (SF), the Cohesion Fund (CF) or the Common Agricultural Policy (CAP), are targeted on the basis of certain criteria and earmarked for selected activities; likewise, the European Investment Bank (EIB) provides funding for multinational infrastructure projects. However, only the European Stability Mechanism (ESM), established in the wake of the GFC, can be regarded as a vehicle of stabilization for member countries facing a payments crisis. The ESM is intended to provide funding subject to conditionality in the form of adjustment reform measures – modelled after standby arrangements with the IMF.

Prominent in the Treaty of Maastricht (reaffirmed in the Treaty of Lisbon) is an explicitly stated *no-bailout clause*, which rules out any intra-EU financial rescue, or assumption of liabilities, of a member country.[5] The motivation for this clause is to deter member countries from financial indiscipline and dampen moral hazard, including that induced by the subsidiarity principle. In the strictest sense, the no-bailout clause can be defined as prohibition of any EU fiscal transfer (including direct support from any member government) to a member government in any circumstance. Under a more realistic interpretation, financial assistance to a member government is permissible in the risk of a potential sovereign default, subject to conditionality as required for qualifying for ESM lending. [6] Access to SF or CF grants requires a prescribed government contribution under the so-called additionality principle.

Further, the purpose of the SGP, created under the Treaty of Maastricht, is to promote fiscal discipline and avoid excessive indebtedness by member governments at the detriment of fiscally more conservative member governments. The fiscal rules prescribed under the Pact, which have evolved over time, are supposed to play both preventive and dissuasive roles to obviate permanently a bailout from consideration. The preventive arm aims at monitoring budgetary positions over the medium term through the stability and convergence programs submitted by member governments, with the support of national independent fiscal institutions and the recently established European Fiscal Board (EFB). The dissuasive arm provides the Excess

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European Deposit Insurance Scheme (EDIS), on which no concrete progress has been made to date, would complete the Banking Union.

[5] The Treaty of Lisbon (Article 125) states: "The Union shall not be liable for or assume the commitments of central governments, regional, local or other public authorities, other bodies governed by public law, or public undertakings of any Member State… "

[6] Contrary to the journalistic misuse of the term – encompassing any form of financial rescue operation, including under IMF standby arrangements – a bailout consists only of an unconditional budgetary transfer, as for example in the case of central government transfers to insolvent local governments mandated by the German constitutional court.

Deficit Procedure (EDP) for the correction of budget deficits incurred in excess over the statutory limit. Failure to comply with the EDP – without a waiver due a contraction in activity – is subject to financial sanctions, which in fact were never imposed.[7] Whereas the fiscal policy rules under the Pact were fairly well designed, in practice they performed poorly in implementation , even after series of revisions.[8]

On the face of it, the subsidiarity and the no-bailout principles may be incompatible as they are framed in the Treaty and embodied in a wide range of institutional arrangements. Whereas the former is intended to facilitate collective action to assist member countries in functions that are beyond their reach, the latter is meant to prevent any assistance that encourages free-rider behavior as collateral damage. Without questioning the justification of each principle in the context of the theory of fiscal federalism, let us examine the practical application of each principle, as well as the adequacy of institutions, for the purpose of macroeconomic stabilization, as illustrated by the management of the GFC and CC, the most severe shocks suffered directly or indirectly by EU member countries so far.

III. Coping with the Global Financial Crisis[9]

From the very start of implementation, the EU macroeconomic policy framework revealed significant weaknesses particularly in the euro area. The SGP suffered an erosion of credibility in several member countries: insufficient ownership by political leaders; pro-cyclical expansionary fiscal stance financed with windfall gains from the sharp interest rate decline due to the vanishing currency risk; non-observance of stability or convergence programs; and questionable effectiveness of the no-bailout clause. [10]

Indeed, widespread violation of the SGP, including by France and Germany, without the imposition of penalties by the European Council (rejecting the recommendation by the European

[7] Sinn (2018) documents 121 violations of the SGP deficit limit in member countries, unjustified by escape clauses.

[8] The rules met rather well most criteria of design (definition, transparency, flexibility, adequacy, consistency, efficiency), but scored rather poorly on enforceability and simplicity; see Kopits (2018). However, this does not exclude that they may have had some disciplining effect on fiscal policies, although such an effect is difficult to measure, because the counterfactual is not available.

[9] Actually, in Europe the GFC had manifested itself in closely interrelated crises undermining financial stability on the hand and sovereign debt sustainability on the other. For presentational convenience and analytical simplicity, here the two crises are discussed under the same heading.

[10] See the evidence in Kopits (2017b).

Commission), contributed to moral hazard by member governments as well as in the financial markets. Moral hazard was exacerbated in a circular fashion by the ECB's open-market operations in rating uniformly all sovereign bonds issued within the euro area as riskless collateral,[11] echoing the favourable rating in the markets reflected in near-zero risk premia on such bonds, which in turn emulated the ECB's own rating – regardless of significant intercountry differences in public debt-to-GDP ratios. In addition, the ECB's Target settlement mechanism, permitting an indefinite accumulation of external imbalances by some member countries through the crisis, has been viewed as a channel for a backdoor bailout.[12]

EU-wide application of the subsidiarity principle was absent not only in collective macro-fiscal stabilization, but also in a unified macroprudential regulation. In fact, uneven and lax banking regulation at the national level contributed to the onset of the financial crisis in peripheral member countries and to its propagation throughout the Union. This eventually aggravated public debt sustainability risk within a doom loop between governments and banks.[13] Governments were called upon to bail out banks; banks in turn were encouraged to expand their holdings of national government paper in their balanced sheets, already impaired due to sharp deleveraging and mounting default on liabilities by households and businesses in distress. The ECB was the only institution that assumed the role of a first responder by easing monetary policy within the euro area, though with limited effectiveness. Overall, these conditions rendered the EU membership distinctly vulnerable to the exogenous shock emanating from the financial system under severe stress across the Atlantic.

Initially, each member government was left to its own devices to contain the crisis.[14] But unable to avoid a sudden stop and loss of access to financial markets, Greece, Ireland and Portugal sought assistance from the IMF which paved the way to adjustment programs[15] with participation of the Commission and the ECB, which together exercised joint tutelage as the so-called Troika. The initial unwillingness to restructure Greece's public liabilities – especially to protect the exposure of French and German banks – and the onerous conditionality (including

[11] The risks of this approach were first observed by Buiter and Siebert (2005).

[12] Sinn (2014) examines critically this practice.

[13] Farhi and Tirole (2018) provide a detailed analysis of the mutually amplified lethal embrace between sovereigns and banks during the crisis.

[14] The European Economic Recovery Program of 2009 was an ad-hoc common expansion in response to the GFC, which needs to be distinguished from our proposed stabilization capacity.

[15] For an assessment of the IMF's involvement in the design and implementation of these programs, conducted by a team of the IMF Independent Evaluation Office, see Kopits (2016) on the fiscal policy aspects and Veron (2016) on the financial policy aspects.

limits on the operation of automatic stabilizers) imposed by the Troika, while providing some financial assistance under the programs, was a belated ad hoc application of both the no-bailout and subsidiarity principles. It was in partial recognition of the failure to have an appropriate, timely and orderly response to the crisis, and in an attempt to prevent future crises, that the ESM was established and initial steps were taken toward the formation of a banking union.

As an upshot, in the wake of the crisis, the ECB launched massive non-conventional quantitative easing to forestall the risk of deflation. The expansionary monetary stance prevailed well into the post-crisis period to restore financial intermediation and alleviate the hysteresis evidenced by lacklustre growth prospects. In broad terms, the interplay of macroeconomic policies shifted from *monetary dominance* in most member countries – as their fiscal stance was supposed to be aligned with the ECB's implicit inflation-targeting regime – before the crisis to some *fiscal dominance* at the start of the crisis,[16] but eventually to *financial dominance* as the monetary and fiscal authorities prioritized the recovery of the banking sector over their own conventional policy goals.

IV. Coping with the Coronavirus Crisis

The GFC was a relatively straightforward occurrence that had begun in the international interconnected financial system, which, in combination with fiscal vulnerability, resulted in a contraction on the demand side of the economy. By comparison, the CC has been far more complex, rooted in a pandemic. This created and amplified shock waves through both demand and supply channels, depressing activity and income levels worldwide.[17] Apart from such differences between the crises, the initial reaction consisted in a familiar inward-looking policy response, securing the availability of medical services and equipment within each country's borders and erecting barriers to exporting to the rest of the Union – contrary to the most elementary interpretation of the subsidiarity principle.

Lacking a collective fiscal mechanism of defense, each member government faced an immediate revenue loss and a rise in spending needs, assisted by the effect of automatic stabilizers, which provided meagre fiscal backstop to the contraction in output. Unlike during the GFC, highly indebted member governments were not prevented from adopting a countercyclical expansionary

[16] See estimates of the fiscal implications of the ECB's nonconventional monetary policy in Orphanides (2017).

[17] Fornaro and Wolf (2020) apply a simple new Keynesian model to capture the macroeconomic effects of the virus. Additional studies can be found in Baldwin and Weder (2020).

fiscal stance through discretionary spending measures – taking advantage of the SGP escape clause triggered by the extraordinary contraction.

At the Union level, however, monetary policy and recently adopted macroprudential tools were alone in alleviating the shock through stepped-up and new asset purchase programs and a temporary cut in the capital adequacy ratios for banks.[18] Yet excessive and indefinite reliance on quantitative easing in the form of massive purchases of sovereign bonds – depressing risk premia thereon[19] – cannot be distinguished from outright monetization of government deficits, clearly a dysfunctional use of monetary policy, violating the spirit of the Treaty. Moreover, the apparent "picking and choosing" winners and champions among sectors or corporations through dedicated bond purchases (for example, so-called "green bonds") by the ECB lies beyond the scope of central banking and can be questioned on allocative efficiency grounds.

In an improvised initiative, led by major member governments, a recovery plan has been launched following a protracted internal negotiation between governments that favor the subsidiarity principle and those that express concern about moral hazard. The plan represents an unprecedented step from a collection of uncoordinated national measures toward a unified response to the severe virus-induced contraction, in terms of a fiscal expansion financed with pooled resources from member governments. Following consensus on its principal features by the EU Council, the plan is subject to approval by the European Parliament. The final product, named 'Next Generation EU' (essentially a fund the bulk of which is the Recovery and Resilience Facility), is likely to be a compromise of sorts as regards scale, timing, allocation, composition, conditionality, and financing. [20]

The magnitude of the fund under the plan seems modest relative to the contraction in output. Extended over the first three years of the forthcoming seven-year Multiannual Financial Framework (MFF), the fund fails to provide timely financial assistance to the hardest-hit member countries. Allocation of assistance among member countries is expected to be calibrated according to lagged national indicators of need (population, unemployment, output loss, etc.) [21] instead of real-time high-frequency regional indicators. Disbursements from the fund are

[18] Purchases via the public sector purchase program (PSPP) were in fact already restarted shortly before the CC. In addition, the ECB set up a new asset purchase program, the Pandemic Emergency Purchase Program (PEPP).

[19] See Perotti (2020) on the effects of the crisis on financial stability and the effects of the monetary response.

[20] See the initial report on the formal proposal of a recovery fund in European Commission (2020), followed by the agreed version among member states in European Council (2020).

[21] See the allocation criteria and country breakdown recommended by the Commission and approved by the Council in Darvas (2020).

comprised of a mix of grants, guarantees, and loans – the latter adding to the recipient country's indebtedness. The fund provides one-off assistance limited primarily to investment spending, disregarding other useful purposes such as manpower training. More important, it fails to meet the need for a permanent EU-wide fiscal stabilization scheme to be triggered in the event of future unanticipated exogenous shocks. Access to the fund is contingent on the recipient government's commitment to implementing growth-enhancing structural measures – and possibly to respecting the rule of law – albeit so far without a well-defined oversight procedure by the Council or the Commission. The fund is to be financed with the issuance of special-purpose euro bonds, possibly supplemented with earmarked union-wide tax revenues from new resources (such as digital taxation and import carbon taxation) yet to be developed.

Apparently, the recovery plan is short of distinguishing innovations, which would set it apart from existing facilities and would make it suitable as an EU-wide vehicle of stabilization. The fund is nested in the MFF, lacking flexibility to be activated in the event of a sudden unanticipated shock. It resembles the Structural Funds or Cohesion Funds, failing to distinguish cyclical from structural indicators of unemployment, activity, and income levels of member countries. In addition, it seems to borrow features from the ESM in terms of lending conditional on structural policy measures and, in a favourable respect, from the EIB in terms of bond financing.

V. Relevant lessons from the United States

The policy tradeoff in applying the subsidiarity principle and the no-bailout principle faced by the EU in tackling the economic consequences of the current corona crisis arises to a greater or lesser extent in most federal or quasi-federal systems, including those with well-established practices. Nevertheless, the comparability between such a system in other countries with the EU is occasionally questioned because the EU central budget is insignificant. For instance, in the US, the share of the federal budget (including defense, infrastructure, public pensions, and other social entitlements) reaches nearly two thirds of consolidated general government expenditures. However, given their earmarked nature, that share of the budget can be utilized to a limited extent for discretionary countercyclical purposes – beyond the countrywide effect of automatic stabilizers. Also, typically, cross-state-border fiscal transfers account for less than one-tenth for the stabilization of output shocks in the US.[22]

[22] According to estimates by the European Commission (2016), cross-border fiscal transfers average 8 % of smoothed output shocks; the other components include 45 % in cross-border factor incomes, 27 % through the credit markets, while 18 % remains unsmoothed in the US. By contrast, in the euro area, 18 % of the contribution to stabilization of shocks occurs through the credit markets and practically nothing through fiscal transfers and factor incomes, while 75 % of the output shocks are not stabilized at all. A key implication of this finding is that short of a closer integration of labor and financial markets, the EU needs to assign a far greater role to a central fiscal capacity to fend off the effects of exogenous shocks.

In any event, the resemblance of intergovernmental tensions in coping with the coronavirus and its aftermath within the EU and the US is remarkable in several respects, and possibly of some relevance for the EU. The US, comprised of a mature federal structure, admittedly demonstrates a more advanced application of the subsidiarity principle, as evidenced by common monetary, defense, foreign and environmental policies, as well as macroeconomic fiscal stabilization. Although a rational allocation of governmental functions and resources has evolved over more than two hundred years, the state and local governments have been at loggerheads with the central government over the division of responsibilities in coping with the present crisis.

Concern about moral hazard regarding US state governments dates to the early 19th century. Following the mutualization of debt overhang inherited by the states from the revolutionary war, state governments abused periodic federal bailouts of their fiscal profligacy. But by the 1840s, the US Congress refused any further bailouts – in what became a strictly observed implicit no-bailout clause, whereby nearly all states adopted a constitutional current budget balance rule (the so-called golden rule), to regain access to the international bond market.[23] Increasingly, over recent decades, some states had nominally complied with the rule by granting to their employees future pension and healthcare benefits instead of wage increases, thereby raising their debt sustainability risk.

Against this backdrop, a major partisan split emerged within Congress between those members who proposed a fiscal package that included a sizable rescue for states and municipalities and those – supported by the President – who resisted the proposal. The latter argued that states and municipalities currently facing severe fiscal stress should go bankrupt, on grounds that in the past they indulged in fiscal profligacy. However, the bankruptcy option is not available for the state governments by virtue of their constitutionally guaranteed status of fiscal sovereignty.[24] The counterargument, much like in the case of EU member states, is that the crisis occurred beyond their control and calls for application of the subsidiarity principle.

Since the central government has been fitful and slow in providing financial and medical assistance to the states from contingency reserves and procurement channels,[25] the Fed felt obliged to act in extending quantitative easing to purchases of state and municipal bonds, albeit

[23] See Henning and Kessler (2012) for a historical summary of the US federal system.

[24] Under the Eleventh Amendment of the US Constitution, the states are immune from bankruptcy. Only local governments (municipalities and counties) have access to Chapter 9 of the Bankruptcy Code. As Puerto Rico is neither a state nor a municipality, Congress had to enact special legislation to manage its recent default.

[25] As interpreted in general, the no-bailout principle does not preclude immediate federal emergency assistance by FEMA to a state or local government to relieve the impact of a natural disaster, such as floods, fire, hurricanes, or earthquakes – following an official declaration of emergency status.

through indirect channels, disregarding all precedent. A drawback of such fiscal framework is that the golden rule allows states to borrow only to finance investment expenditures, at the exclusion of current spending. Furthermore, central bank support of state deficits can be questioned on grounds of monetizing state deficits and of allocative efficiency in earmarked lending.

Despite the highly politicized approach to dealing with the coronavirus in the US, we can draw some lessons of potential relevance for the EU debacle. First and foremost, under the current extraordinary shock, application of the subsidiarity principle, with appropriate safeguards, overrides the no-bailout clause. Second, the subsidiarity principle should elevate the union-wide stabilization function to the highest level of government, given the size and the direct externalities of shocks (whether symmetric or asymmetric) or of cyclical swings at lower level jurisdictions. Third, fiscal transfers should be targeted to lower level governments preferably in the form of grants rather than loans, insofar as those governments are subject to rules-based constraints and are committed to reform their economies where necessary. And fourth, as a vehicle for macroeconomic stabilization, monetary policy through earmarked lending to lower level governments is questionable on allocative efficiency grounds.

VI. A proposal for a permanent common fiscal stabilization facility

While EU policymakers are still busy combatting the coronavirus, it is important to look ahead and complete the EU's institutional infrastructure and governance so that it can cope with new crises that will no doubt come at some point, whether it is a new pandemic, a new financial crisis, a climate-related crisis or a crisis of some yet unknown type. In the past, crises were defining moments for the progress of European integration. The ESM and the initial steps toward a banking union resulted from the GFC – as indicated in Section III. It is possible that the EU Recovery Fund will develop into a permanent EU budget with its own resources and transfer programs, thereby enhancing the effect of national automatic stabilizers measures and contributing to the stabilization of the EU economy through discretionary countercyclical measures; thereby facilitating the stabilization of national economies relative to the aggregate. However, this development is likely to be nonlinear and it may take a long time to reach a widely satisfactory end point. In the meantime, there will be a need for an instrument that can provide immediate and adequate stabilization in the face of unanticipated shocks.[26] We propose a *permanent* central fiscal stabilization facility (henceforth: CFSF). How could it be designed?

[26] Among alternative options, De Grauwe and Ji (2016) suggest simply utilizing the ESM as a stabilization fund. The ESM would issue ESM-bonds in the market to purchase sovereign bonds from crisis-hit member countries; these operations would be reversed during a boom, so that there would be no net accumulation of bonds over the business cycle.

First, support should be concentrated at where it is most needed. To this end, it is useful to distinguish regional shocks, country-specific shocks that affect all the regions in a country, and EU-wide shocks that affect all the member countries. In addition, a common shock may propagate in different ways through countries or regions, with a differential impact across countries.[27] An example is the current CC, which has hit the Spanish economy relatively hard because of the size of the tourist industry with limited possibilities to work from home; similarly, certain manufacturing activities in Lombardy were hit harder than the rest of Italy, because of the large number of coronavirus cases detected there. As well, the diverse response of national and regional governments may have mitigated the crisis and its consequences in some countries, whereas in others it may have aggravated it even contributing to a second wave.

Second, disbursement of support should be semi-automatically triggered (see below) when certain threshold values for high-frequency real-time indicators are reached. These indicators should provide rapid information on an economy, enabling authorities to react quickly. Although the EU-level response to the corona crisis was faster than the response to the GFC, with the activation of the general escape clause of the SGP, the Support to mitigate Unemployment Risks in an Emergency (SURE), the availability of ESM loans under light conditionality and the EU Recovery Fund, all these response elements have been the result of discretionary action and negotiations on the side of the European Commission and the national governments, while the Recovery Fund still needs to be ratified. Discretion and negotiations during a crisis imply a loss of valuable time for action.

Examples of potentially useful real-time indicators are abrupt falls in energy use, a sudden steep increase in applications for unemployment benefits, steep drops in the number of financial transactions, and a sudden surge in medical emergencies and hospitalizations. These indicators can be monitored continuously and provide information almost in real time. However, the use of real-time indicators is not without complications. For example, seasonal patterns may disturb the information from real-time indicators. However, the informational value of such indicators can be expected to increase with the increased availability of data (that can also be used for cross-checking)[28] and their intensified analysis.

Concomitantly, only large exogenous shocks, above threshold values of the specified indicators, should trigger support. Smaller shocks, below those values, can in principle be dealt with at the national level. It is large shocks that may force governments to free up enough resources at the cost of foregoing regular spending or to secure additional funding in the financial markets. Moreover, while inaccuracies associated with real-time indicators are non-negligible, the size of

[27] Technically, we could view a common shock that propagates differently through regions, say, by a set of highly correlated regional shocks with different variances or alternatively as the sum of a common shock and a region-specific shock with a variance that may be allowed to differ across the regions.

[28] Concretely, based on real-time indicators a substantial drop in demand in Germany, say, can be inferred with more certainty if a similar development is observed for France.

the shock inferred from the indicators should be so large that, based on ex-post data revisions, there can be no doubt that the timely support was justified.

Third, what form should support from the CFSF take? There are two extremes: grants or loans issued at concessionary rates. In the latter case, the net financial benefit would be the difference between projected interest payments at the market rate minus the concessionary rate. Hence, the net financial benefit to the country receiving support would be relatively small, while the loan itself adds to the existing debt burden. Still, loans allow a country to overcome an immediate liquidity need when private parties may be increasingly reluctant to lend, except at a widening risk premium. Grants have the advantage that they do not add to the debt burden of the receiver. However, they require the CFSF to secure financing either with additional contributions from participating countries or with debt issuance in financial markets, or with revenue from EU-wide taxes. Both loans and grants may require conditionality based on reforms that enhance potential growth. This would raise the likelihood that a loan would be repaid or that the need for further future grants would be reduced.[29]

Fourth, the CFSF can be financed from different sources or some combination thereof. The required amount of financing might depend on whether support takes the form of grants or loans. In the case of loans, the required resources will depend on the estimated repayment likelihood and the degree to which the interest rate charged is concessionary. For starters, it is necessary to construct some estimate of the size and frequency of exogenous shocks that form the basis for support. Financing of the support can be obtained through regular contributions by member states.[30] As in the case of contributions to the MFF, these would typically be linked to national income: larger and richer countries would contribute more, while stabilizing their economy in response to a shock would generally also require more resources. A second source of funding could come from the EU's own resources with newly imposed taxes, such as a plastic waste tax, a carbon adjustment levy on imported energy and a digital tax. The third source would be a CFSF-bond issued to provide adequate stabilization in the event of a large shock or multiple

[29] The prospect of a better functioning economy would also lead private creditors to demand lower risk premia and speed up a return to the capital market.

[30] Consider a CFSF financed only with contributions from participating states. Suppose that countries contribute 0.25% of GDP each year and that a major EU-wide crisis occurs every 10 years. In that case 2.5% of GDP would be available for a single support action for the entire EU economy within a 10-year period, assuming that the support would be fully spent on a discretionary stimulus. This number, which merely illustrates an order of magnitude, ignores potential interest earnings on accumulated assets and potential changes in GDP. A 2.5% of GDP stimulus is already substantial, though unlikely to offset the output contraction due to the CC. If a severe shock is asymmetric across the EU, the support operation can be focused on those parts of the EU that are hit (hardest), and the degree of stabilization may be substantially larger.

shocks. The debt issued by the CFSF will then be serviced by future revenues. The financing of the CFSF cannot be seen independently of its position relative to other EU arrangements. At some moment in the future, when all EU countries participate, it could become a demarcated part of the MFF, though unlike the MFF, it must be sufficiently flexible for speedy authorization and disbursement.

Fifth, despite the semiautomatic character of disbursements, it is necessary to clearly define the authorization and disbursement process, as well as the authorities in charge of the CFSF. Following the logic under existing arrangements, the ECOFIN should be vested with the ultimate decision-making authority, supported by the opinion of the European Commission. Yet for the disbursements of funds to take place semi-automatically, it might be appropriate to appoint the EFB for making the technical case for disbursement on the basis of a significant fall in relevant real-time indicators below threshold values.[31] Given the fast-track determination by the EFB and advice of the European Commission, the ECOFIN decides by qualified majority vote on the proposal. Alternatively, a reverse qualified majority voting procedure would ensure that the proposal is accepted, unless a qualified majority votes against. Thus an observed drop in real-time indicators allows an independent estimate of the size (in terms of output loss) of the impact of an adverse shock on the EU economy, on national economies and on regions. Given the likely disparity across regions, the focus of the impact assessment should possibly be undertaken according to the "nomenclature of territorial units for statistics" (NUTS).[32]

Sixth, what form should the support take? There are several alternatives. One option is a general transfer to a country or region, as revealed by the real-time indicators. The advantage is that it offers the freedom for the recipient jurisdiction to tailor spending as it deems fit. But the receiver may prefer to spend the resources in a myopic way to maximize its popularity or to advance its own private interests. Hence, it may be more effective to earmark assistance spending for certain purposes, such as wage subsidies, for unemployment insurance or for retraining workers who have become unemployed by the shock.[33] A related question is through which level of government should the assistance be channelled. In principle, assistance should be concentrated towards areas hit hardest by the shock. This implies supporting local governments responsible for specific regions – identified under an appropriate NUTS level – rather than channelling resources to the central government of the recipient country. Supporting regions directly, of

[31] In the current institutional context, the EFB has proved to be better equipped than the Commission to exercise impartial and technical oversight of CFSF operations, given that, over time, the Commission has become increasingly political, as declared by former President Juncker.

[32] The NUTS, established by Eurostat for data harmonization purposes, has been used since 1988 for allocating Structural Funds.

[33] The survey experiment conducted by Beetsma and others (2020) suggests that respondents generally have a preference for earmarking assistance spending for certain specific causes, such as healthcare and education.

course, presupposes that the region has the capacity of allocating the transferred resources most efficiently.[34]

Seventh, to minimize moral hazard, support from the CFSF should be triggered only by exogenous shocks, whose nature, impact, and size are determined as discussed above. Examples are major natural disasters, accidents, epidemics and turbulence in the financial sector, including those originating outside the EU.[35] However, even when the original shock is exogenous, there may be a need for conditionality attached to support from the CFSF. More resilient economies featuring more flexible labour and product markets, or more ample fiscal space for discretionary action, are better placed to cope with exogenous shocks. Hence, conditionality reduces the need for further future support. Conditionality may need to be country-specific and should be targeted at those obstacles that hamper the economy's ability to absorb such exogenous shocks. Importantly, conditionality is not necessarily aimed at improving fiscal discipline in the short run, although in some instances that may be necessary. A major question concerns practical implementation, namely, whether it should involve a letter of intent that commits national authorities to undertake specific measures over a specified time period, subject to performance criteria that can be verified through objective indicators.

A priori it seems that a speedy disbursement of support in the case of a severe shock is difficult to reconcile with conditionality. However, annually, as part of the European Semester, countries submit their National Reform Programmes, the progress of which is monitored by the European Commission.[36] Hence, the state of progress and the Commission's reform recommendations could form the basis for the conditionality attached to the support. While those recommendations normally have no legal bite and deviating from them is without sanctions, they could become legally binding when countries apply for and receive support from the CFSF. Hence, the appropriate conditionality could be designed with little time loss.

[34] On the one hand, paying transfers directly to the regions in line with the severity of the shocks hitting them may result in a more efficient and equitable spending allocation than transfers to the central governments when these do not come with certain qualification, because the lobbying power of the regions may be unevenly distributed and the central government may have its own spending priorities. On the other hand, it is not clear that hard-hit regions have the capacity for conducting effective stabilization programs. In this regard, it may be noted that Structural Funds are not always fully used because of a lack of suitable projects. Moreover, the subsidiarity principle may actually call for national programs with direct cross-regional externalities, such as investments in infrastructure.

[36] For example, see https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester_en.

VII. An illustrative model

A simple model is presented to illustrate the operation and attributes of the proposed CFSF as applied to EU member countries each consisting of several regions hit by region-specific shocks. These shocks can have a component common to all regions, which captures an EU-wide shock, and/or a component common to all regions in a country, which captures a country-specific shock. In any case, the shocks have negative potential externalities beyond the initially affected country or region. There are two periods, allowing the effects of shocks to be spread over time. In addition, economies feature distortions. Reducing these distortions is politically costly, which may lead to moral hazard in implementing structural reforms. The model also allows for hysteresis effects of shocks to output and of cross-regional externalities from economic stabilization.

For analytical convenience, the model abstracts from certain elements that may be relevant in practice. In particular, it is assumed that the CFSF only gives support in the form of grants financed by proportionate national contributions. Absent financial markets, the CFSF does not borrow for on-lending to regions in trouble. Admittedly, moral hazard leads to an inadequate reduction in structural distortions, insofar as the support transfers are spent on specific interests or grand projects intended to boost the recipient government's prestige. To prevent or minimize such behaviour, it is assumed that the Commission monitors that the grants are allocated to economic stabilization and structural reform.

Specifically, there are in total N countries, each consisting of R regions. Income in region j of country i in periods t and $t+1$ is:

$$y_{ijt} = y^*_{ij} - z_{it} - \tau - \varepsilon_{ijt} + g_{ijt} - \delta(\bar{y}^* - \bar{y}_t), \quad \delta \geq 0, \tag{1}$$

$$y_{ij,t+1} = y^*_{ij} - \tau + \mu\left(y_{ijt} - y^*_{ij}\right), \quad 0 \leq \mu \leq 1, \tag{2}$$

where y^*_{ij} is the exogenous level of income in the absence of any distortions, shocks and policy actions – we henceforth refer to it as "non-distortionary income"; z_{it} are losses from inefficiencies and market distortions, which are common for all regions in country i; τ is a contribution to the CFSF – we assume that the contributions are equal in both periods; $\varepsilon_{ijt} > 0$ is a shock leading to a fall in income;[37] g_{ijt} is a transfer received from the CFSF; $\bar{y}_t$ is average

[37] We assume that ε_{ijt} is perfectly observable. We could allow for an overall income shock $\varepsilon_{ijt} + \varphi_{ijt}$, where ε_{ijt} is the real-time estimate of the shock hitting the region in period t, and φ_{ijt} is a mean-zero unobserved measurement error, capturing the imperfection in real-time estimation. But with the quadratic objective functions deployed below, the measurement error φ_{ijt} drops out of the first-order conditions and, hence, the optimal policy settings are not affected by its presence. Hence, in this model, even a small adverse observed shock ε_{ijt} would justify a transfer. However, in practice one reason for excluding

income over all regions in all countries; and $\bar{y}^*$ is the average of y_{ij}^* over all regions in all countries. The assumption behind a constant contribution τ over the two periods is made for tractability as well as realism – that is, not made conditional on the state of the aggregate economy. Alternatively, if the aggregate macroeconomic situation (i.e., the average across all regions over all countries) is unfavorable, it would be optimal to reduce the contribution in period t and raise it in period $t+1$. Parameter δ in (1) captures the intensity of cross-border externalities.[38] If average income falls short of $\bar{y}^*$, this has a negative effect on all the regions. Such negative externalities can originate in reductions in trade, for example. Notably, by implication, if the value of δ collapses to zero, these externalities vanish. [39]

No income shocks are assumed in period $t+1$. Economic activity in this last period is in two ways connected to the preceding period. First, we allow for hysteresis effects, which may arise either from a loss of skills during unemployment, or from an erosion of the capital stock, or from both, as a result of the shock. These are present when $\mu > 0$. The other link between the two periods is the intertemporal budget constraint of the CFSF. We assume that the interest rate is zero and that all the regions are equally sized. Hence,

$$\tau = \bar{g}_t/2, \qquad (3)$$

European Commission's and governments' objectives

The European Commission operates the CFSF and establishes, through consultation with relevant EU institutions (Eurostat, EFB) and national institutions (national governments, independent fiscal councils, statistical bureaus), the magnitude of the shocks hitting the regions. It then makes a proposal on the transfers to the individual regions, to be confirmed in a vote in the ECOFIN. The resulting set of transfers determines the contributions via the budget constraint of the CFSF. The proposed package is set so as to minimize over the set of g_{ijt} the sum over the

transfers based on small shocks is that the costs of operating the transfer system are too high in relation to its benefits. Moreover, small shocks are not likely to have significant externalities and should be offset with discretionary countercyclical stimulus at the national level. Another reason is that it is not practically possible to incorporate the frequent responses to small shocks in the decision process. Finally, the losses resulting from moral hazard may only be justified in the case of large shocks.

[38] For simplicity, parameter δ is assumed to capture an equivalent negative externality of an adverse shock and positive externality of the offsetting transfer.

[39] Arguably, absent externalities across jurisdictions, transfers from the CFSF may be questionable according to the subsidiarity principle, especially insofar as the shock is the result of moral hazard and endogenous to the member country. Otherwise, if the region-specific shock (such as a local earthquake) is exogenous, the Commission may decide on an *ad hoc* one-off transfer. In any event, the downturn in activity may be offset with a local discretionary countercyclical fiscal stance – as permitted by suspension of the deficit reference value under the corresponding waiver.

regions of the quadratic deviations of actual from non-distortionary income in each of the two periods:

$$\frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{R}\left[\left(y_{ij}^{*}-y_{ijt}\right)^{2}+\beta\left(y_{ij}^{*}-y_{ij,t+1}\right)^{2}\right],\quad 0<\beta\leq 1, \tag{4}$$

where β is the discount factor applied to next period's outcome.

The other actors are the national governments, who choose the level of distortions trading off the beneficial effect of a reduction in distortions z_{it} on income in periods t and $t+1$ and the political cost associated with reducing distortions γ. Hence, the government of country i sets z_{it} to minimize the sum of the quadratic deviations of actual from non-distortionary income in country i's regions and the quadratic deviation of distortions z_{it} from its minimum level:

$$\frac{1}{2}\beta\sum_{j=1}^{R}\left[\left(y_{ij}^{*}-y_{ijt}\right)^{2}+\beta\left(y_{ij}^{*}-y_{ij,t+1}\right)^{2}\right]+\frac{1}{2}\gamma z_{it}^{2},\quad \gamma\geq 0. \tag{5}$$

The described setting could give rise to moral hazard if, as the Commission increases the level of transfers to the regions of country, its government has less incentive to introduce politically-costly reduction of distortions. A fear associated with EU level transfers is that their design is suboptimal because the Commission is unable to disentangle to what extent a country's economic situation can be attributed to purely exogenous factors and to what extent to the quality of its policies.[40] This would amount to the individual elements of the combination $z_{it}+\varepsilon_{ijt}$ not being directly observable to the Commission. However, interestingly, it is easy to ascertain that the instrument choices and, hence, all economic outcomes are independent of whether the Commission is able to observe z_{it} and ε_{ijt} separately, or only the sum $z_{it}+\varepsilon_{ijt}$.

European Commission's choice of transfers

In solving the model, we take account of externalities across regions.[41] The solution for the transfers can be split into that for the average level of transfers and the deviation from the average. The former is given by:

$$\bar{g}_t = 2\frac{1+\beta\mu(\mu-1)}{\beta(1-\delta-\mu)(1-\delta)+1+\beta\mu(\mu-1)}\left(\bar{z}_t+\bar{\varepsilon}_t\right) \tag{6}$$

The average transfer is increasing in the average level of distortions and the average shock, in both cases to make up for the income loss relative to non-distortionary income. We observe that the response of the average transfer is increasing in the intensity of externalities, δ. The reason is

[40] Beetsma and Bovenberg (2001) analyze transfers in the presence of moral hazard and imperfect observability of politically-costly effort to reduce structural distortions in the economy.

[41] The derivation of the solution is found in the Appendix.

that the benefit from transfers goes beyond the mere reduction of the shortfall of income from its non-distortionary level in each region, because the reduction in any given region also helps to reduce the shortfall in all other regions. The objective function of the CFSF internalizes this beneficial externality. The region-specific transfer is:

$$g_{ijt} = \bar{g}_t + \left(\varepsilon_{ijt} - \bar{\varepsilon}_t\right) + \left(z_{it} - \bar{z}_t\right), \qquad (7)$$

In other words, the deviation of the region-specific from the average transfer is one-to-one increasing in the region-specific shock component, $\varepsilon_{ijt} - \bar{\varepsilon}_t$, and the deviation of country distortions from the cross-country average level of distortions, $z_{it} - \bar{z}_t$. Because the CFSF balances the quadratic deviations from its targets, and it has a sufficiently large set of instruments (one for each region), it eliminates the region-specific shock component with an equal deviation of the transfer beyond its average. Likewise, it eliminates the cross-regional income differences resulting from differences in distortions.

The governments' choice of reduction in distortions

The solution for the choice of distortions can be split into an average and a deviation from this average. The average solution is:

$$\bar{z}_t = [1 + \beta\mu^2 + \hat{\gamma}(1-\delta)]^{-1}\left[(1+\beta\mu^2)\left(\tfrac{1}{2}\bar{g}_t - \bar{\varepsilon}_t\right) - \tfrac{1}{2}\beta\mu(1-\delta)\bar{g}_t\right], \qquad (8)$$

where

$$\hat{\gamma} = \frac{\gamma}{R\left[1+\left(\frac{\delta}{1-\delta}\right)^{\frac{1}{N}}\right]}.$$

Suppose that we hold $\bar{g}_t$ fixed. Then, a larger average adverse shock $\bar{\varepsilon}_t$ leads government to produce smaller distortions z_{it}. Generally, there are two effects of $\bar{g}_t$ on distortions. On the one hand, support spending raises income, thereby weakening the incentive to reduce distortions. On the other hand, support spending needs to be financed by contributions paid out of the government's budget into the CFSF. As these lower income, they strengthen the incentive to reduce distortions. The term $\frac{1}{2}(1+\beta\mu^2)\bar{g}_t$ within brackets reflects the net effect of the received transfer on income in period t and, via the hysteresis effect, in period $t+1$ and the contribution into the CFSF in period t. This net effect is positive and leads to higher distortions. The term $\frac{1}{2}\beta\mu(1-\delta)\bar{g}_t$ within brackets is the result of the contribution payment to the CFSF in period $t+1$ and leads to a reduction in distortions. To obtain the summary solution for $\bar{g}_t$, it is necessary to substitute (6) into (8) and solve for $\bar{g}_t$ as a function of $\bar{\varepsilon}_t$ only.

The deviation of z_{it} from $\bar{z}_t$ is given by:

$$z_{it} = \bar{z}_t + \left[\frac{1+\beta\mu^2}{1+\beta\mu^2+\hat{\gamma}}\right][(\bar{\varepsilon}_t - \bar{\varepsilon}_{it}) + (\bar{g}_{it} - \bar{g}_t)] \quad (9)$$

where $\bar{\varepsilon}_{it}$ is the average shock hitting the regions of country i. If this average shock is larger than the average shock across all the regions, then the government of country i reduces distortions more than does the average government, while a transfer $\bar{g}_{it}$ to country i higher than the average transfer $\bar{g}_t$ has the opposite effect on the amount of distortions. If $\gamma = 0$, i.e. the political cost of reducing distortions is zero, the difference between z_{it} and $\bar{z}_t$ is set to exactly offset the national deviations in the average shock and the average received transfer. The larger is γ, the more the response of the country-specific component $z_{it} - \bar{z}_t$ of distortions to the country-specific shock component $\bar{\varepsilon}_t - \bar{\varepsilon}_{it}$ and the country-specific spending component $\bar{g}_{it} - \bar{g}_t$ is dampened, while a stronger hysteresis effect μ, a higher discount factor β, larger externalities δ and a smaller number of countries N, all lead to stronger responses of the deviation of distortions from the average.[42] Stronger hysteresis and a smaller discount rate in effect both assign a larger weight to the effect of reducing distortions on future income. Larger externalities benefit future income because the positive effect on other countries' income from reduced distortions in country i feeds back through second-round effects to country i. This feedback effect is proportional to $1/N$. If the number of countries N goes to infinity, the externality from country i on the union's average becomes negligible and so does the feedback effect.

Outcomes as a function of the shocks

Expressions (6) through (9) are response functions, but not the summary solutions expressed in terms of the eventual shocks. Combining the "average expressions" (6) and (8), one solves for $\bar{g}_t$ and $\bar{z}_t$ as linear functions of $\bar{\varepsilon}_t$:

$$\partial\bar{z}_t/\partial\bar{\varepsilon}_t < 0 \text{ and } \partial\bar{g}_t/\partial\bar{\varepsilon}_t > 0$$

Thus, a more adverse average shock leads countries to reduce distortions more on average, while it also implies higher transfers on average. Further, we find that:

$$z_{it} = \bar{z}_t \; \forall i \text{ and } \bar{g}_{it} - \bar{g}_t = \bar{\varepsilon}_{it} - \bar{\varepsilon}_t$$

That each country implements the same amount of reform may seem surprising but is easily explained. The difference between the transfers received by each country and the average transfers exactly offsets the effect of the difference in the shock hitting each country and the

[42] Recall that a higher value of γ implies a higher value of $\hat{\gamma}$ and that larger externalities δ and a smaller number of countries N imply a lower value of $\hat{\gamma}$. Hence, a higher δ and a lower N cause an increase in the coefficient in front of $\bar{\varepsilon}_t - \bar{\varepsilon}_{it}$ and $\bar{g}_{it} - \bar{g}_t$ in (9).

average shock, so that in equilibrium each country has the same incentive to reduce distortions – assuming broadly equivalent political cost thereof.

Reduction in distortions absent the CFSF

The outcomes for a union with a transfer scheme to the same group of countries without a transfer scheme warrants comparison. In the absence of a transfer scheme, not subject to conditionality, the average reduction in distortions is given by:

$$\bar{z}_t = -\left[\frac{1+\beta\mu^2}{1+\beta\mu^2+\hat{\gamma}(1-\delta)}\right]\bar{\varepsilon}_t$$

Hence, for given $\bar{g}_t$, the marginal effect of $\bar{\varepsilon}_t$ on $\bar{z}_t$ is identical without or with a CFSF, assuming that the transfers are not conditional on a reduction of distortions. Because $\bar{g}_t$ itself responds to both $\bar{z}_t$ and $\bar{\varepsilon}_t$, the overall response of $\bar{z}_t$ to $\bar{\varepsilon}_t$ will differ in the presence of a CFSF than without CFSF. In general, it is cumbersome to compare the responses of $\bar{z}_t$ to $\bar{\varepsilon}_t$ taking account this effect. However, in the special case in which externalities are absent, $\delta = 0$,[43] and the hysteresis effect is at its maximum, $\mu = 1$, with and without CFSF we have, respectively,

$$\bar{z}_t = -\left[\frac{\beta}{\beta+\gamma/R}\right]\bar{\varepsilon}_t \quad \text{and } \bar{z}_t = -\left[\frac{1+\beta}{1+\beta+\gamma/R}\right]\bar{\varepsilon}_t.$$

Not surprisingly, without CFSF, the reduction in distortions for given $\bar{\varepsilon}_t > 0$ is larger than with CFSF, because in the latter case, the compensation received from the CFSF disincentivizes the politically-costly reduction in distortions. This disincentive would be weakened if the transfers were subject to structural conditionality. Turning to the solution in deviations, when a CFSF is absent we find:

$$z_{it} - \bar{z}_t = -\left[\frac{1+\beta\mu^2}{1+\beta\mu^2+\hat{\gamma}}\right](\bar{\varepsilon}_{it} - \bar{\varepsilon}_t)$$

In contrast to when a CFSF is present, reductions in distortions will generally differ across countries since the shocks differ across the countries.

Income and welfare comparisons

With a CFSF, the regional component of a transfer, expression (7), offsets the country-specific component in distortion-reducing measures and the region-specific shock component. The

[43] Although analytically convenient, this case ignores an important rationale for establishing the CFSF, namely, to alleviate shocks that have an impact across multiple regions within the Union.

average transfer, in turn offsets the effect of the average shock and the average level of distortions on income, expression (6), resulting in period t income equal to non-distortionary income and an elimination of the hysteresis effect in period $t+1$. Hence, the resulting income levels in the two periods are $y_{ijt} = y_{ij}^*$ and $y_{ij,t+1} = y_{ij}^* - \frac{1}{2}\bar{g}_t$.

A general welfare comparison is straightforward, but algebraically cumbersome. We therefore focus again on the special case of no externalities, $\delta = 0$, and a maximum hysteresis effect, $\mu = 1$. In this special case, $\hat{\gamma} = \gamma/R$. Income in the presence, respectively absence of a CFSF is:

$$y_{ijt} = y_{ij}^*, \quad y_{ij,t+1} = y_{ij}^* - \left(\frac{\hat{\gamma}}{\beta+\hat{\gamma}}\right)\bar{\varepsilon}_t,$$
$$y_{ijt} = y_{ij,t+1} = y_{ij}^* - \left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)\bar{\varepsilon}_{it} - \left(\varepsilon_{ijt} - \bar{\varepsilon}_{it}\right).$$

The expected welfare loss is calculated as the expectation of the union loss in (4). Assuming that the variances of the regional shocks are identical, i.e. $Var\left(\varepsilon_{ijt}\right) = \sigma^2$ for all i, j, expected losses will be identical across regions and the expected union loss is simply the expected loss of an individual region multiplied by NR. That said, the expected welfare losses with and without a CFSF are given by, respectively:

$$\frac{1}{2}\beta\left(\frac{\hat{\gamma}}{\beta+\hat{\gamma}}\right)^2\sigma^2,$$

and

$$\frac{1}{2}(1+\beta)\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)^2 N\sigma^2 + \frac{1}{2}(1+\beta)N(R-1)\sigma^2.$$

While an unambiguous welfare comparison is not feasible short of data-based quantitative simulations, it can be intuitively ascertained in the context of the model that an increase in the number of participating countries N, raises the relative attractiveness of installing a CFSF, because the impact and the alleviation of region-specific shocks, including externalities, can be shared over a broader group of regions.

VIII. Concluding remarks

Establishment of the recovery fund, under the heading of Next Generation EU, represents a pivotal step toward implementing the subsidiarity principle, enacted in the Maastricht Treaty, against the background of two unprecedent macroeconomic crises that affected the majority of EU member countries. Commendable as it may be, the fund has some drawbacks: it is an one-off scheme, primarily focused on investment expenditures, with a considerable delay in disbursements, and allocated on the basis of lagged national indicators of need. The central fiscal stabilization facility (CFSF) proposed herein is an attempt to make up for those deficiencies by

creating a permanent collective stabilization scheme in the presence of large common shocks, especially when the instruments of the ECB prove to be insufficient to contain the impact of such shocks, especially in hard-hit member governments lacking fiscal space to adopt an effective countercyclical fiscal stance.

The proposed CFSF is designed to respond automatically to common exogenous shocks across regions in a timely fashion over an extended time period, if necessary. A major advantage of the proposed scheme is its reliance on real-time high-frequency indicators of economic activity at the regional level – a task that requires technical inputs and data from Eurostat, with support from national statistical agencies. As designed, the CFSF has several merits beyond stabilization during a crisis or a wide cyclical swing. First, the debt it issues would create a new safe asset with the future contributions of the participating countries as collateral.[44] It could be purchased by the ECB to provide liquidity or be held by commercial banks. Second, participating countries effectively commit to saving resources for a rainy day. If the contribution rate is linked to the business cycle, countries could contribute proportionally more during good times than during bad times. Third, the concept of the appropriate euro-area aggregate fiscal stance emphasizes that countries with fiscal space should use this space, which would create positive externalities vis-à-vis countries without such space. However, countries with fiscal space may be overheating at the same time. Fiscal expansion would contribute to further overheating. Disbursements from the CFSF can replace the deployment of the fiscal space by overheating economies. Fourth, as discussed above, the disbursement of resources from the CFSF (or participation in the arrangement at all) could be made conditional on implementing reforms that enhance the resilience of the national economy. Participation in the CFSF may provide a sufficiently strong incentive for necessary reform that would otherwise not take place. Fifth, the CFSF could invest its assets in specific sectors with a promising future or in pan-European infrastructure projects that would not be undertaken otherwise because their positive cross-border externalities would not be internalized at the national level.

A key caveat associated with any collective stabilization facility is the necessity to prevent moral hazard in member countries and financial markets. The CFSF should not give rise to complacency and a perception of a lax interpretation of the no-bailout clause enshrined in the Treaty. Hence, as mentioned, access to CFSF resources should be backed by adequate incentives and safeguards in the form of conditionality, to be monitored by the appropriate EU institutions. In the light of the recent crises, governments of vulnerable member countries should be encouraged to strengthen automatic stabilizers (partly through raising the effective progressivity of tax systems), and in addition, to generate sufficient fiscal space (through long-overdue

[44] As argued in Kopits (2017a), such a stabilization fund would operate symmetrically during the economic cycle, issuing bonds at a low interest rate in a recession and withdrawing them in an upswing as interest rates rise. Meanwhile, increased contributions would accumulate during a boom, to be made available for transfers during a recession.

structural reform) that will permit the conduct of discretionary expansion while possibly avoiding further build-up in government indebtedness. In all, recourse to the CFSF is to be treated as a complement to domestic countercyclical policies.

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Appendix

This appendix derives the outcomes in the main text. The symbols are defined in the main text. There are in total N countries, each consisting of R regions.

In the *absence of a CFSF*, income in region j of country i in periods t and $t+1$ is:

$$y_{ijt} = y^*_{ij} - z_{it} - \varepsilon_{ijt} - \frac{\delta}{1-\delta}(\bar{z}_t + \bar{\varepsilon}_t), \tag{A.1}$$

$$y_{ij,t+1} = y^*_{ij} - \mu\left(z_{it} + \varepsilon_{ijt} + \frac{\delta}{1-\delta}(\bar{z}_t + \bar{\varepsilon}_t)\right). \tag{A.2}$$

In the *presence of a CFSF*, income in region j of country i in periods t and $t+1$ is:

$$y_{ijt} = y^*_{ij} - z_{it} - \tau - \varepsilon_{ijt} + g_{ijt} - \delta(\bar{y}^* - \bar{y}_t), \tag{A.3}$$

$$y_{ij,t+1} = y^*_{ij} - \tau + \mu\left(y_{ijt} - y^*_{ij}\right), \tag{A.4}$$

The intertemporal budget constraint of the CFSF implies:

$$\tau = \bar{g}_t/2, \tag{A.5}$$

Substituting (A.5) into (A.3) and (A.4), and rewriting, we obtain output in the *presence of a CFSF*:

$$y_{ijt} = y^*_{ij} - z_{it} - \frac{1}{2}\left(\frac{1-2\delta}{1-\delta}\right)\bar{g}_t + g_{ijt} - \varepsilon_{ijt} - \frac{\delta}{1-\delta}(\bar{z}_t + \bar{\varepsilon}_t), \tag{A.6}$$

$$y_{ij,t+1} = y^*_{ij} - \frac{1}{2}\bar{g}_t - \mu\left[z_{it} + \frac{1}{2}\left(\frac{1-2\delta}{1-\delta}\right)\bar{g}_t - g_{ijt} + \varepsilon_{ijt} + \frac{\delta}{1-\delta}(\bar{z}_t + \bar{\varepsilon}_t)\right], \tag{A.7}$$

<u>Solution in absence of a CFSF:</u>

Subject to (A.1) and (A.2) the *government* minimizes over z_{it} :

$$\frac{1}{2}\sum_{j=1}^{R}\left[\left(y^*_{ij} - y_{ijt}\right)^2 + \beta\left(y^*_{ij} - y_{ij,t+1}\right)^2\right] + \frac{1}{2}\gamma z_{it}^2,$$

which can be written as:

$$\frac{1}{2}\sum_{j=1}^{R}\left[(1+\beta\mu^2)\left(y_{ij}^{*}-y_{ijt}\right)^2\right]+\frac{1}{2}\gamma z_{it}^2,$$

Using that

$$\frac{\partial\left(y_{ij}^{*}-y_{ijt}\right)}{\partial z_{it}}=1+\left(\frac{\delta}{1-\delta}\right)\frac{1}{N},$$

we can write the first-order condition as:

$$\sum_{j=1}^{R}\left[(1+\beta\mu^2)\left(z_{it}+\varepsilon_{ijt}+\frac{\delta}{1-\delta}(\bar{z}_t+\bar{\varepsilon}_t)\right)\right]\left[1+\left(\frac{\delta}{1-\delta}\right)\frac{1}{N}\right]+\gamma z_{it}=0\Leftrightarrow$$

$$R(1+\beta\mu^2)\left[(z_{it}+\bar{\varepsilon}_{it})+\frac{\delta}{1-\delta}(\bar{z}_t+\bar{\varepsilon}_t)\right]\left[1+\left(\frac{\delta}{1-\delta}\right)\frac{1}{N}\right]+\gamma z_{it}=0\Leftrightarrow$$

$$(1+\beta\mu^2)\left[(z_{it}+\bar{\varepsilon}_{it})+\frac{\delta}{1-\delta}(\bar{z}_t+\bar{\varepsilon}_t)\right]+\hat{\gamma}z_{it}=0, \qquad \text{(A.8)}$$

where

$$\hat{\gamma}=\frac{\gamma}{R\left[1+\left(\frac{\delta}{1-\delta}\right)\frac{1}{N}\right]}.$$

We find both the average reaction function and the reaction function in terms of deviations from the average. Take the average of (A.8). Hence,

$$(1+\beta\mu^2)\frac{1}{1-\delta}(\bar{z}_t+\bar{\varepsilon}_t)+\hat{\gamma}\bar{z}_t=0\Leftrightarrow$$

$$\bar{z}_t=-\left[\frac{1+\beta\mu^2}{1+\beta\mu^2+\hat{\gamma}(1-\delta)}\right]\bar{\varepsilon}_t.$$

Writing (A.8) in differences from its average:

$$(1+\beta\mu^2)[(z_{it}-\bar{z}_t)+(\bar{\varepsilon}_{it}-\bar{\varepsilon}_t)]+\hat{\gamma}(z_{it}-\bar{z}_t)=0\Leftrightarrow$$

$$z_{it}=\bar{z}_t+\left(\frac{1+\beta\mu^2}{1+\beta\mu^2+\hat{\gamma}}\right)(\bar{\varepsilon}_t-\bar{\varepsilon}_{it})$$

Using these outcomes of $\bar{z}_t$ and z_{it}, the outcomes of output become:

$$y_{ijt}=y_{ij}^{*}-z_{it}-\varepsilon_{ijt}-\frac{\delta}{1-\delta}(\bar{z}_t+\bar{\varepsilon}_t)\Leftrightarrow$$

$$y_{ijt}=y_{ij}^{*}-\bar{z}_t+\left(\frac{1+\beta\mu^2}{1+\beta\mu^2+\hat{\gamma}}\right)(\bar{\varepsilon}_{it}-\bar{\varepsilon}_t)-\varepsilon_{ijt}-\frac{\delta}{1-\delta}(\bar{z}_t+\bar{\varepsilon}_t)\Leftrightarrow$$

$$y_{ijt} = y_{ij}^{*} - \frac{1}{1-\delta}(\bar{z}_t + \bar{\varepsilon}_t) - \left(\frac{\hat{\gamma}}{1+\beta\mu^2+\hat{\gamma}}\right)(\bar{\varepsilon}_{it} - \bar{\varepsilon}_t) - (\varepsilon_{ijt} - \bar{\varepsilon}_{it}) \Leftrightarrow$$

$$y_{ijt} = y_{ij}^{*} - \left[\left[\frac{\hat{\gamma}}{1+\beta\mu^2+\hat{\gamma}(1-\delta)}\right]\bar{\varepsilon}_t + \left(\frac{\hat{\gamma}}{1+\beta\mu^2+\hat{\gamma}}\right)(\bar{\varepsilon}_{it} - \bar{\varepsilon}_t) + (\varepsilon_{ijt} - \bar{\varepsilon}_{it})\right],$$

and

$$y_{ij,t+1} = y_{ij}^{*} - \mu\left[\left[\frac{\hat{\gamma}}{1+\beta\mu^2+\hat{\gamma}(1-\delta)}\right]\bar{\varepsilon}_t + \left(\frac{\hat{\gamma}}{1+\beta\mu^2+\hat{\gamma}}\right)(\bar{\varepsilon}_{it} - \bar{\varepsilon}_t) + (\varepsilon_{ijt} - \bar{\varepsilon}_{it})\right].$$

<u>Solution in the presence of a CFSF:</u>

The *European Commission* minimizes over the full set of g_{ijt}:

$$\frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{R}\left[\left(y_{ij}^{*} - y_{ijt}\right)^2 + \beta\left(y_{ij}^{*} - y_{ij,t+1}\right)^2\right].$$

We will use the following partial derivatives:

$$\frac{\partial\left(y_{ij}^{*} - y_{ijt}\right)}{\partial g_{ijt}} = \frac{1}{2}\frac{1}{NR}\left(\frac{1-2\delta}{1-\delta}\right) - 1, \quad \frac{\partial\left(y_{ij}^{*} - y_{ij,t+1}\right)}{\partial g_{ijt}} = \frac{1}{2}\frac{1}{NR} + \mu\left[\frac{1}{2}\frac{1}{NR}\left(\frac{1-2\delta}{1-\delta}\right) - 1\right]$$

$$\frac{\partial\left(y_{kl}^{*} - y_{klt}\right)}{\partial g_{ijt}} = \frac{1}{2}\frac{1}{NR}\left(\frac{1-2\delta}{1-\delta}\right), \quad \frac{\partial\left(y_{kl}^{*} - y_{kl,t+1}\right)}{\partial g_{ijt}} = \frac{1}{2}\frac{1}{NR}\left[1 + \mu\left(\frac{1-2\delta}{1-\delta}\right)\right]$$

The first-order condition with respect to g_{ijt} is:

$$\left(y_{ij}^{*} - y_{ijt}\right)\frac{\partial\left(y_{ij}^{*} - y_{ijt}\right)}{\partial g_{ijt}} + \beta\left(y_{ij}^{*} - y_{ij,t+1}\right)\frac{\partial\left(y_{ij}^{*} - y_{ij,t+1}\right)}{\partial g_{ijt}} + \sum_{(k,l)\neq(i,j)}\left[\left(y_{kl}^{*} - y_{klt}\right)\frac{\partial\left(y_{kl}^{*} - y_{klt}\right)}{\partial g_{ijt}} + \beta\left(y_{kl}^{*} - y_{kl,t+1}\right)\frac{\partial\left(y_{kl}^{*} - y_{kl,t+1}\right)}{\partial g_{ijt}}\right] = 0 \Leftrightarrow$$

$$\left(y_{ij}^{*} - y_{ijt}\right)\left[\frac{1}{2}\frac{1}{NR}\left(\frac{1-2\delta}{1-\delta}\right) - 1\right] + \beta\left(y_{ij}^{*} - y_{ij,t+1}\right)\left[\frac{1}{2}\frac{1}{NR} + \mu\left(\frac{1}{2}\frac{1}{NR}\left(\frac{1-2\delta}{1-\delta}\right) - 1\right)\right] + \sum_{(k,l)\neq(i,j)}\left[\left(y_{kl}^{*} - y_{klt}\right)\frac{1}{2}\frac{1}{NR}\left(\frac{1-2\delta}{1-\delta}\right) + \beta\left(y_{kl}^{*} - y_{kl,t+1}\right)\frac{1}{2}\frac{1}{NR}\left[1 + \mu\left(\frac{1-2\delta}{1-\delta}\right)\right]\right] = 0 \Leftrightarrow$$

$$\frac{1}{2}\frac{1}{NR}\sum_{k,l}\left(y_{kl}^{*} - y_{klt}\right)\left(\frac{1-2\delta}{1-\delta}\right) + \frac{1}{2}\frac{1}{NR}\sum_{k,l}\beta\left(y_{kl}^{*} - y_{kl,t+1}\right)\left[1 + \mu\left(\frac{1-2\delta}{1-\delta}\right)\right] - \left(y_{ij}^{*} - y_{ijt}\right) - \mu\beta\left(y_{ij}^{*} - y_{ij,t+1}\right) = 0 \Leftrightarrow$$

$$\frac{1}{2}\left(\overline{y}^{*} - \overline{y}_t\right)\left(\frac{1-2\delta}{1-\delta}\right) + \frac{1}{2}\beta\left(\overline{y}^{*} - \overline{y}_{t+1}\right)\left[1 + \mu\left(\frac{1-2\delta}{1-\delta}\right)\right] - \left(y_{ij}^{*} - y_{ijt}\right) - \mu\beta\left(y_{ij}^{*} - y_{ij,t+1}\right) = 0 \Leftrightarrow$$

$$\frac{1}{2}(\bar{y}^* - \bar{y}_t)\left(\frac{1-2\delta}{1-\delta}\right) + \frac{1}{2}\beta\left[\frac{1}{2}\bar{g}_t + \mu(\bar{y}^* - \bar{y}_t)\right]\left[1 + \mu\left(\frac{1-2\delta}{1-\delta}\right)\right] = (y_{ij}^* - y_{ijt}) + \mu\beta\left(\frac{1}{2}\bar{g}_t + \mu(y_{ij}^* - y_{ijt})\right) \Leftrightarrow$$

$$\frac{1}{2}(1+\beta\mu^2)(\bar{y}^* - \bar{y}_t)\left(\frac{1-2\delta}{1-\delta}\right) + \frac{1}{4}\beta\bar{g}_t\left[1 + \mu\left(\frac{1-2\delta}{1-\delta}\right)\right] = \frac{1}{2}\beta\mu\bar{g}_t + (1+\beta\mu^2)(y_{ij}^* - y_{ijt}) + \frac{1}{2}\beta\mu(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$\frac{1}{2}\left(\frac{1-2\delta}{1-\delta}\right)(1+\beta\mu^2)(\bar{y}^* - \bar{y}_t) + \frac{1}{2}\beta\left[\frac{1}{2}\left(1 + \mu\left(\frac{1-2\delta}{1-\delta}\right)\right) - \mu\right]\bar{g}_t = (1+\beta\mu^2)(y_{ij}^* - y_{ijt}) + \frac{1}{2}\beta\mu(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$\frac{1}{2}\left(\frac{1-2\delta}{1-\delta}\right)(1+\beta\mu^2)(\bar{y}^* - \bar{y}_t) + \frac{1}{4}\beta\left(1 - \frac{\mu}{1-\delta}\right)\bar{g}_t = (1+\beta\mu^2)(y_{ij}^* - y_{ijt}) + \frac{1}{2}\beta\mu(\bar{y}_t - \bar{y}^*) \quad \text{(A.9)}$$

We find both the average reaction function and the reaction function in terms of deviations from the average. Take the average of equation (A.9). This gives:

$$\frac{1}{2}\left(\frac{1-2\delta}{1-\delta}\right)(1+\beta\mu^2)(\bar{y}^* - \bar{y}_t) + \frac{1}{4}\beta\left(1 - \frac{\mu}{1-\delta}\right)\bar{g}_t = (1+\beta\mu^2)(\bar{y}^* - \bar{y}_t) + \frac{1}{2}\beta\mu(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$-\frac{1}{2}\left(\frac{1}{1-\delta}\right)(1+\beta\mu^2)(\bar{y}^* - \bar{y}_t) + \frac{1}{4}\beta\left(1 - \frac{\mu}{1-\delta}\right)\bar{g}_t = \frac{1}{2}\beta\mu(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$\beta\left(1 - \frac{\mu}{1-\delta}\right)\bar{g}_t = 2(1+\beta\mu^2)(\bar{y}^* - \bar{y}_t)\frac{1}{1-\delta} + 2\beta\mu(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$\beta(1-\delta-\mu)\bar{g}_t = 2(1+\beta\mu^2)(\bar{y}^* - \bar{y}_t) + 2\beta\mu(1-\delta)(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$\beta(1-\delta-\mu)\bar{g}_t = 2(1+\beta\mu^2)\frac{1}{1-\delta}\left(\bar{z}_t + \bar{\varepsilon}_t - \frac{1}{2}\bar{g}_t\right) + 2\beta\mu(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$\left[\beta(1-\delta-\mu) + (1+\beta\mu^2)\frac{1}{1-\delta}\right]\bar{g}_t = \frac{2(1+\beta\mu^2)}{1-\delta}(\bar{z}_t + \bar{\varepsilon}_t) + 2\beta\mu(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$[\beta(1-\delta-\mu)(1-\delta) + (1+\beta\mu^2)]\bar{g}_t = 2(1+\beta\mu^2)(\bar{z}_t + \bar{\varepsilon}_t) + 2\beta\mu(1-\delta)(\bar{y}_t - \bar{y}^*) \Leftrightarrow$$

$$[\beta(1-\delta-\mu)(1-\delta) + (1+\beta\mu^2)]\bar{g}_t = 2(1+\beta\mu^2)(\bar{z}_t + \bar{\varepsilon}_t) + 2\beta\mu\left(\frac{1}{2}\bar{g}_t - \bar{z}_t - \bar{\varepsilon}_t\right) \Leftrightarrow$$

$$\left[\beta(1-\delta-\mu)(1-\delta) + \left(1+\beta\mu(\mu-1)\right)\right]\bar{g}_t = 2\left(1+\beta\mu(\mu-1)\right)(\bar{z}_t + \bar{\varepsilon}_t) \Leftrightarrow$$

$$\bar{g}_t = 2\frac{1+\beta\mu(\mu-1)}{\beta(1-\delta-\mu)(1-\delta)+1+\beta\mu(\mu-1)}(\bar{z}_t + \bar{\varepsilon}_t),$$

which is (6) in the main text. Taking deviations from the average of equation (A.9) gives:

$(1+\beta\mu^2)\left[\left(y_{ij}^{*}-\overline{y}^{*}\right)-\left(y_{ijt}\ -\overline{y}_t\right)\right]=0\Leftrightarrow$

$y_{ij}^{*}-y_{ijt}\ =\overline{y}^{*}-\overline{y}_t\Leftrightarrow$

$g_{ijt}\ =\bar{g}_t+\left(\varepsilon_{ijt}\ -\bar{\varepsilon}_t\right)+\ (z_{it}-\bar{z}_t),$

which is (7) in the main text.

Subject to (A.6) and (A.7) the *government* minimizes over z_{it} :

$$\tfrac{1}{2}\textstyle\sum_{j=1}^{R}\left[\left(y_{ij}^{*}-y_{ijt}\right)^2+\beta\left(y_{ij}^{*}-y_{ij,t+1}\right)^2\right]+\tfrac{1}{2}\gamma z_{it}^2.$$

Using that

$$\frac{\partial\left(y_{ij}^{*}-y_{ijt}\right)}{\partial z_{it}}=1+\left(\tfrac{\delta}{1-\delta}\right)\tfrac{1}{N},\ \ \frac{\partial\left(y_{ij}^{*}-y_{ij,t+1}\right)}{\partial z_{it}}=\mu\left[1+\left(\tfrac{\delta}{1-\delta}\right)\tfrac{1}{N}\right]$$

$\sum_{j=1}^{R}\left[\left(y_{ij}^{*}-y_{ijt}\right)+\beta\mu\left(y_{ij}^{*}-y_{ij,t+1}\right)\right]\left[1+\left(\tfrac{\delta}{1-\delta}\right)\tfrac{1}{N}\right]+\gamma z_{it}\ =0\Leftrightarrow$

$R\left[\left(\overline{y}_i^{*}-\overline{y}_{it}\right)+\beta\mu\left(\overline{y}_i^{*}-\overline{y}_{i,t+1}\right)\right]\left[1+\left(\tfrac{\delta}{1-\delta}\right)\tfrac{1}{N}\right]+\gamma z_{it}\ =0\Leftrightarrow$

$$\tfrac{1}{2}\beta\mu\overline{g}_t+(1+\beta\mu^2)\left[z_{it}\ +\tfrac{1}{2}\left(\tfrac{1-2\delta}{1-\delta}\right)\overline{g}_t+\bar{\varepsilon}_{it}-\overline{g}_{it}+\left(\tfrac{\delta}{1-\delta}\right)(\bar{z}_t+\bar{\varepsilon}_t)\right]+\hat{\gamma}z_{it}\ =0. \qquad \text{(A.10)}$$

Again, we first solve in averages, then in differences. So, taking averages over all countries of (A.10):

$\tfrac{1}{2}\beta\mu\overline{g}_t+(1+\beta\mu^2)\left[\overline{z}_t+\tfrac{1}{2}\left(\tfrac{1-2\delta}{1-\delta}\right)\overline{g}_t+\bar{\varepsilon}_t-\overline{g}_t+\left(\tfrac{\delta}{1-\delta}\right)(\bar{z}_t+\bar{\varepsilon}_t)\right]+\hat{\gamma}\overline{z}_t=0\Leftrightarrow$

$\tfrac{1}{2}\beta\mu\overline{g}_t+(1+\beta\mu^2)\left[\left(\tfrac{1}{1-\delta}\right)(\bar{z}_t+\bar{\varepsilon}_t)-\tfrac{1}{2}\left(\tfrac{1}{1-\delta}\right)\overline{g}_t\right]+\hat{\gamma}\overline{z}_t=0\Leftrightarrow$

$\tfrac{1}{2}\beta\mu(1-\delta)\overline{g}_t+(1+\beta\mu^2)\left(\overline{z}_t+\bar{\varepsilon}_t-\tfrac{1}{2}\overline{g}_t\right)+\hat{\gamma}(1-\delta)\overline{z}_t=0\Leftrightarrow$

$\tfrac{1}{2}[\beta\mu(1-\delta)-(1+\beta\mu^2)]\overline{g}_t+[\hat{\gamma}(1-\delta)+(1+\beta\mu^2)]\overline{z}_t+(1+\beta\mu^2)\bar{\varepsilon}_t=0\Leftrightarrow$

$$\bar{z}_t=\tfrac{1}{2}\left[\frac{(1+\beta\mu^2)-\beta\mu(1-\delta)}{(1+\beta\mu^2)+\hat{\gamma}(1-\delta)}\right]\bar{g}_t-\left(\frac{1+\beta\mu^2}{(1+\beta\mu^2)+\hat{\gamma}(1-\delta)}\right)\bar{\varepsilon}_t.$$

Writing (A.9) in deviations from averages:

$$(1+\beta\mu^2)\left[(z_{it}\ -\bar{z}_t)+(\bar{\varepsilon}_{it}-\bar{\varepsilon}_t)-\left(\overline{g}_{it}-\overline{g}_t\right)\right]+\hat{\gamma}(z_{it}\ -\bar{z}_t)=0\Leftrightarrow$$

$$z_{it}=\bar{z}_t+\left[\frac{1+\beta\mu^2}{1+\beta\mu^2+\hat{\gamma}}\right][(\bar{\varepsilon}_t-\bar{\varepsilon}_{it})+\ (\bar{g}_{it}-\bar{g}_t)]$$

We can now write down the outcomes for *output*. Note that:

$$\bar{z}_t+\bar{\varepsilon}_t-\frac{1}{2}\bar{g}_t=\left[\frac{\beta(1-\delta-\mu)(1-\delta)}{\beta(1-\delta-\mu)(1-\delta)+1+\beta\mu(\mu-1)}\right](\bar{z}_t+\bar{\varepsilon}_t)$$

Hence, recalling the solution in differences:

$$y_{ijt}\ =y_{ij}^*-\bar{z}_t-\frac{1}{2}\bar{g}_t-\varepsilon_{ijt}\ +\bar{g}_t+\varepsilon_{ijt}\ -\bar{\varepsilon}_t\ -\frac{\delta}{1-\delta}\left(\bar{z}_t+\bar{\varepsilon}_t-\frac{1}{2}\bar{g}_t\right)\Leftrightarrow$$

$$y_{ijt}\ =y_{ij}^*-\bar{z}_t+\frac{1}{2}\bar{g}_t-\bar{\varepsilon}_t\ -\frac{\delta}{1-\delta}\left(\bar{z}_t+\bar{\varepsilon}_t-\frac{1}{2}\bar{g}_t\right)\Leftrightarrow$$

$$y_{ijt}\ =y_{ij}^*-\frac{1}{1-\delta}\left(\bar{z}_t+\bar{\varepsilon}_t-\frac{1}{2}\bar{g}_t\right),$$

and

$$y_{ij,t+1}\ =y_{ij}^*-\frac{1}{2}\bar{g}_t-\frac{\mu}{1-\delta}\left(\bar{z}_t+\bar{\varepsilon}_t-\frac{1}{2}\bar{g}_t\right),$$

Note that:

$$\bar{z}_t+\bar{\varepsilon}_t-\frac{1}{2}\bar{g}_t=\left[\frac{\beta(1-\delta-\mu)(1-\delta)}{\beta(1-\delta-\mu)(1-\delta)+1+\beta\mu(\mu-1)}\right](\bar{z}_t+\bar{\varepsilon}_t)$$

$\bar{z}_t$ itself is a function of $\bar{\varepsilon}_t$ and $\bar{g}_t$ and using the solution for $\bar{g}_t$ we obtain $\bar{z}_t$ and $\bar{g}_t$ as functions of $\bar{\varepsilon}_t$.

Welfare comparison for case of $(\mu=1,\delta=0)$:

We assume that shocks have mean zero and we assume that all region-specific shocks have the same variance σ^2. Hence, we have:

$$Var\left(\varepsilon_{ijt}\right)=\sigma^2, Var(\bar{\varepsilon}_t)=\frac{1}{NR}\sigma^2, Var(\bar{\varepsilon}_{it})=\frac{1}{R}\sigma^2, Var\left(\varepsilon_{ijt}-\bar{\varepsilon}_{it}\right)=\left(\frac{R-1}{R}\right)\sigma^2.$$

For tractability we make a welfare comparison for the special case when $(\mu=1,\delta=0)$, i.e. there are no cross-border activity spill-overs and there is a full pass-through of hysteresis into next period output. In this case, the outcomes for output are in the *absence of a CFSF*:

$$y_{ijt}\ =y_{ij,t+1}\ =y_{ij}^*-\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)\bar{\varepsilon}_{it}-\left(\varepsilon_{ijt}\ -\bar{\varepsilon}_{it}\right),$$

while in the *presence of a CFSF* the outcomes for output are given by:

$$y_{ijt} = y_{ij}^{*},\ y_{ij,t+1} = y_{ij}^{*} - \left(\frac{\hat{\gamma}}{\beta+\hat{\gamma}}\right)\bar{\varepsilon}_t\ ,$$

The welfare loss in the *absence of a CFSF* is:

$$\begin{aligned}
&\mathrm{E}\left\{\frac{1}{2}(1+\beta)\sum_{i=1}^{N}\sum_{j=1}^{R}\left[\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)\bar{\varepsilon}_{it} + \left(\varepsilon_{ijt} - \bar{\varepsilon}_{it}\right)\right]^2\right\} = \\
&\frac{1}{2}(1+\beta)\mathrm{E}\left\{\sum_{i=1}^{N}\sum_{j=1}^{R}\left[\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)\bar{\varepsilon}_{it}\right]^2\right\} + \frac{1}{2}(1+\beta)\mathrm{E}\left\{\sum_{i=1}^{N}\sum_{j=1}^{R}\left(\varepsilon_{ijt} - \bar{\varepsilon}_{it}\right)^2\right\} = \\
&\frac{1}{2}(1+\beta)\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)^2\sum_{i=1}^{N}\sum_{j=1}^{R}\mathrm{E}[\bar{\varepsilon}_{it}]^2 + \frac{1}{2}(1+\beta)\sum_{i=1}^{N}\sum_{j=1}^{R}\mathrm{E}\left(\varepsilon_{ijt} - \bar{\varepsilon}_{it}\right)^2 = \\
&\frac{1}{2}(1+\beta)\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)^2 NR\frac{1}{R}\sigma^2 + \frac{1}{2}(1+\beta)NR\,\mathrm{E}\left(\varepsilon_{ijt}^2 - \frac{2}{R}\varepsilon_{ijt}^2 + \left(\frac{1}{R}\sum_{j=1}^{R}\varepsilon_{ijt}\right)^2\right) = \\
&\frac{1}{2}(1+\beta)\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)^2 N\sigma^2 + \frac{1}{2}(1+\beta)NR\left(\sigma^2 - \frac{2}{R}\sigma^2 + \frac{1}{R}\sigma^2\right) = \\
&\frac{1}{2}(1+\beta)\left(\frac{\hat{\gamma}}{1+\beta+\hat{\gamma}}\right)^2 N\sigma^2 + \frac{1}{2}(1+\beta)N(R-1)\sigma^2
\end{aligned}$$

The welfare loss in the *presence of a CFSF* is:

$$\mathrm{E}\left\{\frac{1}{2}\beta\sum_{i=1}^{N}\sum_{j=1}^{R}\left(\frac{\hat{\gamma}}{\beta+\hat{\gamma}}\right)^2\bar{\varepsilon}_t^2\right\} = \frac{1}{2}\beta\left(\frac{\hat{\gamma}}{\beta+\hat{\gamma}}\right)^2\sigma^2.$$