Resolving EU Financial-Stability Challenges: 
Is a Decentralized Decision-Making Approach Efficient?

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Abstract

European finance is becoming pan-European, while the European architecture for safeguarding financial stability—including decision making—have remained decentralized. Policy makers are aware of this dichotomy, but opinions on how to proceed, including on sharing the burden of fiscal costs, have lined up along national and regional political lines with less attention paid to European needs. This paper develops benchmark models—adapted from the ‘economics of alliances’—for assessing whether Europe’s architecture is consistent with the efficient allocation of resources for safeguarding EU financial stability. It also discusses implications for the ongoing debate on EU burden sharing.

JEL Classification Numbers:

Keywords: Safeguarding EU financial stability, burden sharing, EU decentralized decision making, burden sharing

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I. INTRODUCTION

European Union (EU) financial sector policy makers are considering ways of reforming the existing European architecture for safeguarding financial stability, including the management and resolution of European financial crises should EU prevention efforts fail. Much of the discussion has considered whether, and how, the costs of cross-border banking problems should be shared. Although this is a concern, European financial-stability challenges are considerably broader and could involve the (re)creation of an European architecture and reforms aimed at capturing the potential benefits of greater coordination of decision making for providing European—as opposed to national—financial stability.

The timeliness of these challenges can not be overstated. In sharp contrast to the nation-oriented architectures for safeguarding stability and the decentralized decision-making processes for allocating resources, cross-border European finance is continuing to grow rapidly and to become more complex and opaque. Moreover, a European financial system is fast becoming a reality—with extensive pan-European markets and the emergence of regional and European institutions. Driving the debate in Europe is a growing recognition by policy makers and politicians that, along with the obvious and substantial benefits, the emergence of a European financial system might be accompanied by a greater propensity for market turbulence, cross-border contagion, and regional and European systemic risk. Opinions about how to proceed with these efforts, particularly on burden sharing, are lining up along national and regional political lines with less attention paid to safeguarding European financial stability. Nevertheless, the ongoing debate is at an early enough stage that it still could benefit from a rigorous, model-based, public-good perspective.

Building on Nieto and Schinasi (2007), this paper develops and further examines a model-based benchmark for describing the current situation in the EU and for assessing the ability of Europe’s existing institutional architecture—including its decision-making processes—to efficiently allocate resources to safeguard the EU financial system against systemic threats to stability, such as the insolvency of a pan European bank. The approach applied is that of the ‘economics of alliances,” originally developed by Olson (1965) to analyze the nature of decision making by a group of countries (NATO) desiring to produce a ‘pure’ public good (a common military deterrence) to prevent or deal with the fall-out of an outside military threat. The EU’s financial stability challenges share several characteristics with this approach: the EU is comprised of a large number of member countries; there are commonly perceived multiple sources of threats to financial stability; and there is the need to provide financial-stability related public goods.

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2 In this paper, the term ‘EU safety net’ refers to this architecture unless otherwise noted. It encompasses prudential supervision, LOLR, deposit insurance and reorganization and resolution.

3 See also Olson and Zeckhauser (1966), Sandler and Cauley (1975), Sandler (1977), and Sandler and Hartley (2001).
Unlike much of the existing academic qua policy literature, this paper takes the existing decentralized European framework as given (in a simplified way) and asks whether it is capable of producing optimal outcomes. In this sense, the paper takes a more ‘positive’ approach when compared to the relatively ‘normative’ literature cited. The particular question addressed is: Is decentralized decision making effective for optimally allocating EU economic resources for the provision of EU financial-stability public goods?

The paper is organized as follows. Section II briefly describes how the European landscape has changed and the EU’s architecture for financial crisis management. Section III discusses the ongoing debate in Europe for reforming its architecture. Section IV provides an overview of the decision making problem. Section V presents a formal model and analyzes it within the context of a two-country example. Section VI summarizes the main conclusions and avenues for further analyses.

Several general conclusion and implications follow from the models that are relevant for the ongoing debate. First, neither the existing EU framework nor proposals for burden sharing of fiscal costs seem to satisfy the conditions for optimal decision-making and policy design implicit in how a group of countries would behave optimally when they share the benefits of a public good like EU financial stability. Second, a decision-making process that does not fully internalize negative externalities, by providing a sub-optimal amount of the financial-stability public goods, may be associated with a larger fiscal burden to share in resolving financial difficulties. Third, greater coordination of resource-allocating decisions for producing the public good and/or greater internalization of decisions are complementary paths to move closer to what would meet the optimality requirements of rational decision making in the existing theory. Finally, the models also bring into focus the ambiguity of the optimality of an ‘ex ante’ burden sharing of costs based on GDP shares.

II. BACKGROUND ON EU ARCHITECTURE FOR SAFEGUARDING FINANCIAL STABILITY

The process of European financial integration has accelerated and is leading to broader and deeper systemic financial inter-linkages across borders within Europe. As a result, the European financial landscape is taking on many of the features of a single financial market. Although the benefits are obvious and manifest in greater competition and efficiency, it may also be changing the nature of systemic risk within Europe. Table 1 summarizes the key transmission channels that could increase the potential for cross-border contagion within Europe—or what might be called European systemic financial risk.

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4 See, as examples, Prati and Schinasi (1999), Goodhart (2000), Eisenbeis and Kaufman (2007), and Mayes, Nieto and Wall (2007).
Table 1. Major Transmission Channels in the Single European Market

- Integrated money markets and other financial markets
- Integrated financial market infrastructures:
  - Payment systems
  - Securities clearing and settlement systems and other market infrastructures
- Major banks in concentrated domestic markets
- Emergence of pan-European banks with systemic relevance in several Member States (contagion through intra-group linkages and exposures among network of counterparties)
- Centralization of business functions in banking groups
- Emergence of large and complex financial institutions with systemic relevance in several Member States
- Increased foreign ownership of financial institutions and assets (as intensified by the recent EU enlargement)


In contrast to the emergence of a single European financial system, the European institutional architecture for financial crisis management still reflects three principles: decentralization, segmentation, and cooperation (Table 2; see Schinasi and Teixeira for further analysis).

Table 2. The Institutional Architecture of the Single Financial Market

<table>
<thead>
<tr>
<th>Levels</th>
<th>FUNCTIONS</th>
<th>DECISION-MAKERS</th>
<th>COOPERATION STRUCTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU (27 Member States)</td>
<td>EU legislation (minimum harmonization)</td>
<td>ECOFIN Council</td>
<td>Economic and Financial Committee</td>
</tr>
<tr>
<td></td>
<td>Policy-coordination</td>
<td>European Parliament</td>
<td>Financial Services Committee</td>
</tr>
<tr>
<td></td>
<td>Policy-shaping</td>
<td>European Commission:</td>
<td>Regulatory committees</td>
</tr>
<tr>
<td></td>
<td>State aid control</td>
<td>i) legislative proposals/</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) competition authority</td>
<td></td>
</tr>
<tr>
<td>EMU (13 Member States)</td>
<td>Single monetary policy</td>
<td>ECB’s Governing Council</td>
<td>Eurosystrem committees</td>
</tr>
<tr>
<td></td>
<td>Payment systems’ oversight</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contribution to financial stability and supervision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td>National legislation</td>
<td>27 finance ministries</td>
<td>At the EU level</td>
</tr>
<tr>
<td></td>
<td>Use of public funds</td>
<td>27 national parliaments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Banking supervision</td>
<td>13 national central banks</td>
<td>Home- /host-country relationships</td>
</tr>
<tr>
<td></td>
<td>Insurance supervision</td>
<td>13 single (cross-sectoral) supervisory agencies</td>
<td>Consolidated supervision of banking groups</td>
</tr>
<tr>
<td></td>
<td>Securities regulation</td>
<td>1 banking supervisor</td>
<td>Supplementary supervision of financial conglomerates</td>
</tr>
<tr>
<td></td>
<td>Supervision of financial conglomerates</td>
<td>ca. 13 insurance and pensions supervisors</td>
<td>Supervisory committees</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ca. 13 securities regulators</td>
<td>Bilateral, banking groups’, regional and EU-wide MoU</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Function</th>
<th>Entities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central banking functions (Member States outside euro area)</td>
<td>ECB’s Governing Council (euro area) and General Council (EU)</td>
</tr>
<tr>
<td>Lender of last resort (emergency liquidity assistance)</td>
<td>Eurosystem committees (euro area or EU)</td>
</tr>
<tr>
<td>Deposit insurance</td>
<td>EU-wide and regional MoU</td>
</tr>
<tr>
<td>27 national central banks</td>
<td>Ca. 35 schemes (with diverse features)</td>
</tr>
<tr>
<td></td>
<td>Informal</td>
</tr>
</tbody>
</table>

**Legal framework:** EU Treaty + directly applicable national laws and regulations (minimum harmonization through EU legislation) enforced by national authorities and courts


First, responsibility for financial stability functions relevant for crisis management is decentralized, based in large part on the exercise of national responsibilities by banking supervisors, central banks, treasuries and deposit insurance schemes. The European Central Bank (ECB) and the national central banks of the Eurosystem⁵ have financial-stability-related responsibilities, notably in the field of oversight of payment systems and contribution to national policies on financial stability and supervision. The performance of the lender-of-last-resort function is likewise a national responsibility. This is also the case in the euro area, where the provision of emergency liquidity assistance (ELA) is under the responsibility and liability of national central banks. It is a unique circumstance in which a central bank may be providing ELA but has no monetary-policy (as opposed to monetary-operations) responsibilities. There are arrangements for an adequate flow of information within the Eurosystem in order that the potential liquidity impact of ELA operations can be managed in the context of the single monetary policy (ECB 2000).

Second, the financial stability functions are segmented across sectors and Member States. Banking supervision is exercised by single (cross-sectoral) supervisory authorities and national central banks and, in some cases, is shared between the central bank and the supervisor.⁶ The prudential framework followed by supervisors is largely harmonized by EU legislation, however, although its practical application may vary given the decentralized setting. Supervision of banking groups and financial conglomerates is conducted separately by each of the supervisors that licensed each entity of the group. Coordination between supervisors is achieved by “consolidating” and “coordinator” supervisors, which have limited powers to override decisions by individual authorities. In the single monetary jurisdiction of the euro governed by the Eurosystem, banking supervision and ELA are under the responsibility and liability of the national authorities. Lastly, although some elements of

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⁵ The Eurosystem comprises the European Central Bank (ECB) and the national central banks (NCBs) of those countries that have adopted the euro. This contrasts with the European System of Central Banks (ESCB) comprised of the ECB and the NCBs of all EU Member States whether they have adopted the euro or not.

⁶ National central banks perform supervisory functions in 13 of the 25 Member States: Austria (in part), Cyprus, the Czech Republic, Germany (in part), Greece, Italy, Lithuania, the Netherlands, Poland, Portugal, Slovakia, Slovenia, and Spain.
deposit guarantee schemes are harmonized at the EU level, they have broadly developed in different ways in each Member State.

Third, a number of cooperation structures are in place for bridging the potential gaps of coverage between national responsibilities and the several functions. These structures range from committees (which are summarized in Table 3) to memoranda of understanding. There are two Memoranda of Understanding (MoU) in place for financial crisis management. The first was adopted in 2003 between EU banking supervisors and central banks under the aegis of the Banking Supervision Committee of the Eurosystem/ESCB. It would apply in crisis situations with a possible cross-border impact involving individual banks or banking groups, or relating to disturbances in money and financial markets and/or market infrastructures with potential common implications for Member States. The MoU is designed to facilitate the interaction between central banking and supervisory functions in terms of assessing the systemic scope of a crisis and taking actions. Its provisions include principles and procedures for identifying the authorities responsible and on the cross-border flow of information.

Table 3. The Committee-Structures of the Single Financial Market

<table>
<thead>
<tr>
<th>Decision-making</th>
<th>ECOFIN Council</th>
<th>European Parliament</th>
<th>ECB’s Governing Council (euro area of 13 Member States)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance Ministries (policy-making)</td>
<td>ECOFIN Council (Informal Eurogroup)</td>
<td>Economic and Financial Committee</td>
<td>Financial Services Committee</td>
</tr>
<tr>
<td>Commission and Finance Ministries (regulatory)</td>
<td>European Banking Committee</td>
<td>European Insurance and Occupational Pensions Committee</td>
<td>European Securities Committee</td>
</tr>
<tr>
<td>Supervisors (operational)</td>
<td>Committee of European Banking Supervisors (London)</td>
<td>Committee of European Insurance and Occupational Pension Supervisors (Frankfurt)</td>
<td>Committee of European Securities Regulators (Paris)</td>
</tr>
<tr>
<td>Central banks (operational)</td>
<td>Committees of the Eurosystem/ESCB—in euro area or EU-wide compositions (market operations, payment and settlement systems, banking supervision and financial stability)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The second MoU was adopted in May 2005 between the EU banking supervisors, central banks, and finance ministries. The explicit objective is to preserve the stability of the financial systems of both individual Member States and of the EU as a whole, thus acknowledging the need to consider how to balance the different dimensions of systemic risk.

7 In addition to these MoU, the EU banking supervisors and central banks also adopted in 2001 the MoU on cooperation between payment systems overseers and banking supervisors in stage three of economic and monetary union, which sets out arrangements for co-operation and information in relation to large-value payment systems. Press release available at http://www.ecb.int/press/pr/date/2001/html/pr010402.en.html.


The MoU aims in particular at providing initial conditions for policy coordination between all these authorities in the case of systemic crisis with spill-overs in several countries.

III. THE ONGOING POLICY DEBATE IN EUROPE 10

In light of ongoing structural changes, EU national authorities are becoming increasingly aware of, and concerned with, the limitations of the existing decentralized institutional framework. Recent public discussions have focused on the resolution of EU cross-banking problems, and more generally for managing EU cross-border financial crises. Some of the limitations were explicitly acknowledged—openly for the first time in 2004—at the highest level by the Council of Economic and Financial Affairs (ECOFIN) comprised of the ministers responsible for EU economic affairs and finance. 11

More recently, at their 9 September, 2006 Informal ECOFIN meeting, EU finance ministers and central bank governors launched an initiative to explore ways to further develop financial stability arrangements in the EU on the basis of the experiences of a crisis simulation exercise. Within this initiative, the starting point is that an effective crisis management framework must evolve, as markets already have, from a purely national concern to include an explicit cross-border component. The initiative also endeavors more specifically to further develop general principles (i.e. minimum cost resolution) and procedures (i.e. assessment methodologies; bankruptcy procedures) in resolving a cross border financial crisis including the policy issue of \textit{ex ante} burden sharing agreements on the fiscal cost of banking crisis.

Some policymakers see an \textit{ex ante} burden sharing agreement as the cornerstone of a reformed financial stability framework. In their view, such an agreement is a condition for safety net institutions and stakeholders to fully internalize any spillovers of domestic policy actions. Others consider ex-ante cost burden-sharing agreements as premature, in part because the allocation of costs may ultimately be influenced by other more fundamental reforms of the EU framework. Others see it as possibly entailing moral hazard, including in the form of forestalling needed reforms of the existing framework for safeguarding EU financial stability (IMF, 2007).

Although many in the EU understand burden sharing as facilitating cooperative cross-country solutions (that is, as a vehicle for having all countries to work toward the overall objective of EU financial stability), the recent EU debate has focused on the \textit{ex ante} burden sharing of fiscal costs associated with resolving a cross-border banking problem. One rationale given for this focus is that in the event of a failure of a large cross-border European bank, home

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10 This section draws on analysis in Nieto and Schinasi (2007).

11 Council of the European Union 9799/04. ECOFIN 186 EF 25, 26 May, 2004. In the Draft Council conclusions of the Financial Services Committee's report on financial integration, the report of the ECOFIN "... stresses the need for Supervisors, Central Banks and Finance Ministers to work together to ensure that appropriate plans and mechanisms are in place to respond to any developing financial crisis which threatens the stability of the financial system. It also [...] stresses the importance of promoting financial stability and market integrity, through both legislative and practical initiatives [...] ."
country supervisors, deposit insurance agencies, resolution authorities and tax payers would be prepared to meet the financial costs of bank restructuring (i.e. recapitalizing a bank in its entirety).

An important implication of the analysis in this paper is that the existing allocation of resources devoted to providing financial-stability public goods already implies a burden sharing of the costs of the EU financial stability framework. The analysis also demonstrates that there is a wide range of potential ‘socially optimal’ distributions of the fiscal costs of an EU framework. Which one is actually chosen and implemented depends on the willingness and ability of stakeholders to coordinate resource-allocation decisions. Thus, a key implication of the paper is that it is ambiguous what kind of ex ante fiscal agreement (for example, in proportion to GDP), if any, would be socially optimal for the EU. As implied by the discussion so far, this paper takes it as given that the issue is larger than just burden sharing (ex ante or ex post) and entails both the prevention and resolution of cross-border banking problems in an incentive driven decision making setting (that is, driven by either national or EU preferences and constraints or some combination of both via coordination).

IV. OVERVIEW OF THE MODELING APPROACH

For the purposes of financial-system policy making, financial stability can be viewed as a public good. The operational significance of this is that achieving and safeguarding financial stability requires both collective decision-making and action, at times involving private stakeholders, at times public stakeholders (including national authorities, politicians, and policy makers), and at times combinations of both. The crisis-management discussion in Europe has focused recently on fiscal burden sharing, in part because large and systemically important European financial institutions with significant cross-border operations/exposures are emerging. However, the challenge is much broader and, as recognized in the mandate of the ECOFIN task force in 2006, is that of safeguarding EU financial stability. This entails both the prevention of threats to EU financial stability and the effective management and resolution of EU financial problems and crises so that the fiscal costs are minimized.

Safeguarding financial stability is challenging within one legal jurisdiction, in part because it requires significant resources and various kinds of collective action. The challenges are greater within a multi-country and decentralized decision-making framework such as that in the EU. The added difficulty is that the public-good benefits of EU financial stability come about through the efforts and resources (expenditures) of individual countries whose primary objective is national financial stability and not European. Only recently have cooperation mechanisms been established to promote and to foster close cooperation and information sharing.

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12 Chapter 5 in Schinasi (2006) defines financial stability and provides reasons for seeing it as a public good.

13 Financial stability can be considered a pure public good in the same way the provision of national defense is considered as one, because it provides non-excludable and non-rival benefits. Benefits are non-excludable if the provider/producer of the good cannot exclude others from the benefits without incurring significant costs. The benefits are non-rival if consumption by one agent does not reduce benefits to others. The provision of EU financial stability would have these characteristics for all member countries and their citizens.
sharing, both on an ongoing basis and within the context of any crisis situation that might arise. The creation of these mechanisms should be viewed as positive initial steps to take account of the potential externalities that may exist across countries and within pan-European markets. Within this evolving EU financial landscape, cross-border financial problems can emerge, either involving turbulence across European markets or systemically important European financial institutions with extensive cross-border operations and financial exposures. Thus, the ongoing discussions in Europe to cooperate more closely and to share information can be seen as part of the EU’s emerging solution to internalize the potential negative externalities associated with the integration of national financial systems.

Nevertheless, key questions seem to be: Who should provide the public good; and how can its benefits be sustained and safeguarded.

There is not much formal economic analysis examining these issues through the rigor of analytical approaches, which is understandable given the difficulties of doing so. Particularly difficult to formalize is the existing complex, decentralized, and nationally-oriented EU safety net—albeit with some, mainly non-legally binding agreements promoting dialogue, information sharing, and convergence in frameworks. In this regard, the centralization of business operations and risk-management functions of the European large and complex financial institutions have run far ahead of the institutional structures that are responsible for oversight of these very same institutions and the pan-European markets in which they operate.

The ‘economics of alliances’ approach analyzes, in various and quite distinct contexts, the nature of ‘equilibrium’ outcomes that can arise when members of a group of optimizing decision makers share the benefits of a public good (or the costs of its absence) and must decide how to allocate their own scarce resources to contribute to its production. Within this framework, the implications of a variety of decision- and policy-making processes can be modeled and analyzed.

That this can help to sort through some of the difficult financial-stability issues in the EU should be obvious. For example, EU stakeholders that share in the benefits of European financial stability (or who share the costs of its absence) can be viewed as having the option (1) to continue to make decentralized public-good decisions focusing primarily on national objectives or (2) to form coalitions that make joint and mutually advantageous allocations of coalition resources aimed at maximizing coalition public-good benefits. Coalitions can be seen as forming along a continuum ending in full centralization of decision making. In the context of the models this would imply the internalization of potential externalities in the decision-making process (i.e. via central data bases of banks’ financial condition) without necessarily implying the launching of a new centralized institution. The most inclusive coalition would be all European countries; less inclusive would be the EU; even less inclusive would be the Euro area countries. Each coalition can have separate yet related objectives. One can also imagine a coalition of large countries or of small countries or both

14 An exception is Freixas (2003).
considering whether it is to their advantage to design a shared prevention and resolution framework of their own that optimizes the utilization of their joint resources.

Looking ahead to the next section, the decision making problem faced by policy makers in the EU can be viewed as one in which an alliance of a large number of countries (27 in the EU or 13 in Euro area) independently decide the resources to devote to financial stability in their own economies knowing that there is some unquantifiable threat of financial instability to Europe as a whole (i.e. contagion), for example, relating to cross-border bank problems. At the same time, no single or collective entity devotes resources to safeguard the stability of the European financial system—or the amalgamation of these integrated national financial systems. Countries optimize based on knowledge, or at least the presumption, that they may both be conveying benefits to non-citizens and receiving benefits from the actions of other European countries. Because each nation knows this, the simultaneous decision-making takes on the form of a mathematical game, including in which there are incentives for some to free ride on the benefits provided by others (e.g. more prudential supervision) and thereby devote a nationally sub-optimal level of resources to financial stability. 15 Depending on the configuration of countries and other important ‘parameters’ of the model, sub-optimality can take on a variety of forms such as the over-provision of the public good by some countries, under-provision by others, and inefficient provision by all collectively.

This is a dilemma faced by European policy makers that the models developed below make transparent. If each nation makes independent decisions in providing a public-good in the form of financial stability, then there is the possibility if not likelihood that each country will devote a sub-optimal amount of resources to safeguarding EU financial stability as a whole and a sub-optimal level of resources nationally as well. While well-known in welfare economics, this conclusion and its implications have rarely if at all been analyzed within this financial-stability context; and the models developed below carry several other interesting and important implications for the current debate in Europe.

V. BENCHMARK ‘PURE’ PUBLIC-GOODS MODEL OF THE EU’S DECENTRALIZED APPROACH 16

This section formally develops and examines a simple ‘benchmark’ model for evaluating aspects of the ongoing debate in the EU, such as: (1) the implications of decentralized versus centralized decision making and (2) the benefits versus costs of ‘ex ante’ burden sharing agreements for resolving threats to financial stability (or what amounts to the same thing in the models, to producing the optimal amount of financial-stability benefits). The model examines the implications of simultaneous decentralized decision making in allocating

15 In this simplified scheme, “quality” (adequacy of allocation) is considered constant, and the “quantity” (amount of resources devoted) varies per country.

16 The ‘pure’ public goods model applied here was first examined in Olson and Zeckhauser (1966) and extended by Sandler and co-authors in the publications cited in the bibliography.
resources to the production of a ‘pure’ public good that conveys benefits to all countries and citizens within a group of countries.17

A. Decentralized Decision-Making in the Provision of a ‘Pure’ Public Good

Before formally introducing definitions and assumptions, the simplest model can be briefly summarized as follows. Each member of a group of countries (hereafter referred to as Europe) chooses an allocation of resources for producing a private good (or an index of private goods) and a public good so as to maximize its own welfare. The benefits of the public good fully convey to all citizens in all countries of Europe: they can be seen, for example, as the resolution of threats to the stability of the European financial system, such as the insolvency of a pan-European bank.

Each country’s decision making is subject to two constraints: (1) an income constraint (say, GDP), which requires that the cost of producing both an index of private goods and the public good does not exceed the nations income and (2) the condition that each other country chooses an optimal resource allocation conditional on every other country doing likewise. The second constraint is relevant because all countries contribute to, and share the benefits of, the public good. Accordingly, each country chooses its own welfare-maximizing mix of private/public goods presuming that all other member countries are also choosing optimal mixes of private and public goods conditional on their optimal choices. Characterized as such, this decision-making problem has the features of a mathematical game, and the solution concept is that of a *Nash equilibrium*.

While not an exact indicator, a country’s GDP relative to total GDP of the group of countries (Europe) can be seen as proxy for the volume of the country’s financial activities relative to the size of the European financial system.18 Thus, in what follows size can be taken as providing some indication of the potential for (1) spillovers of negative externalities of financial difficulties to the wider European financial system and (2) ‘spill-ins’ of benefits of country-specific public goods to other countries in Europe.

Keeping the exercise relatively simple requires a number of important assumptions: (i) all countries share the benefits of a single pure public good (as opposed to an imperfect public or club good, with some exclusively private benefits); (ii) preferences of citizens in each country can be represented in a continuous and twice differentiable utility function; (iii) the cost of providing the public good is identical in each country; (iv) all decisions are made

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17 A companion paper will examine the production of a public good that conveys some exclusive public-good benefits to the country that provides it and some pure public-good benefits to all other countries as well. This joint-public-good encompasses the pure public good model and so the features and results of these two models can be easily compared. The joint model was first examined in Ypersele de Strihou (1967) and later generalized by Sandler and Cauley (1975), Sandler (1977), and Cornes and Sandler (1984).

18 One can think of noteworthy exceptions (e.g., Benelux), which can be explicitly accommodated in more elaborate models.
simultaneously; and (v) the public good produced by one country is the same as another (perfect substitutability).

More formally, each of n countries allocates its national income, I, between a private numeraire good, y, and a pure public good, q, in the form of activities that safeguard European financial stability. The group of countries together produce an aggregate amount of the public good, Q, from which all countries receive benefits (which they may value differently, however). For each country \((i = 1, 2, ..., n)\), this total can be represented as the sum of a country-specific component, \(q^i\), and an ‘all-other-country component, \(Q_{-i}\), representing the amount of the public good provided by all other countries that share in the benefits.

Countries are assumed to optimally allocate resources to safeguard the European financial system against a commonly perceived threat to stability, denoted as T. The threat may be seen as taking the form of the potential cost of resolving the insolvency of a pan-European bank (which is the focus of the current debate within Europe), or it can be seen more generally as representing the potential European-wide costs of establishing a framework that safeguards the European financial system against all and any threats to stability, through both prevention and resolution efforts.

Given these definitions and assumptions, and using the notation of Sandler and others, the preferences of citizens in country \(i = 1, 2, ..., n\), can be represented by the utility function,

\[ U^i = U^i(y^i, Q, T), \]  \[1a\]

\[ U^i = U^i(y^i, q^i + Q_{-i}, T), \]  \[1b\]

where,

\[ Q = q^i + Q_{-i}, \]  \[2b\]

\[ Q_{-i} = \sum_{j \neq i} q^j, \]  \[2a\]

Equations 2 embody the notion of a ‘pure’ public good because the aggregate European effort to provide financial stability is the simple sum of countries’ resource allocations. This production ‘technology’ implies that each country’s provision of the public good, \(q^i\), is perfectly substitutable for any other country’s q. This property of perfect substitutability leaves open the possibility that countries may find it optimal to free ride on the efforts of other countries.

Each country is assumed to face the resource constraint,

\[ I^i = y^i + p q^i, \]  \[3\]
in which the price/cost of a unit of y is equal to 1, and the cost of providing a unit of the public good is p. By definition, p represents the relative cost of a unit of the public good, q_i, in terms of the numeraire private good, y_i.

**B. Nash equilibrium as the solution concept**

The current European institutional and legal framework for financial stability is highly decentralized: within the context of this simple model, each country can be viewed as making its own resource-allocation decisions. In the absence of cooperation, each country technically represents a ‘player’ in a non-cooperative game in which it could be viewed as rational to assume optimal behavior on the part of other players of the game. Under this assumption, optimal behavior implies that each player of the game will choose an optimal allocation of its scarce resources in anticipation of similarly optimal responses by other players.

If European countries behave in this way, then their decision-making process can be seen as resulting in optimal resource allocations that represent a Nash equilibrium. In Nash equilibrium, each country’s decision is an optimal response that anticipates optimal responses by other countries that share the benefits of the public good. This outcome represents an equilibrium in the sense that no country has the incentive to alter its allocation when all other countries maintain theirs—which they will in Nash equilibrium.

A Nash equilibrium allocation of resources is obtained when countries simultaneously maximize their utility, equation 1, subject to their own resource constraint, equation 3, and subject to the best-response (denoted by *) allocation of resources by all other countries, denoted as,

\[
Q^{* - i} = \sum_{j \neq i} q_j^* .
\]  

Equation 4 is the best-response spill-in of benefits to country i from the provision of public goods by all other countries in Europe.

**C. Maximization and Nash Equilibrium**

The Nash problem for each country (i = 1, 2, ..., n) can now be formalized as,

\[
\text{Max}_{\{y^i, q^i\}} \{ U^i(y^i, q^i + Q^{* - i}, T) \} \text{ subject to } I^i = y^i + p q^i. \]  

Assuming that all countries individually provide a positive amount of the public good, q^i, a Nash equilibrium consists of country allocations of resources (y^i, q^i) that solve equations 5 for all countries i. As described more fully in the two-country example below, the first-order conditions for optimization are satisfied when each country chooses the mix of private and public goods that equates the marginal rate of substitution between private and public goods to the relative marginal costs of producing both, i.e., when for all i,
Note that the MRS for each country is the ratio of the marginal utility of the public good, Q, to that of the private good, y. It represents a country’s marginal valuation of an additional unit of the public good in terms of the numeraire private good.

An important relationship that follows from the optimal decisions of each country is a ‘reaction’ or ‘response’ function for each country \( i = 1, 2, \ldots, n \),

\[
q^i = q^i (Q_{-i}, p, I^i, T),
\]

which establishes a relationship between country \( i \)'s optimal choices of how much of the public good to produce to choices made by other countries and the exogenous variables \( p, I^i, \) and \( T \). The Nash equilibrium level of aggregate provision of the public good for all countries combined, \( Q \), corresponds to the sum of all countries levels of provision of the public good that simultaneously satisfies the reaction function for each country \( \{i = 1, 2, \ldots, n\} \). This relationship will be exploited below in the 2 country case below.

**Digression: A Two-Country Example**

The utility functions for countries \( \{i = 1, 2\} \) can be represented as equations [E1], respectively:

\[
\begin{align*}
U^1 & = U^1 (y^1, Q, T) = U^1 (y^1, q^1 + q^2, T) \quad [E1a] \\
U^2 & = U^2 (y^2, Q, T) = U^2 (y^2, q^1 + q^2, T) \quad [E1b]
\end{align*}
\]

where:

\( U^1 \) and \( U^2 \) are continuous, twice differentiable, and quasi-concave functions;

\[
Q = q^1 + q^2 \; ; \text{and where} \quad [E2a]
\]

\[
Q_{-1} = q^2 \quad \text{and} \quad Q_{-2} = q^1 \quad [E2b]
\]

represent the spill-ins from the other country’s decisions. Each country \( \{i = 1, 2\} \) is assumed to face the country-specific resource constraint,

\[
I^i = y^i + pq^i, \quad [E3]
\]

in which the price/cost of a unit of y is equal to 1, and the cost of providing a unit of the public good is \( p \). By definition, \( p \) represents the relative cost of a unit of the public goods, \( q^1 \) and \( q^2 \), in terms of the value of the numeraire private goods, \( y^1 \) and \( y^2 \).
The *Nash equilibrium* allocation of resources is obtained when countries 1 and 2 simultaneously maximize their utility, equation [E1], subject their own resource constraint, equation [E3], and subject to the *best-response* (denoted by *) allocation of resources by the other country, denoted as, respectively as

\[ Q_{1}^{*} = q^{*2} \text{ and } Q_{2}^{*} = q^{*1}. \]  

[E4]

Equations E4 are the *best-response spill-in* of benefits to country 1 and 2 from the provision of public goods by country 2 and 1, respectively.

Because we are assuming the income constraint holds with equality, we can substitute [E3] into equations [E1]. Accordingly, country 1’s utility becomes a function of \( q^{1} \) and \( q^{*2} \).

The *Nash problem* for countries 1 and 2 can now be formalized, respectively, as maximizing the budget-constrained utility functions in equations [E5] below:

\[
\begin{align*}
\text{Max}_{\{q^1\}} \{ & U^1(I^1 - p q^1, q^1 + q^{*2}, T) \} \quad \text{[E5a]} \\
\text{and} \\
\text{Max}_{\{q^2\}} \{ & U^2(I^2 - p q^2, q^{*1} + q^{2}, T) \} \quad \text{[E5b]}
\end{align*}
\]

Assuming that both countries individually provide a positive amount of the public good, a *Nash equilibrium* consists of country allocations of resources that solves equations [E5].

As is evident from the first-order conditions below, an EU equilibrium is obtained when each country chooses the mix of private and public goods that equates the marginal rate of substitution between private and public goods to the relative marginal costs, \( p \), of producing both, i.e., when for \( i = 1, 2 \). Specifically, solving equations [E5] leads to the FOC,

\[
U_{q}^{i} = -U_{y}^{i} \cdot p + U_{Q}^{i} = 0,
\]

where subscripts indicate it is a partial derivative with respect to the variable subscripted. For example, \( U_{y}^{i} \) is the partial derivative of country i’s utility function, \( U^{i} \) in equation [5a] with respect to its income, \( y^{i} \), which is the first argument of the utility function. The expressions in [6] can be simplified as follows for each country:

\[
\frac{U_{Q}^{i}}{U_{y}^{i}} = \frac{MRS_{Q}}{MRS_{y}} = p. \quad \text{[E6]}
\]
The ratio of the marginal utility of the public good, Q, to that of the private good, y is the country’s marginal rate of substitution, denoted as $MRS_{Qy}^i$. It represents a country’s marginal valuation of an additional unit of the public good in terms of the numeraire private good. The Nash equilibrium occurs at that level of production for countries 1 and 2 that simultaneously satisfies these conditions. For well behaved utility functions, this equilibrium will be unique and stable.

The derivation of the Nash reaction functions (equations [7] in the n-country case) can be represented geometrically in $(q^1, q^2)$ space. Consider country 1’s budget-constrained preference map space, as in Figure 1 below. Country 1 is better off with greater levels of $q^2$, so higher indifference curves are associated with greater welfare. Consider the slope of country 1’s indifference curves for any given level of utility, which is obtained by taking the total derivative of the utility function in [E5a]:

$$
\frac{dq^2}{dq^1} \bigg|_{U^i = U^0} = \frac{U^1_q}{U^1_Y} = p \frac{U^i_y}{U^i_Q} - 1 = \frac{P}{MRS_{Qy}^i} - 1.
$$

**Figure 1. Country 1’s Indifference Map**

When this slope is zero, then the FOC condition, $MRS_{Qy}^1 = p$ is satisfied for country 1. For any given level of production of the public good by country 2 (represented in the graph as a horizontal line), there is a level of production of the public good by country 1 which satisfies country 1’s welfare maximization, which occurs along the indifference curve that is tangent to the horizontal line defined by that level of $q^2$. 
The locus of all of these points in the graph, N1, is the set of all Nash equilibria for country 1. In effect, the Nash locus is the country’s ‘optimal reaction function,’ which depends on country 2’s supply of the public good, country 1’s income, the relative cost of producing Q, or \( p \), and the threat to stability, T. The same analysis can be done for country 2 and the two can be combined in the same graphs, as in Figure 2a. Note that as long as the private and public goods are ‘normal’ goods with positive income elasticities, the reaction function will be downward sloping.

The intersection of these two reaction functions at \( N^* \) represents the Nash equilibrium level of each country’s production of the public good, \( q_{1N^*} \) and, \( q_{2N^*} \) respectively, and their sum is the community’s level of the public good, \( Q^{N^*} = q_{1N^*} + q_{2N^*} \), that all share equally. Note that the quantity \( Q^{N^*} \) can be shown geometrically by drawing a line segment with a slope of -1 from \( N^* \) to the horizontal axis.

Figure 2a. Nash Equilibrium
The derived reaction functions N1 and N2 assume that income, the relative cost of the public good, and the threat are held fixed: changes in any of these will shift the reaction functions. For example, as shown in Figure 2b, if the threat to stability increases for country 2, this will shift curve N2 up and to the right, implying that country 2 will provide more of the public good and country 1 will provide less; in fact, country 1 takes advantage of the rise in country 2’s threat and ‘free rides’ on country 2’s reaction. It can be shown, however, that the aggregate quantity of the public good would rise. The same kind of shift in country 2’s reaction function would occur if its income were to rise or its relative cost of producing the public good were to fall.

**D. Sub-Optimality of Nash Equilibrium**

Although the Nash solution is an equilibrium in the sense that there are no incentives for unilateral changes in the allocation of resources, the Nash equilibrium is by no means the best that countries and the EU can achieve in terms of social welfare. The sub-optimality of the Nash equilibrium achieved in the n-country decentralized decision-making process for providing a group level of the pure public good can be established by comparing the Nash equilibrium amount of the pure public good, $Q^N$ (which represents a non-cooperative solution to the ‘game’), to that of a Pareto-optimal cooperative solution amount, $Q^P$.

In the Nash equilibrium, each country is concerned only with the social welfare of its own citizens, and it ignores the potential benefits conferred on others that lie outside its borders. A group-wide Pareto efficient allocation of the same resources would be achieved if, for example, the entire group of countries vested a centralized decision-maker with the task of choosing a resource allocation for providing the public good that maximizes the social welfare for Europe as a whole.
The Pareto-optimal provision of the public good is derived by maximizing each country’s utility (equation 1) subject to two different constraints: (1) the constancy of other allies’ utility levels and (2) the European resource constraint, the simple sum of the country resource constraints.

This European optimization problem can be seen as one in which Europe chooses the levels of public good provided by all countries subject to the European budget constraint as in equation 5’ below:

\[
\text{Max}_{\{y^1, y^2, \ldots, y^n, q^1, q^2, \ldots, q^n\}} \{U^i(y^1, y^2, \ldots, y^n, q^1, q^2, \ldots, q^n; T)\} \tag{5’}
\]

subject to \(\sum_i I^i = \sum_i (y^i + pq^i)\).

As originally demonstrated by Samuelson (1954 and 1955) in a more general context, the resulting first-order condition for reaching this optimum is that the sum of the group of countries MRSs are equal to the relative cost of a unit of the public good, \(p\), as expressed below in equation 7.

\[
\sum_{j=i}^{n} \text{MRS}_{q_j} = p . \tag{6’}
\]

Thus, within the context of this model, the (decentralized) Nash-equilibrium level of resources devoted to European financial stability would be suboptimal relative to the Pareto-optimal allocation of resources consistent with maximizing EU welfare (rather than each individual countries’ welfare). Even though each country chooses to allocate resources to produce a private/public good output mix that maximizes its own welfare (conditional on simultaneous optimal choices by others as well), the resulting European equilibrium will be suboptimal from an European perspective. It is sub-optimal because no country considers the costs and benefits to other European countries of its individual optimizing decisions for the provision of the public good. Thus, a less than optimal level of the public good will be provided by a decentralized process compared to a coordinated one in which some of the positive externalities (benefits) from collective action can be internalized and distributed to all EU member countries.

**Digression: Sub-optimality in the 2-country example**

Reverting back to the 2-country example, Figures 3 and 4 respectively first show that there are more desirable choices for both countries compared to the Nash equilibrium \(N^*\). In Figure 3, for country 1, all points on income-constrained indifference curves lying above the Nash equilibrium—such as indifference curve \(U^1\)—constitute an improvement in country 1’s welfare. Similarly, in Figure 4, for country 2, all points on income-constrained indifference curves to the right of point N are welfare improving.
The region bounded by these two indifference curves $U^2$ and $U^1$ to the right of point $N^*$ are welfare improving for each country and the group together (see Figures 5a and 5b).
Additionally, it can also be shown geometrically that there are superior equilibria – Pareto equilibria – that can be obtained that internalize all of the externalities for the group of countries. In the two-country case, the optimization problem can be seen as one in which all of the externalities are to be internalized to obtain levels of the public good provided by all countries subject to the European budget constraint as in equations \([E5']\) below:
\begin{align*}
\text{Max}_{\{y^1, y^2, q^1, q^2\}} \{ U (y^1, y^2, q^1, q^2, T) \} & \quad [E5'] \\
\text{subject to } \sum_i I^i = \sum_i y^i + pq^i. & \\
\end{align*}

As was shown in the n-country case, the first-order condition for reaching this optimum is that the sum of the group of countries MRSs are equal to the relative cost of a unit of the public good, \( p \), as expressed below in equation 7.

\[ \sum_{j=1}^{2} \frac{MRS^i_{j}}{Q_y} = p. \quad [E6'] \]

Geometrically, the Pareto optimal equilibria occur when there is a tangency between country indifference curves. This tangency is represented below as the equality of the slopes of the indifference curves as follows:

\[ p \frac{U^1_{y^1}}{U^1_{Q}} - 1 = \frac{1}{p \frac{U^2_{y^2}}{U^2_{Q}} - 1}, \quad \text{which can be simplified into the optimum condition } [E6'] \text{ above,} \]

\[ p = \frac{U^1_{Q}}{U^1_{y^1}} + \frac{U^2_{Q}}{U^2_{y^2}} = MRS^1_{Qy^1} + MRS^2_{Qy^2}. \]

Many of the points that satisfy these first-order conditions are represented in Figures 6 as the locus PP, and all of these equilibria are socially optimal relative to the Nash equilibria and all other equilibria in the set bounded \( U^2 \) and \( U^1 \). Similarly, the other implications drawn in subsection D can be demonstrated in this two-country example.
E. Other Implications of the Benchmark n-Country Pure Public Good Model

A number of other implications of this decentralized, Nash equilibrium are relevant for the current debate on the design of an EU financial stability framework, and specifically on the least-cost resolution and sharing of costs.
First, the decentralized decision-making framework will lead some countries to free-ride on the efforts of others. This will be reflected in the country distribution of the supply of the public good. More specifically, the optimal allocation of the burden of providing financial stability (or resolving a cross-border bank, for example) will fall disproportionately on the larger (higher income) countries. From the point of view of the larger countries, the decentralized decision making process will be inferior to an ‘ex ante’ agreement to burden share according to country size. Thus, *compared to the decentralized Nash equilibrium, the proposal to agree ‘ex ante’ to share the costs in proportion to GDP would favor the larger countries at the expense of the smaller countries.* That is, a negotiation to agree a burden sharing arrangement would most likely lead to a greater share of the cost of safeguarding financial stability (both prevention and resolution costs) falling on the smaller countries than would be implied by a Nash equilibrium, as the larger countries would tend to push some of their disproportionately high costs onto others.

Second, at the Nash equilibrium, member countries’ propensities to provide the public good will depend on four factors: country-specific income ($I_i$), the relative cost of producing financial stability ($p$), the aggregate amount of resources devoted to financial stability by other member countries ($Q - q_i$), and the commonly perceived threat (or cost) of financial instability ($T$). If all factors were measurable, these demand functions would be estimable.

Third, the match between benefits received from EU financial stability and the actual effort allocated by many countries will be weak owing to free riding.

Fourth, the addition of member countries (for example, EU enlargement) would imply additional marginal benefits to the group as a whole (more contributors) without a diminution in the benefits for existing member countries.

These implications will change if some of the assumptions of the model and optimization exercise are relaxed or altered. For example, if one allows for country differences in the marginal cost of maintaining financial stability (for example, because of more efficient legal structures for resolving a bank), optimal decentralized decision making would imply that the more efficient countries would take on a larger share of the EU wide costs, regardless of their size. Thus, by relaxing this assumption, a country with a comparative advantage in providing financial stability would supply more of it.

**VI. BROAD CONCLUSIONS AND AREAS FOR FUTURE RESEARCH**

This paper has introduced and applied a benchmark model of decision making—drawn from the ‘economics of alliances’ literature that is useful for assessing the ability of Europe’s existing institutional architecture—including its decision-making processes—to effectively (if not optimally) allocate EU resources for safeguarding EU financial stability. The public good considered in the paper can be thought of either generally as safeguarding the EU financial system from systemic financial events (including prevention and resolution efforts) or specifically as resolving a European systemic financial event, such as the liquidity/insolvency of a pan-European bank or a pan-European-market-driven systemic threat to stability.
If the decentralized decision making process presented in the paper can be taken as a rough approximation of how European decisions are made, then the implications of the ‘pure’ public good model are instructive for the ongoing debate in Europe. Two implications are most pertinent.

First, decentralized decision making in Europe in the provision of shared financial-stability public goods results in an (Nash) equilibrium that is sub-optimal from a European perspective, even though each country views its own decision as optimal and has no incentive to change its resource allocation decision if other countries maintain theirs. In making decisions that do not account for the public good benefits/costs of other countries, each European country chooses a level of the public good that jointly turns out to be inferior relative to the socially optimal level for European stability. While this ‘fundamental theorem’ of welfare economics is well known, it serves as a timely reminder that greater coordination and harmonization, if not full internalization, of decisions and policies in safeguarding EU financial stability would most likely lead to welfare enhancing improvements relative to the existing European decentralized architectures and decision-making processes. In recent years, there has been a growing recognition of this potential ‘efficiency’ gap, which, in turn, has led to tangible efforts to capture some of these potential gains through policy coordination of countries via participation in joint fora, and some of the other initiatives discussed in Section II. From this perspective, the models outlined in Section IV can be seen as ‘explaining’ what has already occurred and potentially capable of ‘predicting’ what kind of incentives could drive coordination efforts in the period ahead.

Second, the equilibrium established in providing shared public benefits has the important characteristic that country size – as a proxy for systemic importance – matters. In this context, the larger countries in Europe will end up footing a disproportionately large share of the overall (and socially sub-optimal) burden of allocating resources to the production of the public good relative to GDP (including the financial resources to bail out banks) and there may not be a close matching across countries of the benefits received and the costs incurred in contributing to the shared public good. Within the context of the model games discussed in Section IV, and consistent with a broad range of other applications of the ‘economic of alliances,’ the larger countries might have the incentive to exercise their strength, form a coalition, and move the equilibrium from Nash to one of the many other welfare-improving equilibria—which could shift some of their disproportionately large share of the burden onto smaller countries. In this regard, the proposal to agree on an ex ante burden sharing in which countries contribute in proportion to GDP to a European reserve for resolving the insolvency of a cross-border European bank can be seen as consistent with the larger countries improving on the Nash equilibrium at the expense of the smaller countries. 19

A companion paper considers the provision of financial-stability public goods that convey benefits that are partially ‘exclusive’ (country-specific) and partially fully shared (as in the case of ‘pure’ public goods). While not analyzed here, some of the implications of this model can be summarized. In the joint-public-good model, each country’s calculus changes

19 See Goodhart and Schoenmaker (2006) for a discussion of this proposal.
and the resulting European equilibrium has different characteristics and implications. The exact nature of the Nash equilibrium and the other socially more optimal ones changes in ways that depend importantly on the extent to which benefits conveyed are ‘exclusive’ relative to total benefits. The key implications are the following.

First, while the Nash equilibrium remains broadly suboptimal, compared to the Nash equilibrium in the ‘pure’ good case, smaller countries will end up sharing more in the cost burden to the extent that benefits in terms of financial stability are ‘exclusive’ (i.e. they do not have implications for the financial stability of the EU).

Second, within a decentralized decision making process, there are greater incentives for coalition forming than in the case of pure public goods. Countries that produce a small share of exclusive benefits may join forces to create a framework excluding countries with a very large share of exclusive benefits in order to capture some of the existing externalities. Thus, the exact mix of joint public goods can provide incentives for, and influence the country composition and nature of, the formation of coalitions of a subset of member countries. To some extent this has already happened within the EU (Nordic or Benelux countries, for example).

A final implication with some relevance is that as the share of exclusive benefits to total benefits increases, the gains from collective action through cooperation and alliances naturally declines. In the limit, when all benefits are exclusive, there are no shared benefits between countries to internalize. As the exclusive benefits relative share approaches one, market solutions and the formation of ‘clubs’ or ‘regional coalitions’ are capable of yielding solutions that achieve more efficient equilibrium outcomes for their membership. Reflecting these kinds of incentives, safety net regulators in the Nordic countries and the Benelux countries have formed such coalitions, and other coalitions are likely within Europe in the period ahead unless full internalization of these conflicts takes place.

Future research on these challenges could consider model specifications that more closely account for other important features of the European financial system and decision-making process. For example, extensions to the model can be envisioned that account for some of the differences between countries within Europe. Three types of countries can be distinguished.

- First, consider a large country in Europe whose economic and financial activities comprise a relatively large share of European activities. In providing for national financial stability the large country may be providing both ‘exclusive’ public goods, whose benefits are received by nationals, and ‘pure’ public goods, whose benefits are received by a large majority, if not all, European countries. For such countries, the provision and maintenance of financial stability can be seen as providing joint products: the ‘exclusive’ or national benefits of stability to its own citizens (which collectively amounts to a public good) as well as the positive externalities of stability conveyed through market integration and cross-border financial institutions to citizens of other nations whose financial systems are closely integrated: the public good from the European perspective. The widespread benefits of ‘pure’ public goods
can arise, for example, because of the important role of the large country’s markets, financial institutions, or market infrastructures in the integrated EU market place.

- Second, there are (small) countries in the EU whose financial activities are either small relative to EU activity or primarily domestic. In these countries, the resources devoted to safeguarding national financial stability can be seen as providing primarily ‘exclusive’ benefits to their nationals.

- Third, and by contrast, there are countries in Europe whose size and resources devoted to preserve financial stability are small relative to the potential negative externalities that might be conveyed to the EU markets (e.g. by the failure of a large cross-border bank whose parent is licensed in the jurisdiction of this small country). All of these distinctions can be analyzed in the model.

Another direction for further research is an analysis of the potential efficiency gains from a more coordinated approach in the EU. Another avenue for future development of these benchmark models would be to introduce the concept of contagion and link to it the degree of integration.20 A final avenue for research would be to examine the same issues within the context of models of ‘mechanism design.’ 21

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21 See Čihák and Decressin (2007)
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