Is a Fiscal Union Optimal for a Monetary Union?*

Rafael Berriel[†‡] Eugenia Gonzalez-Aguado[§] Patrick J. Kehoe[¶]

Elena Pastorino[‖]

October 2023

Abstract

When is a fiscal union appropriate for a monetary union? In a monetary union without fiscal externalities, when local fiscal authorities have an informational advantage over a central fiscal authority in terms of their knowledge of countries' preferences for government spending, a decentralized fiscal regime dominates a centralized one. Our novel result is that in the presence of fiscal externalities across countries, however, a decentralized fiscal regime is optimal for small monetary unions, whereas a centralized fiscal regime is optimal for large ones. These results shed new light on the debate on fiscal integration within the EU and its enlargement.

JEL Classification: E6, E61, E62, E65, F42, F45.

Keywords: Fiscal Delegation, Fiscal Federalism, Externalities, Public Goods, European Union Enlargement

*We thank Marco Bassetto, our discussant at the CRNY conference, and Tom Sargent for many useful comments.

[†]Correspondence to: Patrick Kehoe, Stanford University, 579 Jane Stanford Way, Landau Economics Building Office 336, Stanford, CA 94305, USA.

[‡]Stanford University. Email: rberriel@stanford.edu.

[§]Toulouse School of Economics. Email: eugenia.gonzalez@tse-fr.eu.

[¶]Stanford University and NBER. Email: pkehoe@stanford.edu.

[‖]Stanford University, Hoover Institution, SIEPR, and NBER. Email: epastori@stanford.edu.

1 Introduction

The appropriate allocation of decision-making power over fiscal policy between a central authority and multiple local ones has been debated for millennia. For instance, Aristotle argued that *"we should know over which matters several local tribunals are to have jurisdiction, and in which authority should be centralized*" (Aristotle, Politics 4.15).

At present, this question is especially relevant for the European Union (EU). Most EU member countries have adopted the euro as their primary currency and sole legal tender and are thus part of a monetary union—the eurozone.[1] The EU, though, affords all member countries a large degree of independence in determining national fiscal policy. Many have argued that the optimal delegation of fiscal decisions—namely, whether such decisions should be centralized within a union-wide fiscal authority or left instead to member states—is one of the most important issues for the future of the EU (Tabellini, 2003). Similarly, Saiegh and Tommasi (1999), Nicolini et al. (2002), and Cooper and Kempf (2004) have emphasized how the complex system governing the rules of fiscal federalism in Argentina is largely responsible for the poor performance of its fiscal and monetary policy.

The purpose of this paper is to adapt some of the ideas central to the doctrine of fiscal federalism in order to reassess standard results in the macroeconomics literature on how fiscal authority in general should be allocated within a monetary union and on when a fiscal union in particular is desirable for a monetary union. Canonical models such as that in Aguiar et al. (2015) imply that it is always optimal to delegate fiscal policy to a central fiscal authority. The reason is twofold. First, a central fiscal authority internalizes any possible fiscal externality that local fiscal authorities do not have an incentive to take into account. Second, local fiscal authorities are typically thought of as having no advantage on fiscal matters over a central one. This approach to the fiscal delegation problem contrasts sharply with the common approach in the literature on fiscal federalism dating back at least to Oates (1972), which presumes that central authorities of fiscal unions are less able to design their policies in accord with member states' preferences over local public spending than a local authority is. That is, under fiscal centralization, policies are more uniform across states than is desirable. Given this premise, an important insight from the fiscal federalism literature is that without large fiscal externalities in the provision of public goods, such as

[1]The non-eurozone countries are Bulgaria, Czechia, Denmark, Hungary, Poland, Romania, and Sweden.

those from union-wide defense, it is optimal to delegate fiscal decisions to local authorities.

Our paper proposes a model of a monetary economy that microfounds this approach in a parsimonious way and, through its lens, illustrates key forces governing the optimal delegation of fiscal policy within a monetary union. The idea underlying the model is that when the size of a monetary union is small, fiscal externalities across member states are also limited. Thus, any natural advantage that a decentralized fiscal regime may have in adapting policies to each member state's characteristics and preferences outweighs the costs of uninternalized fiscal externalities across member states, making a fiscal union unappealing. But as the number of countries in a monetary union increases, so do the free-riding incentives arising from any fiscal externality, which make a fiscal union attractive.

In light of these conflicting forces, we establish a novel result on optimal fiscal delegation: a decentralized fiscal regime is desirable for small monetary unions, whereas a fiscal union is desirable for large ones. Namely, a threshold size for a monetary union exists such that a decentralized regime of fiscal authority is optimal below that size and a higher threshold size also exists such that a centralized regime—that is, a fiscal union—is optimal above it. We characterize in detail the forces that determine these thresholds, which relate primarily to the quality of the information about the preferences of member states' citizens over public spending that a central fiscal authority has access to and to the magnitude of fiscal externalities across countries. We also show that in many settings of interest under the assumption of log preferences, these two thresholds coincide and the optimal delegation policy admits a unique threshold for fiscal centralization.

A key insight from the literature on fiscal federalism is that in the absence of countervailing forces, fiscal authority within a union should be delegated to individual states. Article 5(3) of the Treaty on European Union (TEU), signed in 1992, formalizes this exact idea by enshrining the principle of *subsidiarity* of fiscal delegation, which defines the circumstances under which it is preferable for an action to be undertaken by the EU rather than by member states as instances in which the authority or competence of member states is insufficient or inadequate.[2] Although the EU is technically not a federation, many have noted that several of the ideas from the classic theory of fiscal federalism can be applied to it to determine

[2]These instances include when: *i*) the competence in an area is shared between the union and member states (*non-exclusive competence*); *ii*) the objectives of the proposed action cannot be sufficiently achieved by member states (*necessity*); and *iii*) the action can therefore, by reason of its scale or effects, be implemented more successfully by the union (*added value*).

the conditions under which various types of fiscal authority should be delegated to member states and those under which they should instead be centralized (Tabellini, 2003). This paper pursues this strategy by developing a framework that incorporates these ideas and is applicable to both real and monetary economies in order to evaluate the benefits of fiscal centralization.

Our work builds on one of the seminal studies on fiscal federalism—namely, Oates (1972). A key tenet of the theory in Oates (1972) is that a central fiscal authority tends to be less responsive to the different preferences for public spending of the residents of different local communities and so has a natural tendency towards uniformity in fiscal policy across communities (Oates, 1972, p. 11). Oates (1972) approaches the issue of delegation by focusing on what he terms an ideal special case, in which all individuals in a specific geographic area are immobile and have identical preferences for public goods. Moreover, any local fiscal authority enjoys an advantage over a central fiscal authority in that it has complete knowledge of the tastes of its constituents, and so it can finely tailor its policies to local needs. Oates (1972) simply imposes that any fiscal decision taken by the central government must be homogeneous across regions. Under this assumption and a few others, Oates (1972) argues that a general decentralization theorem holds in that

> "*for a public good—the consumption of which is defined over geographical subsets of the total population, and for which the costs of providing each level of output of the good in each jurisdiction are the same for the central or the respective local government—it will always be more efficient (or at least as efficient) for local governments to produce Pareto-efficient levels of output for their respective jurisdictions than for the central government to provide any specified and uniform level of output across all jurisdictions*" (p. 35).

This influential perspective has been challenged, though. In a survey of the benefits of decentralization, Lockwood (2005, p. 2) characterizes Oates's (1972) thesis as a preference-matching argument whereby "*goods provided by governments in localities will be better matched to the preferences of residents in those localities*." Lockwood (2005, p. 3) questions such a benefit of decentralization since it rests on the "*ad-hoc assumption of policy uniformity: the central government is assumed to set a uniform level of local good provision in all regions*." For instance, the author notes that spending on the highway system in the United States is effectively targeted to state needs and hence heterogeneous across states. Lockwood (2005) further argues that although local governments may have bet-

ter information about local preferences for public goods than a central government has, a benevolent central authority could design an incentive mechanism to elicit these preferences from each region and implement the efficient outcome accordingly. Besley and Coate (2003, p. 2612) similarly dispute the idea that the centralization of fiscal authority implies policy uniformity. They argue that empirically, many examples exist of public goods that are unequally provided by a federal government to local regions, whereas theoretically, it is unclear why a government charged with providing public goods within a centralized system cannot differentiate their provision according to the "*heterogeneous tastes in each district*."

In this paper, we propose a model that is consistent with the idea that local authorities have a natural advantage in designing their policies on the basis of their constituents' preferences but that is immune from these criticisms. Namely, we depart from Oates's ad-hoc assumption of complete policy uniformity under centralization and instead microfound the degree of optimal policy uniformity as arising from the assumption that local authorities have more precise information about their citizens' tastes for local public goods than does a central authority. In particular, in a decentralized regime, each local government observes the preferences of its citizens, whereas in a centralized regime, the union-wide fiscal authority observes only a noisy signal about the preferences of each member state's citizens. We then formalize the notion that although member states have no incentive to conceal their information and instead attempt to communicate their true preferences to a central authority, this communication process is imperfect.

Some empirical support for the notion that even well-meaning agents often find it difficult to convey their preferences to others has been documented by Waldfogel (1993). Waldfogel (1993) argues that an important economic aspect of gift giving, say, around the holidays, is that gifts may be mismatched to their recipients' tastes. Intuitively, according to standard consumer choice logic, the best a gift giver can do is to duplicate the choice that the recipient would have made with an equal amount of resources available. But if the gift giver is less than perfectly informed about the recipient's preferences, it is likely that the gift will make the recipient worse off than if the recipient had directly made the consumption choice. Hence, gift giving is a potential source of deadweight loss. Proceeding from this idea, Waldfogel (1993) documents that holiday gift giving from significant others destroys about 10 percent of the value of gifts, whereas gifts from members of the extended family destroy about a third of their value. If even close family members do not seem to be able to convey well to each other

their preferences for the typically simple goods and services exchanged as gifts, difficulties in communication may well arise for officials of a member state trying to communicate to a central fiscal authority its citizens' preferences for complex goods and services.

We begin our analysis with a model of a multi-country monetary union that highlights the ideas behind Oates's (1972) decentralization theorem. We start with an economy that features no externalities across countries, but a central fiscal authority receives only noisy signals about countries' preferences for public goods. In both the decentralized and the centralized fiscal regime, each local government pays for its own spending with locally raised tax revenues. A natural generalization of Oates's (1972) decentralization theorem then holds: a decentralized regime dominates a fiscal union and the degree of dominance increases as the preference signals received by the central fiscal authority become less informative.

We then augment this economy with a direct fiscal externality by assuming that any country's government spending is characterized by a component that contributes solely to its own public goods and a component that contributes to the public goods of every other country.[3] Our main result for this augmented model is that since the fiscal externality worsens as the monetary union grows in size, the optimal fiscal delegation policy has a threshold-rule form. Namely, a decentralized fiscal regime is optimal for small enough monetary unions but a centralized fiscal regime is optimal for large enough monetary unions. Also, fiscal centralization tends to be more appealing the higher is the informational quality of the signals that the central fiscal authority receives about countries' preferences for government spending and the stronger is the fiscal spillover across countries.

We conclude by exploring some extensions and qualifications of our results. We first show that our results apply virtually unchanged regardless of whether the quality of the information available to a central fiscal authority decreases, is constant, or increases with

[3]Draghi (2023) provides support for the notion that this common component is substantial in the context of the EU. Specifically, he argues that "*in Europe today we have never faced so many shared supranational goals, by which I mean goals that cannot be managed by countries acting alone. We are undergoing a series of major transitions that will require vast common investments. The European Commission puts the investment needs for the green transition at more than 600 billion euro annually until 2030—and between a quarter and a fifth of this will have to be funded by the public sector.*"

the size of a monetary union.[4] We then show how the type of externality that motivates our analysis and is standard in the fiscal federalism literature—see Lockwood (2002, 2005)—has the feature that as a monetary union grows in size, a centralized fiscal regime eventually dominates a decentralized one. We examine the role of this form of fiscal externality for our results. In particular, we show that it is theoretically possible to construct alternative externality functions such that a centralized fiscal regime never dominates a decentralized one. However, these forms of externalities are atypical compared with those that are the focus of the fiscal federalism literature both theoretically and empirically.

We now turn to discuss how our results relate to those in the existing literature. In a related paper, Berriel et al. (2023), we consider an economy in which countries finance their government spending with nominal debt and distortionary taxes, and inflation has a negative effect on aggregate productivity. We find that when the monetary authority lacks the ability to commit to an inflation policy and faces a larger level of nominal debt, it finds it optimal to inflate more so as to lessen the need to raise taxes. But when deciding on its own level of spending and debt, each country considers only the negative impact of the induced inflation on its own productivity, thus ignoring its effect on other countries' productivity. Hence, in a decentralized regime, a fiscal externality arises that is both *endogenous* and *indirect* in that although the spending of any country does not affect the utility or production of any other country, the resulting increase in inflation that such spending induces impacts all countries. The negative indirect endogenous externality of this multi-period economy has parallels with the positive direct exogenous externality that we focus on in this paper. Since this negative externality becomes more severe as the size of a monetary union increases, in this setting as well, a cutoff size of a union exists such that a decentralized regime is optimal for any small-sized unions, but a centralized regime is optimal for any large-sized unions.

Our conclusions differ from the consensus in the macroeconomics literature, which has long been that whenever cross-country externalities are present, a centralized fiscal regime is strictly preferred to a decentralized one for a monetary union. The reason is that this

[4]In our baseline analysis, we maintain that as a monetary union grows, the informational disadvantage of a central fiscal authority relative to local ones remains constant. We then explore a richer environment in which, instead, the informational disadvantage of a fiscal union decreases as a monetary union grows, say, because of increasing returns to scale in information acquisition. In this case, the centralization of fiscal authority can be optimal even for small monetary unions. We also show that, by contrast, if the informational disadvantage of a fiscal union increases at a faster rate than the rate at which fiscal externalities increase as a monetary union grows, then a fiscal union is optimal only for large enough monetary unions.

literature abstracts from key aspects of fiscal federalism that the public finance literature on it has instead emphasized. In our view, a critical dimension missing from the macroeconomics literature is the idea that local policymakers have a natural advantage in tailoring policies to their constituents' interests. As we show, once we incorporate this feature into an otherwise standard macroeconomic model, a novel result emerges: a centralized fiscal regime is no longer always optimal. Rather, it is typically preferable to pair a small monetary union with a decentralized fiscal regime and a large monetary union with a centralized one. This delegation principle, which accounts for the potential benefits of decentralization, may be worth serious consideration when contemplating fiscal delegation in practice.

One strand of the macroeconomics literature has examined the optimal delegation of fiscal authority in the context of cross-country insurance against aggregate shocks—an issue that we abstract from. One view, associated with Kenen (1969), is that cross-regional fiscal transfers are critical to the functioning of a monetary union. An alternative view, associated with Mundell (1973), is that the need for such transfers lessens in the presence of sophisticated international financial markets. Kehoe and Pastorino (2017) address this debate and prove the conjecture of Mundell (1973) for a simple environment, building on the framework of Fahri and Werning (2013). Specifically, Kehoe and Pastorino (2017) show that the same welfare achieved in a Kenen-style regime, in which a central fiscal authority redistributes income via cross-region transfers, can be achieved in a Mundell-style regime, in which decentralized fiscal authorities rely on international insurance markets to implement the desired outcomes. In this sense, Kehoe and Pastorino (2017) prove that Mundell's (1973) conjecture holds.[5]

Fogli and Pastorino (2021) argue that this view is subject to two caveats. First, an aggregate shock that simultaneously affects multiple countries of a monetary union, like the recent pandemic, may make a coordinated union-wide response appropriate. Second, the notion that greater fiscal integration is unnecessary in the presence of well-developed financial markets presumes that a union-wide authority has no advantage over member countries in implementing domestic fiscal policies. But if member countries face distortions that they are unable to correct, then a central fiscal authority that imposes the appropriate taxes or transfers may be strictly beneficial—even if no common currency existed among

[5]Note that Fahri and Werning (2013) do not focus on delegation. Rather, they show that a fiscal union without access to insurance markets but with access to a rich set of transfers and other tax instruments dominates a pure *laissez-faire* equilibrium without any government but with sophisticated financial markets.

the members of the union. Here, we abstract from these considerations in order to focus solely on the question of fiscal delegation in the presence of an informational advantage to decentralization.

A related political economy literature analyzes centralized decision-making departing from the idea that central governments maximize the welfare of their citizens. This literature focuses on settings in which locally elected representatives are part of a central legislature that decides on the provision of public goods for each member state. Outcomes then depend on the specific assumptions about the political decision-making process—for instance, whether a majority rule applies whereby all regions share equally in the costs of provision of public goods, regardless of whether they receive a funded project. As Lockwood (2002) shows, because of such forms of cost-sharing through uniform taxation, these setups tend to lead to legislatures biased towards minimizing the cost of projects rather than maximizing their net benefits. Besley and Coate (2003) derive similar results under different assumptions. In our work, as noted, each region pays for its spending with its own tax revenues, so no such cost-sharing issues arise. We therefore view our work as complementary to this literature.

The paper is organized as follows. Section 2 begins by analyzing a baseline model of a monetary union without externalities and then examines a version of it augmented with a fiscal externality across countries, establishing our main results. Section 3 explores the robustness of our findings to extensions of our framework. Section 4 concludes. All omitted proofs and details are collected in the online appendix.[6]

2 A Model of a Monetary Union

We propose a simple model of a monetary union that formalizes the main idea behind Oates's (1972) decentralization theorem, which holds that local fiscal authorities have a natural advantage over a centralized one in deciding on local fiscal matters. Oates (1972) argues that a basic shortcoming of a centralized system is its "*probable insensitivity to varying preferences among the residents of different communities*" (p. 11). By contrast, "*a decentralized form of government ... offers the promise of increasing economic efficiency by providing a range of output of certain public goods that correspond more closely to the differing tastes of groups of consumers*" (p. 12). In this seminal work, Oates simply assumes that a central fiscal

[6]The online appendix is available from the authors' webpages.

authority must provide the same level of public goods to all member states, although states have differing preferences for them. We both generalize and provide a microfoundation for this premise by assuming that a central fiscal authority observes a noisy signal about each member state's preferences for public goods, so it is unable to precisely tailor its policies to member states' preferences. The case in which the signal from each member state is uninformative about the preferences for public goods of the state's citizens nests the case discussed by Oates (1972), as it implies that fiscal policy is optimally uniform across states.

The decentralization theorem focuses on what Oates (1972) terms the case of *perfect correspondence* in the provision of public goods, which rests on six assumptions. The first is that individuals in each geographic region have the same tastes for local public goods, and only one local government has jurisdiction over each such region. The second is that the only citizens who benefit from a region's local public good are those in the region. The third is that the cost of providing this good is the same at the local level and at the centralized level. The fourth is that cross-country transfers are infeasible in that local public goods are paid for by local taxes in both the decentralized and the centralized regimes. The fifth is that each local government possesses "*complete knowledge of the tastes of its constituents*." The sixth assumption, which amounts to a requirement of policy uniformity under centralization, is that policies are homogeneous across regions when fiscal authority is centralized. Under these assumptions, the theorem states that "*it will always be more efficient (or at least as efficient) for local governments to provide the Pareto-efficient levels of output for their respective jurisdictions than for the central government to provide any specified and uniform level of output across all jurisdictions*."

We set up our baseline model to be consistent with all of these assumptions, except for the sixth one. Instead of imposing policy uniformity under centralization, we allow for a general informational structure for the central fiscal authority that leads to optimal policy uniformity as a special case—namely, when the signals that the central fiscal authority receives about the preferences of countries' citizens for government spending are uninformative. We show that a *generalized decentralization theorem* holds in this setup: as long as local fiscal authorities have better information about their citizens' tastes than a central fiscal authority, decentralization is preferred. In this sense, we address the criticism of Besley and Coate (2003, p. 2612), who challenge the notion that "*centralization implies uniformity*" and argue that this assumption is "*neither empirically nor theoretically satisfactory*" by establishing that a version of the

result applies to the richer environment that we consider.

We then turn to a case in which externalities arise and Oates's (1972) second assumption is violated. We focus on a situation in which a fiscal externality emerges because any given country's government spending provides not only direct benefits to the country's citizens but also indirect benefits to all other countries' citizens—such as the case of spending on roads or bridges connecting regions of different countries. We obtain a new result—namely, that a cutoff rule in the size of a monetary union exists such that for a small enough monetary union, a decentralized regime is optimal, but for a sufficiently large monetary union, a fiscal union is optimal.

In this augmented model, effective government spending in each member state depends on both a state's own government spending and a fraction of the spending of all other member states' governments. We focus on this case because as the fraction of other states' spending increases from zero to one, the model subsumes the two extreme cases of a purely local public good and a purely union-wide public good, as well as any case in between. For example, it covers the case of, say, French parks, which provide much larger benefits to French citizens than to non-French citizens of the EU. It also includes the case of, say, French tanks provided for the common defense of the EU, which offer relatively similar benefits to French and non-French citizens of the EU. As in Oates (1972, 1999), we assume that each country's government budget is balanced in that its spending is entirely paid for by its own taxes. Hence, none of the considerations that arise from the cost-sharing of expenditures, which stem from a common tax rate but differing spending across regions and motivate much of the political economy literature on fiscal federalism, emerge in our framework.

We note that Oates (1972) interprets the economies to which the decentralization theorem applies as monetary unions with fixed nominal exchange rates between them. As the author makes clear, the idea is that in a monetary union, prices are common across countries, and a union-wide monetary authority sets monetary policy, so only fiscal policy is country-specific. We follow the spirit of Oates (1972), but we first begin with an explicit monetary-union setup and then show that it reduces to the type of real economies that Oates (1972) classifies as monetary unions.

2.1 The Economy

Consider a one-period economy in which each of I countries is populated by a representative consumer and a government. The countries are part of a monetary union in which monetary policy amounts to the choice of the price level p leading to the gross inflation rate $\pi = p/\overline{p}$, where $\overline{p}$ is the price level inherited from the past. Output in each country i is produced by a representative firm using the production function $A(x_i)y$, where x_i is an input purchased from abroad that increases productivity in that $A'(x_i) > 0$ and y is a domestic input, which we assume is fixed for simplicity. In order to capture the costs of inflation, we assume that the representative firm in country i has an initial amount of money M that it can use to buy the input x_i at a nominal cost of px_i units of money subject to the constraint $px_i \leq M$ or, equivalently, $\pi\overline{p}x_i \leq M$. Hence, a higher inflation rate reduces aggregate productivity. The budget constraints of country i's consumers and government are

$$p(c_i + T_i) = pA(x_i)y \quad \text{and} \quad pg_i = pT_i, \tag{1}$$

where c_i is private consumption, g_i is government spending, and T_i are lump-sum taxes. The two budget constraints can be consolidated into a country-wide budget constraint,

$$p\left(c_i + g_i\right) = pA(x_i)y. \tag{2}$$

At the beginning of the period, the union-wide monetary authority chooses the gross level of inflation $\pi \geq 1$ before governments, consumers, or firms make any decisions—note that we impose that (net) inflation must be non-negative. The monetary authority anticipates that in order to maximize the output produced, each firm will find it profitable to spend all of its money on imported intermediate goods in that $x_i = M/(\pi\overline{p})$. It is then optimal for the monetary authority to set net inflation to zero ($\pi = 1$). From now on, we thus normalize $\overline{p}$ and $A(M)$ to 1. Under these normalizations, we can abstract from firms and simply let each consumer in country i be endowed with an amount y of goods. The budget constraints for the consumer and the government of country i then reduce to $c_i + T_i = y$ and $g_i = T_i$, so that country i's resource constraint is

$$c_i + g_i = y. \tag{3}$$

Hence, in effect the monetary economy described reduces to a real one.

Lemma 1. *The monetary economy is equivalent to a real economy in which both the price level and aggregate productivity are constant.*

Consumers in different countries differ only in their preferences for government spending. The utility function of a representative consumer in country i is

$$u(c_i) + \theta_i h(g_i), \tag{4}$$

where $u(\cdot)$ and $h(\cdot)$ are strictly increasing and strictly concave functions. The taste of country i's consumers for government spending on public goods, θ_i, is a random variable that is drawn for each country at the beginning of the period. For notational simplicity only, we assume that θ_i takes two values, $\theta_i \in \{\theta_H, \theta_L\}$, with $\theta_H > \theta_L > 0$. Letting q be the probability of θ_H, we denote the mean of θ by $\mu_\theta = q\theta_H + (1-q)\theta_L$.

The decision-making process about each country's government spending depends on the degree of centralization of fiscal authority. In a decentralized regime, the government of each country i chooses its level of government spending g_i to maximize the welfare of its citizens. In a centralized regime, also referred to as a *fiscal union*, a central fiscal authority chooses g_i for each country i to maximize the welfare of all citizens in the union instead. In both cases, fiscal authorities are subject to the same government budget constraint $g_i = T_i$. Hence, as discussed, we abstract from any role that a central fiscal authority may play in redistributing resources across regions.

A key feature of this setup motivated by Oates (1972) is that country i's government is assumed to have better information about its citizens' taste for public spending than does a central fiscal authority. Formally, the government of country i observes θ_i, whereas the central fiscal authority observes only a noisy signal about θ_i, $s_i \in \{s_H, s_L\}$, which is symmetric in that

$$\phi = \Pr(s_H|\theta_H) = \Pr(s_L|\theta_L) \quad \text{and} \quad 1-\phi = \Pr(s_L|\theta_H) = \Pr(s_H|\theta_L), \tag{5}$$

where $\phi \in [1/2, 1]$ denotes the informativeness of the signal. When $\phi = 1/2$, the signal is uninformative in that $\mathbb{E}(\theta_i|s_H) = \mathbb{E}(\theta_i|s_L) = \mu_\theta$, whereas when $\phi = 1$, the signal is perfectly informative in that $\mathbb{E}(\theta_i|s_H) = \theta_H$ and $\mathbb{E}(\theta_i|s_L) = \theta_L$. More generally, Bayes's rule yields

that given the prior q that consumer taste is θ_H, the posterior probabilities that it is θ_H are

$$\Pr(\theta_H|s_H) = \frac{q\phi}{p_H} \quad \text{and} \quad \Pr(\theta_H|s_L) = \frac{q(1-\phi)}{1-p_H}, \tag{6}$$

after a high and low signal, where p_H is the unconditional probability of a high signal,

$$p_H = q\phi + (1-q)(1-\phi). \tag{7}$$

Here, we assume that the informativeness of each country's signal does not depend on the number of countries in a monetary union, thus abstracting from any increasing or decreasing returns to scale in information gathering or processing. In Section 3, we show that our main results hold not only in the presence of increasing or decreasing returns to scale in information but also, more generally, *regardless* of how the informativeness of the preference signal varies with the number of countries in the union.

Note that this economy has been purposely designed to be consistent with Oates's (1972) first five assumptions. Specifically, the utility function in (4) implies that all the consumers in a given country have the same tastes for government spending and the jurisdiction of country i's government is only over these consumers. Moreover, there are no external benefits to country i from any other country's spending g_j, $j \neq i$. Next, from the budget and resource constraints, it is immediate that the cost of providing g_i is the same for country i and for a fiscal union. In both regimes, each government pays for its spending with locally raised taxes. Finally, country i's government knows its citizens' taste θ_i for public goods. As for Oates's (1972) sixth assumption, we extend Oates (1972) by allowing a central fiscal authority to receive a noisy signal about θ_i and optimally choose g_i conditional on it, rather than simply imposing that g_i is the same for all countries regardless of their citizens' underlying tastes.

The idea behind this formulation is that although each local government wishes to communicate to the central fiscal authority its true preference parameter θ_i, the communication is imperfect because tastes are difficult to either completely describe or specify in a verifiable manner. Hence, all the central fiscal authority perceives is a noisy signal $\overline{s} = (s_1, \ldots, s_I)$ about each country's preference parameter. It is worth noting that in the fiscal federalism literature, the premise of the results on fiscal decentralization is not that agents do not truthfully reveal their privately known tastes for public goods but rather that central authorities have a natural tendency towards policy uniformity across states. Hence, our formulation

generalizes the standard case considered by Oates (1972, 1999), which can be thought of as the uninformative case in which policy uniformity is optimal.

Throughout, for simplicity, we consider two polar cases in which countries' preferences for government spending and the central fiscal authority's signals about them are either perfectly correlated across countries or independently drawn for each country. For each case, we evaluate two alternative scenarios for the delegation of fiscal authority: a *decentralized* regime and a *centralized* one—that is, a fiscal union.

Decentralized Regime. In this regime, each country i's government has perfect information about its citizens' tastes for government spending and thus solves the problem

$$W^D(\theta_i) = \max_{c_i, g_i} [u(c_i) + \theta_i h(g_i)], \tag{8}$$

subject to the constraint $c_i + g_i = y$. Country i's ex-ante welfare is then

$$V^D = qW^D(\theta_H) + (1-q)W^D(\theta_L). \tag{9}$$

Note that country i's consumption choices do not depend on any other country j's consumption choices, $j \neq i$. As all countries are ex-ante symmetric, V^D is also the ex-ante average welfare of the monetary union under an equal weighting scheme.

Centralized Regime. In a fiscal union, the central fiscal authority observes the vector of signals $\overline{s} = (s_1, \ldots, s_I)$ about countries' preferences for government spending and chooses the level of government spending $\overline{g} = (g_1, \ldots, g_I)$ for all countries. The first step in deriving the fiscal union's ex-ante welfare consists of solving the central fiscal authority's problem of determining spending for each country by calculating the maximized value of welfare for any given vector of signals $\overline{s}$. The second step consists of calculating ex-ante welfare as the expected value of this ex-post welfare over all possible signal realizations.

For the first step, let $W^C(\overline{s}, I)$ denote the value of the central fiscal authority's problem of maximizing an equally weighted average of the expected utilities of the consumers of the I countries given the vector of signals $\overline{s}$,

$$W^C(\overline{s}, I) = \max_{\{c_i, g_i\}} \frac{1}{I} \sum\nolimits_{i=1}^{I} \mathbb{E}\left[u(c_i) + \theta_i h(g_i) | \overline{s}\right], \tag{10}$$

subject to the constraint $c_i + g_i = y$ for all i, where the conditional expectation in (10) is over θ_i. The problem of the fiscal union in (10) reduces to one of maximizing the utility of each country's consumers separately, given the signal received. This property holds because the utility of each country i's consumers does not depend on the actions or outcomes in any other country and because both countries' preferences for government spending and the central fiscal authority's signals about them are either perfectly correlated or independent across countries. Hence, $W^C(\overline{s}, I)$ simplifies to $\sum_i W^C(s_i)/I$, where for each country i, $W^C(s_i) = \max_{c_i, g_i} \mathbb{E}\left[u(c_i) + \theta_i h(g_i) | s_i\right]$, which further reduces to $W^C(s_i) = \max_{c_i, g_i}[u(c_i) + \tilde{\theta}_i h(g_i)]$ with $\tilde{\theta}_i \equiv \mathbb{E}(\theta_i | s_i)$, subject to the constraint $c_i + g_i = y$.

For the second step, we calculate ex-ante welfare for the fiscal union,

$$V^C = p_H W^C(s_H) + (1 - p_H) W^C(s_L), \tag{11}$$

where p_H and $1 - p_H$ are the probabilities of a high and a low signal, respectively.

[FIGURE 1 HERE]

Oates's (1972) decentralization theorem corresponds to the uninformative case, when $\phi = 1/2$. In this case, the central fiscal authority *prefers* a uniform level of government spending for each country, rather than being constrained to choose such a level as in Oates (1972). As ϕ increases from 1/2 to 1, the central fiscal authority increasingly tailors the level of spending to the tastes of each country's citizens and does so perfectly when ϕ reaches one. This result is shown in the left panel of Figure 1, which depicts a government's policy functions in the decentralized and centralized regimes for different degrees of informativeness ϕ of the preference signal. Clearly, if $\phi < 1$, then compared with a local fiscal authority, the central fiscal authority has inferior information, so the local fiscal authority is able to better allocate resources. As a result, a decentralized fiscal regime dominates a centralized one, as shown in the right panel of Figure 1, which reports ex-ante welfare as a function of ϕ in the two regimes. Welfare is equal in the two regimes only when the signal is perfectly informative ($\phi = 1$). We formalize these observations in the following proposition, which follows from Blackwell's informativeness theorem.

Proposition 1 (A Generalized Decentralization Theorem)**.** *When signals about countries' preferences for government spending are not perfectly informative in that $\phi < 1$, a decentralized regime yields strictly higher ex-ante welfare than does a centralized regime—that is,*

a fiscal union. The difference in ex-ante welfare between a decentralized and a centralized regime decreases with the informativeness of the preference signal and equals zero when $\phi = 1$.

Proof. To prove this result, we rely on Blackwell's theorem on informational structures (Blackwell, 1951). We first establish that ex-ante welfare in the centralized regime declines as the preference signal becomes less informative. We then show that when $\phi < 1$, ex-ante welfare in the decentralized regime is strictly higher than that in the centralized regime. To this end, we set up some useful notation. Consider two informational structures σ_1 and σ_2 represented by $\sigma_k(s|\theta)$, $k = 1, 2$, which is the conditional probability of signal s given state θ under informational structure k. Note that σ_2 is a *garbling* of σ_1 if an agent who knows σ_1 could replicate σ_2 by randomly drawing a signal s' after observing the signal s; that is, there exists a *garbling function* $\varphi(s'|s) \in [0, 1]$ such that

$$\sigma_2(s'|\theta) = \sum\nolimits_s \varphi(s'|s)\sigma_1(s|\theta), \tag{12}$$

where $\sum_{s'} \varphi(s'|s) = 1$ and $\varphi(s'|s) \leq 1$, with strict inequality for some s and s'. In our setup, to (strictly) garble a signal, the garbling function must, say, sometimes report that the signal is high when it is actually low or that the signal is low when it is actually high. Blackwell's theorem states that if σ_2 is a garbling of σ_1, then a Bayesian decision maker prefers σ_1 to σ_2.

Consider now a symmetric informational structure with informativeness $\phi_k \in [1/2, 1]$, where $\phi_k = \sigma_k(s_H|\theta_H) = \sigma_k(s_L|\theta_L)$ and $1-\phi_k = \sigma_k(s_L|\theta_H) = \sigma_k(s_H|\theta_L)$. Under informational structure σ_k, let $p_{Hk} = q\phi_k + (1-q)(1-\phi_k)$ be the unconditional probability of a high signal and denote ex-ante welfare in the centralized regime by

$$V_k^C = p_{Hk}W_k^C(s_H) + (1 - p_{Hk})W_k^C(s_L), \tag{13}$$

with $W_k^C(s_i) = \max_{c_i,g_i} \mathbb{E}_k \left[u(c_i) + \theta_i h(g_i)|s_i\right]$ for each i, subject to $c_i + g_i = y$.

To show that ex-ante welfare in the fiscal union decreases as the informativeness of the signal decreases from ϕ_1 to ϕ_2, with $\phi_2 < \phi_1$, we need only show that the associated informational structures satisfy condition (12). Consider then the symmetric garbling function that transforms the original signals s_H and s_L into the garbled signals $\tilde{s}_H$ and $\tilde{s}_L$; namely,

$$\varphi = \Pr(\tilde{s}_H|s_H) = \Pr(\tilde{s}_L|s_L) \;\text{ and }\; 1 - \varphi = \Pr(\tilde{s}_L|s_H) = \Pr(\tilde{s}_H|s_L).$$

We can represent the less informative signal as a garbled version of the original signal as

$$\phi_2 = \Pr(\tilde{s}_H|\theta_H) = \Pr(\tilde{s}_H|s_H)\Pr(s_H|\theta_H) + \Pr(\tilde{s}_H|s_L)\Pr(s_L|\theta_H) = \varphi\phi_1 + (1-\varphi)(1-\phi_1) \tag{14}$$

and $1 - \phi_2 = \Pr(\tilde{s}_L|\theta_H)$. Solving (14) for φ gives that $\phi_2 < \phi_1$ if and only if

$$\varphi = \frac{\phi_1 + \phi_2 - 1}{2\phi_1 - 1} < 1, \tag{15}$$

so that φ is a strict garbling. Thus, by Blackwell's theorem, ex-ante welfare in the centralized regime satisfies $V_2^C < V_1^C$. To show that ex-ante welfare in the decentralized regime is higher than that in the fiscal union, note first that ex-ante welfare in the decentralized regime is independent of the informativeness ϕ of the signal. Observe next that ex-ante welfare under the centralized regime equals ex-ante welfare under the decentralized regime when the signal is perfectly informative ($\phi = 1$) and, by Blackwell's theorem, is lower for any less informative signal ($\phi < 1$). It is then immediate that the difference between ex-ante welfare under decentralization and ex-ante welfare under centralization decreases with ϕ. □

Intuitively, a local fiscal authority has a natural advantage over a central one because of its superior information about local preferences for government spending. Therefore, a fiscal union is never preferable. Although Proposition 1 does not depend on the assumption that countries' preference types for government spending and signals about them are discrete or independently or identically distributed across countries, key to this result is the assumption that government spending in all other countries does not affect utility in any given country. Next, we relax this assumption by introducing a fiscal externality across countries.

2.2 Adding a Fiscal Externality

Suppose now that the value of public goods to country i's citizens depends not only on country i's government spending but also on any other country j's government spending, $j \neq i$. We capture this feature by letting the function $h(\cdot)$ of government spending, which is part of the utility function of any country's consumers, also depend on the vector of government spending of all other countries $\overline{g}_{-i} = (g_1, \ldots, g_{i-1}, g_{i+1}, \ldots, g_I)$. Accordingly, the utility function of a consumer in country i is now $u(c_i) + \theta_i h(g_i, \overline{g}_{-i})$ with $\partial^2 h(\cdot)/\partial g_i \partial g_j \neq 0$. Hence,

non-trivial externalities across countries emerge in that the optimal level of government spending in country i is affected by government spending in any other country.[7]

We find it convenient to focus on the case in which

$$h(g_i, \overline{g}_{-i}) = h\left(g_i + \gamma \sum\nolimits_{j \neq i} g_j\right), \tag{16}$$

so that total effective government spending in country i is the sum of its own spending g_i and a fraction $\gamma \in (0,1)$ of the spending of all other countries. Intuitively, suppose that a fraction $1-\gamma$ of any country's spending benefits only that country and the remaining fraction γ benefits all countries. Since any country i's spending can be decomposed into these two components as $g_i = (1-\gamma)g_i + \gamma g_i$, country i's total effective government spending can be expressed as $(1-\gamma)g_i + \gamma \sum_{j=1} g_j$ or, indeed, as $g_i + \gamma \sum_{j \neq i} g_j$. We denote country i's total effective government spending when all countries' government spending is $\overline{g} = (g_1, \ldots, g_I)$ by $G_i(\overline{g}) = g_i + \gamma \sum_{j \neq i} g_j$. Note that as the fraction of other countries' spending γ increases from zero to one, the model subsumes the two extreme cases of a purely local public good and a purely union-wide public good as well as any intermediate case.

We set up the economy so that it leads to a symmetric equilibrium in the relevant sense. That is, in the decentralized regime, all countries with the same realized preference for public goods θ_i choose the same level of government spending g_i. Likewise, in the centralized regime, the central fiscal authority optimally assigns the same level of government spending g_i to all countries with realized preference signal s_i. We begin with the case in which preferences for government spending and signals about them are perfectly correlated across countries and then turn to the case in which both preferences and signals about them are independently distributed. We consider utility functions with the following standard properties.

Assumption 1. *The utility function over the consumption of private goods satisfies the following properties:* $u'(x) > 0$, $u''(x) < 0$, $\lim_{x \to 0} u'(x) = \infty$, *and* $\lim_{x \to \infty} u'(x) = 0$. *The utility function over the consumption of public goods satisfies the following properties:*

[7] This assumption is violated when preferences for government spending are linear in spending. A setup with quasi-linear preferences would substantially simplify our analysis but would not capture the key forces behind our motivating examples. In the case of tanks, for instance, we are interested in situations in which in a decentralized regime, if all other countries in the union purchased a large number of them, then the last country's benefit from purchasing its own tanks would be small. In our view, eliminating this type of free-riding behavior is a critical benefit of fiscal centralization, which is at the heart of the current debate within the EU about not only the gains from greater fiscal integration but also the purview of the EU's common security and defense policy.

$\lim_{x\to\infty} h(x) = \infty$, $h'(x) > 0$, $h''(x) < 0$, $\lim_{x\to 0} h'(x) = \infty$, *and* $\lim_{x\to\infty} h'(x) = 0$.

The requirement that $\lim_{x\to\infty} h(x) = \infty$, together with the form of the externality in (16), ensures that ex-ante welfare under a fiscal union becomes arbitrarily large as the number of countries in the monetary union progressively increases. This property will prove crucial in establishing the existence of a cutoff rule for optimal fiscal delegation in Proposition 2.

2.2.1 Perfectly Correlated Preferences across Countries

We examine first the simpler case in which all countries draw the same preference type, either θ_H with probability q or θ_L with probability $1 - q$. We assume that in the decentralized regime, each country's local fiscal authority observes its citizens' preferences, whereas in the fiscal union, the central fiscal authority observes the same signal s about all countries' common preference type, which satisfies assumptions (5) to (7). The assumption that all countries share the same preference type but the central fiscal authority cannot observe it may seem implausible. However, we can interpret this case as one in which, from the point of view of the central fiscal authority, the common component of the signals that the central fiscal authority receives about each country's preferences for government spending is large enough. A practical reason for interest in this case has been articulated by Draghi (2023), who argues that more correlated shocks that are likely to affect preferences for government spending in a uniform way across countries, thereby inducing correlation in their spending, are increasingly common in the eurozone: "*the nature of the shocks we are facing is changing. With the pandemic, the energy crisis, and the war in Ukraine, we are increasingly confronting common, imported shocks rather than asymmetric, self-inflicted ones.*"

Centralized Regime. By the assumed symmetry and concavity properties of preferences, it is clearly optimal for the fiscal union to treat all countries with the same preference signals symmetrically.[8] Hence, without loss, we restrict attention to allocations such that for any given number of countries I, if the central fiscal authority observes signal s_H, then all countries are assigned the same level of government spending $g(s_H, I)$, whereas if it observes signal s_L, then all countries are assigned the same level of government spending $g(s_L, I)$.

[8]This result holds because, for any signal, the central fiscal authority's problem is a strictly concave programming problem that admits a unique solution, which is symmetric.

In contrast to the previous case of no fiscal externalities, we can no longer solve for allocations for each country separately. But by symmetry, we can first maximize ex-post welfare from symmetric allocations in the class $\{g(s_H, I), g(s_L, I)\}$ for a given number of countries I, conditional on the signal s_i. We can then determine the expected welfare value of these allocations over all possible preference signals and so obtain the ex-ante welfare of the fiscal union. Since signals are perfectly correlated in that $s_i = s$ for all i, ex-post welfare is simply $W^C(\overline{s}, I) = \sum_i W^C(s_i, I)/I = W^C(s_i, I)$ for all i. That is, given signal $s_i \in \{s_H, s_L\}$, the fiscal union maximizes ex-post welfare; namely,

$$W^C(s_i, I) = \max_g [u(y - g) + \tilde{\theta}_i h(G(\overline{g}))], \tag{17}$$

with $\tilde{\theta}_i = \mathbb{E}(\theta_i | s_i)$ and $G(\overline{g}) = [1 + \gamma(I - 1)]g$. Ex-ante welfare in a fiscal union is then

$$V^C(I) = p_H W^C(s_H, I) + (1 - p_H) W^C(s_L, I), \tag{18}$$

where $p_H = q\phi + (1 - q)(1 - \phi)$. We now characterize key properties of $V^C(I)$. Applying the envelope theorem to the problem in (17) and imposing symmetry, we obtain that

$$\frac{\partial W^C(s_i, I)}{\partial I} = \tilde{\theta}_i h'([1 + \gamma(I - 1)]g)\gamma g > 0, \tag{19}$$

where the optimal g is strictly positive by Assumption 1. Thus, ex-post welfare under centralization $W^C(s_i, I)$ strictly increases with the number of countries I, and so does $V^C(I)$, since it is simply the expected value of $W^C(s_i, I)$ over all possible signal realizations. Moreover, as $W^C(s_i, I)$ is evaluated at the optimal level of spending, it must be that for any arbitrary level of spending $g' \in (0, y)$,

$$W^C(s_i, I) \geq u(y - g') + \tilde{\theta}_i h([1 + \gamma(I - 1)]g').$$

Taking expectations of both sides of the above over all possible signal realizations yields that

$$V^C(I) \geq u(y - g') + \mu_\theta h([1 + \gamma(I - 1)]g'). \tag{20}$$

Then, as I arbitrarily increases, the right side of (20) grows arbitrarily large, and so does $V^C(I)$. The next lemma summarizes this discussion.

Lemma 2. *When preferences for government spending are perfectly correlated across countries, ex-ante welfare in a fiscal union strictly increases with the number of countries in the monetary union and becomes arbitrarily large as the number of countries arbitrarily increases.*

To illustrate this result, consider the case of a utility function of the form

$$\log(c_i) + \theta_i \log(G(\overline{g})). \tag{21}$$

The first-order condition of the central fiscal authority's problem in (17), after we impose symmetry, is $1/(y - g_i) = \tilde{\theta}_i/g_i$. It is then immediate that the solution to (17) is

$$c^C(s_i) = \frac{1}{1+\tilde{\theta}_i} y \quad \text{and} \quad g^C(s_i) = \frac{\tilde{\theta}_i}{1+\tilde{\theta}_i} y, \tag{22}$$

with $\tilde{\theta}_i = \mathbb{E}(\theta_i|s_i)$. Note for later that the optimal fraction of output that is devoted to the consumption of public goods does not vary with the number of countries in the monetary union; importantly, however, total effective government spending,

$$G^C(s_i, I) = [1 + \gamma(I-1)]g^C(s_i), \tag{23}$$

grows arbitrarily large as the number of countries in the monetary union progressively increases. Substituting (22) into the expression for ex-ante welfare in (18), we obtain that

$$V^C(I) = \sum\nolimits_{i=H,L} p_i \big[\log(c^C(s_i)) + \tilde{\theta}_i \log(G^C(s_i, I)) \big], \tag{24}$$

with $p_L = 1 - p_H$. As the number of countries in the monetary union progressively increases, ex-ante welfare from private consumption is constant, but ex-ante welfare from public consumption becomes larger and larger under a fiscal union. Intuitively, although each country's government spends a constant amount of its endowment on public goods, the spillover from other countries' government spending through the externality term $\gamma(I-1)$ in (23) increases as the number of countries in the monetary union increases, eventually making government spending infinitely valuable for the union as a whole.

Decentralized Regime. Given the observed taste parameter $\theta_i \in \{\theta_H, \theta_L\}$, the problem of country i's local fiscal authority, when all other countries spend the same amount g_{-i}, is

$$W^D(\theta_i, I, g_{-i}) = \max_g [u(y-g) + \theta_i h(g + \gamma(I-1)g_{-i})]. \tag{25}$$

The solution to this problem, denoted by $\hat{g}^D(\theta_i, I, g_{-i})$, defines country i's *best response* to all other countries' government spending g_{-i}. A symmetric equilibrium in the decentralized regime entails a solution to the fixed-point problem $g = \hat{g}^D(\theta_i, I, g)$ for each country, which we denote by $g^D(\theta_i, I)$.[9] Ex-ante welfare is the expected value of $W^D(\theta_i, I, g_{-i})$, evaluated at $g_{-i} = g^D(\theta_i, I)$ and, in a slight abuse of notation, denoted by $W^D(\theta_i, I) \equiv W^D(\theta_i, I, g^D(\theta_i, I))$, and is given by

$$V^D(I) = qW^D(\theta_H, I) + (1-q)W^D(\theta_L, I). \tag{26}$$

We now turn to characterizing the main properties of $V^D(I)$. By taking the first-order condition of (25) and imposing symmetry, we obtain that

$$u'(y-g) = \theta_i h'(g + \gamma(I-1)g). \tag{27}$$

Then, $g^D(\theta_i, I)$, which solves (27), strictly decreases with I.[10] By substituting $g^D(\theta_i, I)$ into (25) and using (27) to derive an alternative expression for $g + \gamma(I-1)g$, it follows that

$$W^D(\theta_i, I) = u(y - g^D(\theta_i, I)) + \theta_i h\left((h')^{-1}\left(\frac{u'(y - g^D(\theta_i, I))}{\theta_i}\right)\right), \tag{28}$$

which strictly increases with I, since it is the sum of two terms, $u(\cdot)$ and $\theta_i h(\cdot)$, both strictly increasing with I.[11] Ex-ante welfare under decentralization $V^D(I)$, which is the expected value of $W^D(\theta_i, I)$ over all possible preference types, also strictly increases with I. Finally,

$$\lim_{I\to\infty} V^D(I) = \lim_{I\to\infty} \mathbb{E}[W^D(\theta_i, I)] = u(y) + \mathbb{E}\left[\theta_i h\left((h')^{-1}\left(\frac{u'(y)}{\theta_i}\right)\right)\right] \equiv \overline{V}^D < \infty, \tag{29}$$

[9] In the online appendix, we show that the equilibrium under decentralization is unique and symmetric.

[10] Note that $\partial g^D(\theta_i, I)/\partial I = -\theta_i h''(\cdot)\gamma g^D(\theta_i, I)/\{u''(\cdot) + \theta_i h''(\cdot)[1 + \gamma(I-1)]\} < 0$ by Assumption 1.

[11] To see why, recall that $g^D(\theta_i, I)$ strictly decreases with I. Hence, since $u(\cdot)$ is a strictly increasing function, the first term on the right side of (28) clearly strictly increases with I. The second term on the right side of (28) also strictly increases with I because $h(\cdot)$ is a strictly concave function, so $(h')^{-1}(\cdot)$ is a strictly decreasing function, and $u'(y - g^D(\theta_i, I))$ strictly decreases with I.

where we have used that $\lim_{I\to\infty} g^D(\theta_i, I) = 0$ for all θ_i.[12] Since ex-ante welfare under decentralization strictly increases with I and its limit is finite, it follows that it is bounded above by a constant, unlike ex-ante welfare under centralization, which grows unbounded as I increases by Lemma 2. The next lemma summarizes these observations.

Lemma 3. *When preferences for government spending are perfectly correlated across countries, ex-ante welfare in a decentralized regime strictly increases with the number of countries in the monetary union and converges to the upper bound $\overline{V}^D$ in (29), which is independent of γ, as the number of countries arbitrarily increases.*

As we did before, we consider the utility function in (21) to illustrate Lemma 3, which will also prove useful when comparing welfare between the centralized and the decentralized regimes. Note that after imposing symmetry, the first-order condition of a local fiscal authority's problem in (27) reduces to $1/(y-g) = \theta_i/\{[1+\gamma(I-1)]g\}$. Hence,

$$c^D(\theta_i, I) = \left[\frac{1+\gamma(I-1)}{1+\theta_i+\gamma(I-1)}\right] y \quad \text{and} \quad g^D(\theta_i, I) = \left[\frac{\theta_i}{1+\theta_i+\gamma(I-1)}\right] y \tag{30}$$

solve (27). Observe that in stark contrast to the centralized case, as the number of countries I becomes arbitrarily large, each country's fraction of output devoted to government spending becomes arbitrarily small, so private consumption eventually absorbs all output ($c = y$). Total effective government spending

$$G^D(\theta_i, I) = [1+\gamma(I-1)]\, g^D(\theta_i, I) = \left[\frac{1+\gamma(I-1)}{1+\theta_i+\gamma(I-1)}\right] \theta_i y,$$

however, converges to the constant $\theta_i y$. Substituting these policies into the ex-post welfare function $W^D(\theta_i, I) = \log(c^D(\theta_i, I)) + \theta_i \log(G^D(\theta_i, I))$ implies that as the number of countries grows arbitrarily large, ex-post welfare in the decentralized regime converges to a constant,

$$\lim_{I\to\infty} W^D(\theta_i, I) = \lim_{I\to\infty} [\log(c^D(\theta_i, I)) + \theta_i \log(G^D(\theta_i, I))] = \log(y) + \theta_i \log(\theta_i y).$$

Thus, when I arbitrarily increases, ex-ante welfare under decentralization converges to the constant $\overline{V}^D = \log(y) + \mathbb{E}[\theta_i \log(\theta_i y)]$, which is independent of γ.

[12] To see that this limit holds, suppose, by way of contradiction, that there exists $\underline{g} > 0$ such that $g^D(\theta_i, I) \geq \underline{g}$ for all θ_i and I. Then, as I grows arbitrarily large, total effective government spending also grows arbitrarily large, and so the right side of (27) converges to zero by Assumption 1. The left side of (27), though, is bounded below by $u'(y)$, which is bounded away from zero for any finite y by Assumption 1, a contradiction.

Centralization vs. Decentralization. The comparison of the two fiscal regimes revolves around a fundamental trade-off. Given the superior information of a local fiscal authority relative to that of a central one, a decentralized fiscal regime can better adapt policies to the preferences for government spending of a country's citizens. Such a regime, however, does not internalize fiscal externalities across countries. By contrast, a fiscal union internalizes them, but it can only imperfectly design policies in response to the preferences of its member countries' citizens. Which regime is preferred then naturally depends on the strength of the informational advantage of local fiscal authorities and the magnitude of the fiscal externalities across countries. Given these two opposing forces, we can show that for general utility functions, there exists a sufficiently small number of countries $\underline{I}(\phi,\gamma) = \min\{I \in [1,\infty) : V^C(I;\phi,\gamma) \geq V^D(I;\gamma)\}$ such that a decentralized fiscal regime is preferred for any number of countries smaller than $\underline{I}(\phi,\gamma)$.[13] Likewise, there exists a sufficiently large number of countries $\overline{I}(\phi,\gamma) = \max\{I \in [1,\infty) : V^C(I;\phi,\gamma) \leq V^D(I;\gamma)\}$ such that a centralized fiscal regime is preferred for any number of countries greater than $\overline{I}(\phi,\gamma)$. Clearly, $\overline{I}(\phi,\gamma) \geq \underline{I}(\phi,\gamma)$, since when $I = 1$, ex-ante welfare under decentralization is higher than ex-ante welfare under centralization, and when I is large enough, by Lemmas 2 and 3, ex-ante welfare under centralization is higher than ex-ante welfare under decentralization.

Given that $\overline{I}(\phi,\gamma) \geq \underline{I}(\phi,\gamma)$, this characterization result leaves open the question of which fiscal regime is optimal in between these two cutoffs. A sufficient condition for a unique cutoff $I(\phi,\gamma) = \underline{I}(\phi,\gamma) = \overline{I}(\phi,\gamma)$ for optimal fiscal delegation to arise is that, as functions of I, ex-ante welfare under centralization and ex-ante welfare under decentralization satisfy the single-crossing property in that the functions $V^C(I)$ and $V^D(I)$ cross only once. Such a condition is satisfied, for instance, when consumers' utility function is of the log form.

In general, both the quality of the information about countries' preferences for government spending and the size of the fiscal externality across countries affect the cutoffs $\underline{I}(\phi,\gamma)$ and $\overline{I}(\phi,\gamma)$. To examine how these cutoffs vary with the informativeness of preference signals and the magnitude of the fiscal externality, observe that, as functions of I, ex-ante welfare under centralization crosses ex-ante welfare under decentralization from below at both cutoffs, by the same argument we used to show that $\overline{I}(\phi,\gamma) \geq \underline{I}(\phi,\gamma)$.[14]

[13] Throughout, for simplicity, we treat the number of countries I as continuous in our formal arguments.

[14] To build intuition, we focus here on the generic case in which such a crossing occurs. Technically, non-generic cases can arise such as when, say, at the largest number of countries $\overline{I}$ at which $V^C(\overline{I}) = V^D(\overline{I})$, these functions are equal at one point, $\overline{I}$, but $V^C(I) > V^D(I)$ in an interval around $\overline{I}$. Proposition 2 below applies to these cases as well, although the argument is more involved, so it is provided in the online appendix.

Consider then the role of the quality of the central fiscal authority's information about member countries' preferences for government spending, as measured by the informativeness ϕ of the signals it receives. As information improves—that is, as ϕ increases—so does the central fiscal authority's ability to tailor its policies to member countries' preferences, which makes a centralized regime more appealing. Hence, when information improves, ex-ante welfare under centralization as a function of I shifts up, whereas ex-ante welfare under decentralization remains constant. Because the former ex-ante welfare function crosses the latter from below, more informative signals lead both cutoffs $\underline{I}(\phi, \gamma)$ and $\overline{I}(\phi, \gamma)$ to decrease. That is, centralization becomes preferable for smaller monetary unions.

Consider next the role of the magnitude of the fiscal externality, as captured by the parameter γ. Intuitively, the larger is γ, the greater is the advantage of the central fiscal authority relative to a local one, because the former takes into account that greater government spending in any given country benefits all countries, and so the more appealing is a centralized regime. Indeed, both cutoffs $\underline{I}(\phi, \gamma)$ and $\overline{I}(\phi, \gamma)$ decrease with γ. This result builds on the following lemma, which relates how ex-ante welfare varies with the magnitude of the fiscal externality and with the size of the monetary union under both fiscal regimes.

Lemma 4. *When preferences for government spending are perfectly correlated across countries, the following relationships hold:*

$$\frac{\partial V^C(I;\gamma)}{\partial \gamma} = \left(\frac{I-1}{\gamma}\right) \frac{\partial V^C(I;\gamma)}{\partial I} \quad \textit{and} \quad \frac{\partial V^D(I;\gamma)}{\partial \gamma} = \left(\frac{I-1}{\gamma}\right) \frac{\partial V^D(I;\gamma)}{\partial I}. \tag{31}$$

Proof. For the first equality in (31), we differentiate ex-post welfare under centralization in (17) with respect to γ and I, apply the envelope theorem, and use (19) to obtain that

$$\frac{\partial W^C(s_i, I;\gamma)}{\partial \gamma} = \tilde{\theta}_i h'([1+\gamma(I-1)]g)(I-1)g = \left(\frac{I-1}{\gamma}\right) \frac{\partial W^C(s_i, I;\gamma)}{\partial I}.$$

Taking expectations over the signals s_i yields the desired result. For the second equality in (31), we differentiate ex-post welfare under decentralization in (28) with respect to γ and I and apply the envelope theorem to obtain that

$$\frac{\partial W^D}{\partial \gamma} = \theta_i h'(G^D)(I-1)\left(g^D + \gamma \frac{\partial g^D}{\partial \gamma}\right) \quad \text{and} \quad \frac{\partial W^D}{\partial I} = \theta_i h'(G^D)\gamma\left[g^D + (I-1)\frac{\partial g^D}{\partial I}\right], \tag{32}$$

where $W^D = W^D(\theta_i, I;\gamma)$, $G^D = [1+\gamma(I-1)]g^D$, and $g^D = g^D(\theta_i, I;\gamma)$.

To compare the two terms in (32), we calculate $\partial g^D(\theta_i, I; \gamma)/\partial\gamma$ and $\partial g^D(\theta_i, I; \gamma)/\partial I$ by totally differentiating (27), which gives the result that

$$\gamma\frac{\partial g^D}{\partial\gamma} = -\frac{\theta_i h''(G^D)\gamma(I-1)g^D}{u''(y-g^D)+\theta_i h''(G^D)[1+\gamma(I-1)]} = (I-1)\frac{\partial g^D}{\partial I}. \tag{33}$$

Substituting (33) in (32) and taking expectations over θ_i yields the desired result. □

We turn now to establishing our main result about the existence of cutoff rules for optimal fiscal delegation as well as how the associated cutoffs vary with the informativeness of signals about countries' preferences for government spending and the size of the fiscal externality.

Proposition 2 (Cutoff Rule for Fiscal Delegation with Correlated Preferences)**.** *For a given degree of informativeness $\phi \in [1/2, 1)$ of the preference signal and a given value of the fiscal externality parameter $\gamma > 0$, if $h(x)$ has the form in* (16)*, then i) there exists a cutoff $\overline{I}(\phi, \gamma)$ such that a centralized regime is preferred if $I > \overline{I}(\phi, \gamma)$, with $\overline{I}(\phi, \gamma)$ decreasing with ϕ and γ; ii) there exists a cutoff $\underline{I}(\phi, \gamma)$ such that a decentralized regime is preferred if $I \leq \underline{I}(\phi, \gamma)$, with $\underline{I}(\phi, \gamma)$ decreasing with ϕ and γ; and iii) if $u(x) = h(x) = \log(x)$, then there exists a unique cutoff $I(\phi, \gamma)$ such that a centralized regime is preferred if $I > I(\phi, \gamma)$ and a decentralized regime is preferred if $I \leq I(\phi, \gamma)$, with $I(\phi, \gamma)$ decreasing with ϕ and γ.*

Proof. For the cutoffs $\underline{I}(\phi, \gamma)$ and $\overline{I}(\phi, \gamma)$ to be well defined, ex-ante welfare under centralization and under decentralization, $V^C(I; \phi)$ and $V^D(I)$, must cross at least once as functions of I. To see why they do, note first that at $I = 1$, ex-ante welfare under decentralization is strictly higher than ex-ante welfare under centralization because of the informational advantage of decentralization and the absence of externalities when $I = 1$, so $V^D(I = 1) > V^C(I = 1; \phi)$. That ex-ante welfare under centralization is eventually higher than ex-ante welfare under decentralization follows from Lemmas 2 and 3, since the former implies that $V^C(I; \phi)$ grows arbitrarily large as I arbitrarily grows, whereas the latter implies that $V^D(I)$ is bounded above by the constant $\overline{V}^D$. Hence, ex-ante welfare under centralization is eventually higher than ex-ante welfare under decentralization, so $\hat{I} > 1$ exists such that $V^D(I) < V^C(I; \phi)$ for all $I > \hat{I}$. Thus, $V^C(I; \phi)$ and $V^D(I)$ must cross at least once and both cutoffs are well-defined. This argument also implies that ex-ante welfare under centralization crosses ex-ante welfare under decentralization from below at both cutoffs.

Next, we prove that both cutoffs decrease with ϕ and γ. First, since local fiscal authorities observe their citizens' taste for government spending, $V^D(I)$ is independent of the

informativeness of the preference signal. By contrast, $V^C(I;\phi)$ strictly increases with ϕ by Blackwell's theorem. Since ex-ante welfare under centralization crosses ex-ante welfare under decentralization from below, it follows that as ϕ increases, both cutoffs $\underline{I}(\phi,\gamma)$ and $\overline{I}(\phi,\gamma)$ decrease. Second, to prove that both cutoffs decrease with γ, note that as argued, ex-ante welfare under centralization crosses ex-ante welfare under decentralization from below. Hence, it must be that $\partial V^C(I;\gamma)/\partial I \geq \partial V^D(I;\gamma)/\partial I$ for I evaluated at either of the cutoffs. By Lemma 4, then, an increase in γ increases ex-ante welfare under centralization weakly more than ex-ante welfare under decentralization at these cutoffs; that is,

$$\frac{\partial V^C(I;\gamma)}{\partial \gamma} - \frac{\partial V^D(I;\gamma)}{\partial \gamma} = \left(\frac{I-1}{\gamma}\right)\left[\frac{\partial V^C(I;\gamma)}{\partial I} - \frac{\partial V^D(I;\gamma)}{\partial I}\right] \geq 0. \tag{34}$$

Therefore, the two cutoffs must decrease with γ. This concludes the proof of parts *i*) and *ii*). The proof of part *iii*) is presented in the online appendix. □

To illustrate Proposition 2, we consider a numerical example with log preferences comparing ex-ante welfare under a centralized and under a decentralized regime, in which the cutoff number of countries for which centralization is preferred is unique. The left panel of Figure 2 shows ex-ante welfare in both regimes as a function of the number of countries in a monetary union for a value of the externality parameter of $\gamma = 0.2$ and two values of the informativeness of the preference signal, $\phi = 0.5$ (lowest) and $\phi = 0.9$ (high). As the signal's informativeness increases, ex-ante welfare increases under centralization, whereas it is unchanged under decentralization. Hence, with a more informative signal, the cutoff value of I for which centralization is preferred decreases. In particular, the cutoff is $I(\phi = 0.5, \gamma = 0.2) = 9$ for an uninformative signal, but it decreases to $I(\phi = 0.9, \gamma = 0.2) = 5$ for a very informative one.

[FIGURE 2 HERE]

In the right panel of Figure 2, we fix the preference signal's degree of informativeness to $\phi = 0.9$ and show how the cutoff number of countries for centralization to be preferred varies with the size of the fiscal externality induced by government spending, as measured by γ. In particular, as the externality increases from a low level of $\gamma = 0.2$ to a high level of $\gamma = 0.7$, a decentralized regime's inability to internalize these spillovers makes such a regime less attractive. Accordingly, the cutoff for which centralization is preferred decreases from $I(\phi = 0.9, \gamma = 0.2) = 5$ to $I(\phi = 0.9, \gamma = 0.7) = 2$.

Intuitively, the results we have established depend on the technology of information acquisition for the central fiscal authority, the nature of the fiscal externalities across countries, and the properties of consumer utility function. In Section 3, we examine the robustness of our results to allowing for increasing or decreasing returns to scale in information acquisition, alternative fiscal spillover functions, and different specifications for consumer utility.

2.2.2 Independent Preferences across Countries

Suppose now that each country draws its taste for government spending θ_i independently from any other. We assume that a local fiscal authority in any country perfectly observes its preference type θ_i as well as those of all other countries. The idea behind this common observability assumption is that any country can observe other countries' decisions on government spending at a preliminary planning stage and countries commit to these decisions. By contrast, a central fiscal authority observes only a signal about each country's preference type, $\overline{s} = \{s_1, \ldots, s_I\}$. The same intuitions and results for the case of perfectly correlated preferences apply to the case of independent preferences, with the difference that the problem of a fiscal union now involves a combinatorial evaluation of the probability-weighted outcomes for all possible realizations of preference types and signals about them for each country.

We consider preferences for government spending as specified in (16), which satisfy the properties in Assumption 1. Hence, without loss, in the centralized regime, we restrict attention to symmetric allocations of the form $g_H = g(s_H, I, n)$ and $g_L = g(s_L, I, n)$, where n denotes the number of countries with signal s_H. Similarly, in the decentralized regime, we restrict attention to symmetric allocations of the form $g_H = g(\theta_H, I, n)$ and $g_L = g(\theta_L, I, n)$, where n denotes the number of countries of type θ_H.[15]

Centralized Regime. For a fiscal union, we can first solve for ex-post welfare by positing an arbitrary symmetric allocation in the class $\{g(s_H, I, n), g(s_L, I, n)\}$ corresponding to any realization of n high signals s_H and $I - n$ low signals s_L for the I countries, and solve such a problem for a fixed n. We can then calculate the relevant expectation over these allocations

[15]The allocations in the centralized regime solve a strictly concave programming problem, so the solution of the central fiscal authority's problem is unique; it is also symmetric. For the decentralized regime, it is easy to show that equilibrium is symmetric and unique. See the online appendix for details.

to obtain ex-ante welfare. The first step consists of solving the fiscal union's ex-post problem,

$$W^C(I,n) = \frac{1}{I}\max_{g_H,g_L}\big\{n\big[u(y-g_H)+\tilde{\theta}_H h(g_H+\gamma[(n-1)g_H+(I-n)g_L])\big] \\ +(I-n)\big[u(y-g_L)+\tilde{\theta}_L h(g_L+\gamma[ng_H+(I-n-1)g_L])\big]\big\}, \tag{35}$$

conditional on n high signals, where $\tilde{\theta}_H = \mathbb{E}(\theta_i|s_H)$ and $\tilde{\theta}_L = \mathbb{E}(\theta_i|s_L)$ for any i. Denote the solution of this problem by $g^C(s_H,I,n)$ and $g^C(s_L,I,n)$. The second step consists of calculating ex-ante welfare over all possible signals s_i, given a country's preference type, and over all possible countries' preference types. Note that the distribution of n high signals for the I countries is binomial with parameters I and p_H, which is the unconditional probability of a high signal for any country in (7). Ex-ante welfare under a fiscal union is then

$$V^C(I) = \sum\nolimits_{n=0}^{I}\binom{I}{n}p_H^n(1-p_H)^{I-n}W^C(I,n). \tag{36}$$

By the same logic as in the discussion that precedes Lemma 2, we can characterize key properties of ex-ante welfare under centralization. Note first that since ex-post welfare $W^C(I,n)$ is evaluated at the optimal level of government spending, it follows that $W^C(I,n) \geq u(y-g')+\tilde{\theta}_i h([1+\gamma(I-1)]g')$ for an arbitrary level of spending $g' \in (0,y)$. Taking expectations of both sides of this latter inequality over all possible signals, we obtain that

$$V^C(I) \geq u(y-g')+\mu_\theta h([1+\gamma(I-1)]g'). \tag{37}$$

Since the right side of (37) becomes larger and larger as I arbitrarily grows, so must $V^C(I)$. In contrast to the case of perfectly correlated preferences, characterizing the monotonicity of $V^C(I)$ with I in the case of independent preferences in general is challenging. This is because different levels of spending are optimal depending on the number of realizations of high and low preference signals for any given number of countries, which complicates the ranking of ex-ante welfare across different values of I. Nonetheless, to prove our main result on optimal fiscal delegation—namely, Proposition 3, below—we just rely on ex-ante welfare under centralization being smaller than ex-ante welfare under decentralization for small I and growing arbitrarily large as I becomes larger and larger. Thus, the global monotonicity of ex-ante welfare with I per se plays no role. When the preference signal is uninformative in that $\phi = 1/2$, the cases of independent and correlated preferences coincide and so, by

our previous analysis, we know that ex-ante welfare under centralization increases with the number of countries. The next lemma summarizes these observations.

Lemma 5. *When preferences for government spending are independent across countries, ex-ante welfare in a fiscal union becomes arbitrarily large as the number of countries in the monetary union arbitrarily increases. If the preference signal is uninformative in that* $\phi = 1/2$*, then ex-ante welfare in a fiscal union strictly increases with the number of countries.*

Decentralized Regime. Under a decentralized regime, we can first solve for ex-post welfare by positing an *almost symmetric* allocation $(g_i; g(\theta_H, I, n), g(\theta_L, I, n))$ such that all *other* types, besides that of the country i we consider, choose symmetric allocations for their type, $g(\theta_H, I, n)$ and $g(\theta_L, I, n)$. We do so because given the symmetric behavior of all other $I-1$ countries, we just need to examine the outcomes induced if a country of either type θ_H or θ_L best responds to the actions of all others by choosing a potentially asymmetric action for its type. The ex-post problem of the local fiscal authority of a country of type θ_H is then

$$W^D(\theta_H, I, n, g_H, g_L) = \max_g [u(y-g) + \theta_H h(g + \gamma[(n-1)g_H + (I-n)g_L])]. \tag{38}$$

The solution to this problem, $\hat{g}^D(\theta_H, I, n, g_H, g_L)$, yields the best response of a country of type θ_H in an almost symmetric candidate allocation, in which the $n-1$ other countries of type θ_H choose g_H and the $I-n$ countries of type θ_L choose g_L. The analogous ex-post problem for a country of type θ_L, which defines the best response $\hat{g}^D(\theta_L, I, n, g_H, g_L)$, is

$$W^D(\theta_L, I, n, g_H, g_L) = \max_g [u(y-g) + \theta_L h(g + \gamma[ng_H + (I-n-1)g_L])]. \tag{39}$$

An equilibrium in the decentralized regime entails a pair $(g^D(\theta_H, I, n), g^D(\theta_L, I, n))$ for each n that solves the two-dimensional fixed-point problem defined by

$$g^D(\theta_i, I, n) = \hat{g}^D(\theta_i, I, n, g^D(\theta_H, I, n), g^D(\theta_L, I, n)) \text{ for } i = H, L. \tag{40}$$

Substituting these equilibrium government expenditure policies into the ex-post problems in (38) and (39) yields ex-post welfare for a country of either type θ_H or θ_L; namely,[16]

$$W^D(\theta_i, I, n) \equiv W^D(\theta_i, I, n, g^D(\theta_H, I, n), g^D(\theta_L, I, n)) \text{ for } i = H, L. \tag{41}$$

The last step consists of calculating ex-ante welfare, which accounts for the probability of any number $n \in \{0, \ldots, I\}$ of high preference types among the I countries:

$$V^D(I) = \frac{1}{I} \sum\nolimits_{n=0}^{I} \binom{I}{n} q^n (1-q)^{I-n} \left[n W^D(\theta_H, I, n) + (I-n) W^D(\theta_L, I, n) \right]. \tag{42}$$

We now characterize key properties of this function. Note that the first-order condition of the problem of country i's local fiscal authority in (38) and (39) is

$$u'(y - g_i) = \theta_i h' \Big(g_i + \gamma \sum\nolimits_{j \neq i} g_j \Big). \tag{43}$$

Since countries with different preference types choose different levels of government spending, we can no longer guarantee that in general ex-ante welfare in a decentralized regime increases with the number of countries I. We can, however, construct an upper bound for this value by an argument similar to that for Lemma 3. Specifically, by manipulating the first-order condition of the problem of country i's local fiscal authority evaluated at the equilibrium level of spending, we obtain that ex-post welfare $W^D(\theta_i, I, n)$ can be expressed as

$$W^D(\theta_i, I, n) = u(y - g^D(\theta_i, I, n)) + \theta_i h \left((h')^{-1} \left(\frac{u'(y - g^D(\theta_i, I, n))}{\theta_i} \right) \right).$$

Recall that $h((h')^{-1}(\cdot))$ is a strictly decreasing function and that $u'(y - g_i^D) \geq u'(y)$ for $i = H, L$ by Assumption 1, so it follows that

$$W^D(\theta_i, I, n) \leq u(y) + \theta_i h \left((h')^{-1} \left(\frac{u'(y)}{\theta_i} \right) \right). \tag{44}$$

[16] Formally, $W^D(\theta_H, I, \cdot, g_H, g_L)$ and $W^D(\theta_H, I, \cdot)$ are not well defined at $n = 0$, so we set $W^D(\theta_H, I, 0, g_H, g_L) \equiv 0$ and $W^D(\theta_H, I, 0) \equiv 0$. Similarly, $W^D(\theta_L, I, \cdot, g_H, g_L)$ and $W^D(\theta_L, I, \cdot)$ are not well defined at $n = I$, so we set $W^D(\theta_L, I, I, g_H, g_L) \equiv 0$ and $W^D(\theta_L, I, I) \equiv 0$. We apply analogous conventions to policy functions.

By taking first expectations with respect to θ_i, we obtain that

$$\mathbb{E}[W^D(\theta_i, I, n)|n] \leq u(y) + \mathbb{E}\left[\theta_i h\left((h')^{-1}\left(\frac{u'(y)}{\theta_i}\right)\right)\middle| n\right]. \tag{45}$$

Then, taking expectations with respect to n gives the result that

$$V^D(I) \leq u(y) + \mathbb{E}\left[\theta_i h\left((h')^{-1}\left(\frac{u'(y)}{\theta_i}\right)\right)\right] = \overline{V}^D,$$

with $\overline{V}^D$ defined in (29). Finally, using that $\lim_{I\to\infty} g^D(\theta_i, I, n) = 0$ for all θ_i and n by an argument analogous to that in the case of perfectly correlated preferences—see footnote 12—it follows that $\lim_{I\to\infty} V^D(I) = \overline{V}^D$. The following lemma summarizes this discussion.

Lemma 6. *When preferences for government spending are independent across countries, ex-ante welfare in a decentralized regime converges to the upper bound $\overline{V}^D$ in (29), which is independent of γ, as the number of countries in the monetary union arbitrarily increases.*

By Lemma 5, ex-ante welfare under centralization grows unbounded with I, whereas by Lemma 6, ex-ante welfare under decentralization is bounded above. Thus, a centralized fiscal regime must be preferred for any sufficiently large I. Conversely, since ex-ante welfare under decentralization is higher than ex-ante welfare under centralization for $I = 1$, a decentralized fiscal regime must be preferred for any sufficiently small I. The following result then holds.

Proposition 3 (Cutoff Rule for Fiscal Delegation with Independent Preferences)**.** *For a given degree of informativeness $\phi \in [1/2, 1)$ of the preference signal and a given value of the fiscal externality parameter $\gamma > 0$, if $h(x)$ has the form in* (16)*, then i) there exists a cutoff $\overline{I}(\phi, \gamma)$ such that a centralized regime is preferred if $I > \overline{I}(\phi, \gamma)$, with $\overline{I}(\phi, \gamma)$ decreasing with ϕ; and ii) there exists a cutoff $\underline{I}(\phi, \gamma)$ such that a decentralized regime is preferred if $I \leq \underline{I}(\phi, \gamma)$, with $\underline{I}(\phi, \gamma)$ decreasing with ϕ.*

Proposition 3 is the analogue of Proposition 2 when preference types for government spending are independent across countries; see the proof in the online appendix. Since the proofs of parts *i*) and *ii*) of Proposition 3 are very similar to those of the corresponding parts of Proposition 2, here we provide a sketch of what differs. The argument follows the same steps as those of the proof of Proposition 2, except that we rely on Lemmas 5 and 6, which are the analogues of Lemmas 2 and 3 in the perfectly correlated case. Lemmas 5

and 6 guarantee that with independent preferences, ex-ante welfare under centralization and ex-ante welfare under decentralization satisfy the same properties as ex-ante welfare under both regimes with perfectly correlated preferences, which we exploited to prove Proposition 2. Namely, as functions of I, ex-ante welfare under decentralization is higher than ex-ante welfare under centralization for $I = 1$, and ex-ante welfare under centralization is higher than ex-ante welfare under decentralization for sufficiently large values of I. Hence, both cutoffs $\underline{I}(\phi, \gamma)$ and $\overline{I}(\phi, \gamma)$ for optimal fiscal delegation are well-defined, ex-ante welfare under centralization crosses ex-ante welfare under decentralization from below at both cutoffs, and the two cutoffs decrease with the informativeness of the signal—footnote 14 applies.

To pursue the analogy with Proposition 2, we examine how optimal fiscal delegation varies with the degree of informativeness of the preference signal and the size of the fiscal externality. We proceed as in the perfectly correlated case and assume that consumers have log preferences—in all our examples for this specification of utility, the cutoff for optimal fiscal delegation is unique.[17] The left panel of Figure 3 shows ex-ante welfare in both regimes as a function of the number of countries in the monetary union for a value of the externality parameter of $\gamma = 0.2$ and two values of the informativeness of the preference signal, $\phi = 0.5$ (lowest) and $\phi = 0.9$ (high). As was the case before, increasing the informativeness of the signal increases ex-ante welfare under centralization, whereas ex-ante welfare under decentralization is unaffected. This feature implies that the cutoff value of I for which centralization is preferred decreases from $I(\phi = 0.5, \gamma = 0.2) = 5$ to $I(\phi = 0.9, \gamma = 0.2) = 3$.

[FIGURE 3 HERE]

In the right panel of Figure 3, we vary the magnitude of the fiscal externality parameter γ, from 0.2 to 0.7, holding fixed the degree of informativeness of the signal at $\phi = 0.9$. As in the case of perfectly correlated preferences, a strengthening of the fiscal externality makes a decentralized regime, which does not internalize fiscal spillovers across countries, less attractive than a centralized one. Thus, the cutoff number of countries for a centralized regime to be preferred decreases from $I(\phi = 0.9, \gamma = 0.2) = 3$ to $I(\phi = 0.9, \gamma = 0.7) = 1$.

[17] With independent preferences, the case of log utility is less tractable than with perfectly correlated preferences, because of the combinatorial problem that arises. For this reason, the analogue of case *iii*) of Proposition 2—namely, the existence of a unique cutoff for optimal fiscal delegation—is difficult to establish in general. Also, we can no longer guarantee that the cutoffs for optimal fiscal delegation in general decrease with the size of the externality. The following examples, though, suggest that such a result easily holds.

3 Discussion

Our novel result is that regardless of whether the taste of countries' citizens for government spending is perfectly correlated or independent across countries, it is in general optimal to pair small monetary unions with decentralized fiscal regimes and large monetary unions with centralized ones. Here, we explore some generalizations and qualifications of this result.[18]

In terms of the informational structure, so far we have focused on the case in which the information about countries' preferences for government spending under a centralized fiscal regime does not vary with the number of countries in a monetary union. We now evaluate the implications of allowing for increasing or decreasing returns to scale in information acquisition under a centralized regime by letting the informativeness of the signal $\phi(I)$ about countries' preferences either increase or decrease with I. We show that regardless of how the informativeness of the signal $\phi(I)$ varies with I, provided it varies continuously, our main result holds. Namely, a sufficiently *small* cutoff number of countries exists such that a decentralized fiscal regime is preferred for any number of countries smaller than it as long as $\phi(1) < 1$, as is consistent with the premise of Oates's (1972) analysis. Likewise, a sufficiently *large* cutoff number of countries exists such that a centralized fiscal regime is preferred for any number of countries larger than it.

We then provide examples that illustrate how the lower cutoff number of countries in a monetary union for fiscal centralization to be preferred can be strictly smaller than the upper cutoff, in contrast to all our examples so far. That is, when the quality of the information acquired by a central fiscal authority arbitrarily varies with the size of a monetary union, although the optimal degree of centralization is unambiguous for small and large unions, it is not obvious for monetary unions of intermediate size. For such unions, the primitive characteristics of countries' economies, the informational advantage of decentralization, and the fiscal benefits of centralization all matter for the optimal allocation of fiscal authority.

In terms of the fiscal externality, we have considered throughout a specification for it that is standard in the fiscal federalism literature. Specifically, we have assumed that the

[18]We thank Marco Bassetto and Tom Sargent for many insightful comments on a preliminary draft presented at the CRNYU conference. In particular, they encouraged us to explore the robustness of our results beyond the exercises contained in that preliminary draft along the dimensions considered here. In the discussion of that draft, Bassetto and Hall (forthcoming) proposed an alternative framework with quasi-linear preferences and normally distributed preference shocks that allows them to derive closed-form solutions even in the presence of independent preference shocks. We found the discussion of Bassetto and Hall (forthcoming) to be very useful in preparing the current version of our paper.

fiscal externality depends on a fraction of the *total* government spending of all countries in a monetary union; see equation (16) and the survey in Lockwood (2005) for a reference. This standard case fits well our motivating examples such as defense and infrastructure spending in a union. Solely to clarify the role of this assumption, we discuss an alternative case in which the externality depends on a fraction of the *average* government spending of all countries. We show that in this case, the optimal fiscal delegation rule does not admit a cutoff form. Rather, regardless of the number of countries in a monetary union, either a decentralized regime is always preferred or a centralized regime is. Since the formulation of the fiscal externality in this alternative case is uncommon in the fiscal federalism literature, we deduce that our main result may not apply to atypical cases.

We conclude by discussing the role of the specification of consumer preferences for our results. We emphasize that all the results derived next apply both when preferences for government spending are perfectly correlated and when they are independent across countries.

3.1 The Role of Returns to Scale in Information Acquisition

Consider the role of the preference signal's informativeness ϕ, which we now assume can be represented by a continuous function $\phi(I)$ of the number of countries I in the monetary union, with $\phi(I) \in [1/2, 1]$ for all I and $\phi(1) < 1$. The following result generalizes Propositions 2 and 3 to this more general informational structure.

Proposition 4 (Cutoff Rule for Fiscal Delegation with Returns to Scale in Information)**.** *When preferences for government spending are either perfectly correlated or independent across countries, for a given continuous informativeness function $\phi(I) \in [1/2, 1)$ of the preference signal and a given value of the fiscal externality parameter $\gamma > 0$, if $h(x)$ has the form in* (16)*, then i) there exists a cutoff $\overline{I}(\phi(\cdot), \gamma)$ such that a centralized regime is preferred if $I > \overline{I}(\phi(\cdot), \gamma)$; ii) there exists a cutoff $\underline{I}(\phi(\cdot), \gamma)$ such that a decentralized regime is preferred if $I \leq \underline{I}(\phi(\cdot), \gamma)$; and iii) if two informativeness functions $\phi(I)$ and $\phi'(I)$ satisfy $\phi'(I) \geq \phi(I)$ for all I, then $\overline{I}(\phi'(\cdot), \gamma) \leq \overline{I}(\phi(\cdot), \gamma)$ and $\underline{I}(\phi'(\cdot), \gamma) \leq \underline{I}(\phi(\cdot), \gamma)$.*

Proof. The proofs of parts *i*) and *ii*) are nearly identical to those for Propositions 2 and 3. See the online appendix for details. To prove part *iii*), let $\phi'(I) \geq \phi(I)$. By Blackwell's theorem, $V^C(I; \phi'(I)) \geq V^C(I; \phi(I))$ for all I. As local fiscal authorities observe the taste of their country's citizens for government spending, $V^D(I)$ is independent of the informativeness

of the preference signal. It then follows that if the informational structure $\phi(I)$ is replaced by the informational structure $\phi'(I)$, with $\phi'(I) \geq \phi(I)$ for all I, a fiscal union becomes relatively more attractive than a decentralized regime. Since, as functions of I, ex-ante welfare under centralization crosses ex-ante welfare under decentralization from below, both cutoffs $\underline{I}(\cdot, \gamma)$ and $\overline{I}(\cdot, \gamma)$ are lower under $\phi'(I)$ than under $\phi(I)$. Footnote 14 applies here too. □

Proposition 4 yields that as long as we consider an informational structure that is consistent with Oates's (1972) premise, then regardless of how the informativeness of the signal varies with the number of countries in the monetary union, the optimal fiscal delegation policy has a cutoff-rule form. The proposition also sheds light on how the cutoffs $\underline{I}(\phi(\cdot), \gamma)$ and $\overline{I}(\phi(\cdot), \gamma)$ vary with more general informational structures than in our baseline model.

For example, suppose that the central fiscal authority faces decreasing returns to scale in acquiring information about the preferences for government spending of the monetary union's member countries—namely, as the union grows, the quality of the signal about each country's preferences deteriorates—so that $\phi(I)$ decreases with I. If we compare this economy with one in which the degree of informativeness of the preference signal is constant at level $\phi(1)$, then Proposition 4 implies that the cutoffs for optimal fiscal delegation in the economy with decreasing returns to scale in information are higher than those in the economy with constant returns to scale in information, since $\phi(1) \geq \phi(I)$. By contrast, with increasing returns to scale in information—namely, $\phi(I)$ increasing with I—the cutoffs for optimal fiscal delegation are lower than those with constant returns to scale, since $\phi(1) \leq \phi(I)$.

To illustrate these results, Figures 4 and 5 exhibit three economies with alternative types of returns to scale in information acquisition for the cases of perfectly correlated and independent preferences for government spending across countries, respectively. In both figures, panel *a*) shows how the informativeness $\phi(I)$ of the preference signal varies with the number of countries I. We choose functional forms for $\phi(I)$ so that when $I = 1$, the informativeness of the signal is equal in the three economies. The solid gray line shows the case of increasing returns to scale in information in that $\phi(I)$ increases with I, the solid black line shows our baseline case with $\phi(I)$ constant with I, and the dashed gray line shows the case of decreasing returns to scale in information in that $\phi(I)$ decreases with I.

[FIGURE 4 HERE]

[FIGURE 5 HERE]

For the case in which preferences for government spending are perfectly correlated across countries, panel b) of Figure 4 compares ex-ante welfare in the baseline economy with a constant $\phi(I)$ with ex-ante welfare in an economy with decreasing returns to scale in information in that $\phi(I) = 0.5 + 0.4/I$ under fiscal centralization. Note that the economy with decreasing returns to scale features a higher cutoff number of countries for a centralized fiscal regime to be preferred than that of the economy with constant returns to scale. In particular, the cutoff is $I(\phi, \gamma) = 5$ for the economy with constant returns to scale, but it increases to $I(\phi(\cdot), \gamma) = 9$ for the economy with decreasing returns to scale. Panel c) of Figure 4 shows that the cutoff number of countries for a centralized fiscal regime to be preferred in the presence of increasing returns to scale in information decreases relative to the cutoff in our baseline. Namely, with increasing returns to scale of the form $\phi(I) = 0.9 - 0.1/I$, the cutoff number of countries decreases from $I(\phi, \gamma) = 5$ to $I(\phi(\cdot), \gamma) = 3$. Figure 5 shows similar results when preferences for government spending are independent across countries.

Note that the last part of Proposition 2, which ensures a unique cutoff for optimal fiscal delegation with log preferences, does not have a counterpart in Proposition 4. To see why, consider the following experiment. Start with an economy with log preferences and a constant degree of informativeness of the preference signal $\overline{\phi} > 1/2$. Let $I^* = I(\overline{\phi}, \gamma)$ be the unique cutoff in this economy such that fiscal decentralization is preferred for $I \leq I^*$.

Consider now a second economy with decreasing returns to scale in information in that $\phi(I) = \overline{\phi}$ for $I \leq I^*$ and $\phi(I)$ rapidly decreases to $1/2$ for $I > I^*$. By construction, the second economy yields the same ex-ante welfare under centralization as the first one for $I \leq I^*$. In particular, for low enough I, the decentralized regime is preferred. However, for $I > I^*$, if the rate of decay of the signal's informational quality is sufficiently fast to offset the gains from the fiscal externality under centralization, then ex-ante welfare under centralization decreases and is lower than ex-ante welfare under decentralization for a number of countries greater than I^*. Since ex-ante welfare under centralization grows arbitrarily large as the number of countries progressively increases, eventually ex-ante welfare under centralization exceeds ex-ante welfare under decentralization. By this logic, multiple cutoffs for optimal fiscal delegation exist. Namely, as the number of countries increases, the decentralized regime is initially preferred, then the centralized regime is preferred, then the decentralized regime is preferred again, and finally the centralized regime is preferred from then on.

[FIGURE 6 HERE]

[FIGURE 7 HERE]

Figures 6 and 7 illustrate such a scenario through a simple example for the cases of perfectly correlated and independent preferences across countries, respectively. In particular, for the case of perfectly correlated preferences, we parameterize the informativeness of the signal by the function $\phi(I) = 0.9$ for $I \leq 7$ and the function $\phi(I) = 0.5+0.4/(I-6)^2$ for $I > 7$. This informational structure leads to multiple cutoffs for optimal fiscal delegation. Namely, for low enough I ($I \leq 5$), decentralization is preferable; for I equal to 6 and 7, centralization is preferable; for I equal to 8 and 9, decentralization is preferable again because of the sharp decrease in the informativeness of the signal; and for all $I > 9$, centralization is preferable once again, as the fiscal externality becomes larger and larger. A similar multiplicity of cutoffs arises with independent preferences, as shown in Figure 7.

3.2 The Role of the Form of Fiscal Externalities

We analyze next how our results depend on the nature of fiscal externalities. We have focused so far on the standard form of spillovers in the fiscal federalism literature (Lockwood, 2005) such that a fraction of the government spending of any country in the monetary union benefits the citizens of all countries in the union. The result that under a fiscal union, each country's ex-ante welfare becomes arbitrarily large as the size of the monetary union progressively increases clearly depends on this assumed specification of the fiscal spillover. For the sake of completeness only, we construct an example of an atypical externality in which this standard property fails and our main result no longer holds. In this example, a fraction of the *average government spending* in other countries, rather than a fraction of their *total government spending* as in (16), affects consumer utility in any given country:

$$h(g_i, \overline{g}_{-i}) = h\Big(g_i + \frac{\gamma}{I-1}\sum\nolimits_{j\neq i} g_j\Big). \tag{46}$$

Then, when preferences for government spending are perfectly correlated across countries, ex-post welfare under both a fiscal union and a decentralized fiscal regime is constant with I. To see why, note that ex-post welfare under centralization becomes

$$W^C(s_i, I) = \max_{\{g_i\}} \left[u(y-g_i) + \tilde{\theta}_i h\left(g_i + \frac{\gamma}{I-1}\sum\nolimits_{j\neq i} g_j\right)\right],$$

with $\tilde{\theta}_i = \mathbb{E}(\theta_i|s_i)$. After imposing symmetry, $W^C(s_i, I)$ reduces to

$$W^C(s_i, I) = \max_g [u(y-g) + \tilde{\theta}_i h\left((1+\gamma)g\right)]. \tag{47}$$

Hence, ex-ante welfare under centralization does not depend on I.

To see that ex-post welfare under decentralization does not depend on I either, observe that country i's ex-post welfare, for given government spending g_{-i} in all other countries, is

$$W^D(\theta_i, I, g_{-i}) = \max_g \left[u(y-g) + \theta_i h\left(g + \frac{\gamma}{I-1}\sum\nolimits_{j\neq i} g_{-i}\right)\right].$$

When all other countries choose the same level of government spending g_{-i}, country i's ex-post welfare reduces to

$$W^D(\theta_i, I, g_{-i}) = \max_g \left[u(y-g) + \theta_i h\left(g + \gamma g_{-i}\right)\right]. \tag{48}$$

The first-order condition of this problem is $u'(y-g) = \theta_i h'(g + \gamma g_{-i})$, which yields that

$$u'(y - g^D(\theta_i)) = \theta_i h'((1+\gamma)g^D(\theta_i)) \tag{49}$$

after imposing symmetry, where $g^D(\theta_i)$ is the equilibrium level of government spending for a country with preference type θ_i. Since $g^D(\theta_i)$ does not depend on I, neither ex-post welfare $W^D(\theta_i) \equiv W^D(\theta_i, I, g^D(\theta_i))$ nor ex-ante welfare $V^D = \mathbb{E}(W^D(\theta_i))$ do.

Since ex-ante welfare does not depend on the number of countries in the monetary union under either regime, either the centralized regime is always preferred or the decentralized regime is, regardless of the number of countries in the union. In this case, then, a cutoff rule for optimal fiscal delegation does *not* exist. This result also arises when preferences for government spending are independent across countries, as we discuss next.

[FIGURE 8 HERE]

Figure 8 illustrates this result for the case of log preferences and a fixed degree of informativeness $\phi = 0.9$ of the preference signal, when the fiscal externality parameter takes the values $\gamma = 0.4$ and $\gamma = 0.98$. The left panel shows the case in which preferences for government spending are perfectly correlated across countries and the right panel shows the case in which preferences are independent across countries. In both cases, when $\gamma = 0.4$,

the fiscal externality is sufficiently small that it is more than offset by the informational advantage of decentralization so that decentralization is always preferred. By contrast, when $\gamma = 0.98$, the fiscal externality is sufficiently large that it dominates the informational advantage of decentralization. Thus, centralization is always preferred. As the right panel of the figure makes clear, similar intuitions and results apply to the case in which preferences for government spending are independent across countries.

3.3 The Role of Preferences

We now turn to examining how the cutoff rules for optimal fiscal delegation that we have characterized so far are affected by the degree of risk aversion of consumer preferences over private and public consumption. Here, we focus on our main specification of the fiscal spillover function in (16) so that consumers in any country value government spending in all other countries in the monetary union. We consider utility functions of the form $u(c) = c^{1-\sigma}/(1-\sigma)$ and $h(g) = g^{1-\sigma}/(1-\sigma)$, where σ is the coefficient of relative risk aversion, which would be consistent with balanced growth if we extended our model to multiple periods.

[FIGURE 9 HERE]

Figure 9 illustrates how the cutoff number of countries for a centralized fiscal regime to be preferred is affected in a minor way by the curvature of the utility function for conventional values of the relative risk aversion parameter. In particular, the figure depicts ex-ante welfare under a centralized fiscal regime and a decentralized one for $\sigma = 1.1$ and $\sigma = 2$. As is apparent from the figure, the cutoff number of countries for which the centralized regime is preferred barely changes across these two values of σ, both in the case in which preferences for government spending are perfectly correlated (left panel) and in the case in which they are independent (right panel) across countries. Similar results hold for both smaller and larger values of σ as well as for alternative values of all other parameters.

4 Conclusion

The question of which fiscal regime is appropriate for a monetary union is at the heart of salient policy debates—for instance, the current ones concerning the desirability of greater fiscal integration among EU countries and the benefits of an enlargement of the union. We

have proposed a simple framework to illustrate how ideas from the fiscal federalism literature about the design of an optimal regime for fiscal policy can be usefully applied to examine the desirable degree of fiscal coordination within a monetary union.

In light of the informational gains associated with fiscal decentralization and the benefit of internalizing cross-country spillovers associated with fiscal centralization, a robust finding of our analysis is that small monetary unions should be paired with *decentralized* fiscal regimes, whereas large monetary unions should be paired with *centralized* ones. In particular, as a monetary union grows in size, a centralized fiscal regime is likely to be preferable, as it is better suited at internalizing fiscal externalities across countries. For our analysis, we have purposely constructed a minimal framework so as to make the countervailing forces at play most transparent and thereby highlight the different premises of the literature on fiscal federalism, which emphasizes the benefits of fiscal decentralization, and the literature on monetary unions, which emphasizes instead the benefits of fiscal centralization.

Throughout, we have focused on one type of fiscal policy, a single country-wide level of public spending in a monetary union, with only one dimension of heterogeneity across countries—namely, the desirability of such spending—in which monetary policy plays no role. A fruitful avenue of future research would be to extend some of the ideas explored here to richer environments with heterogeneity both within and across regions of a monetary union and an active role for a monetary authority, which could inform practical decisions on the appropriate degree of fiscal decentralization in existing monetary unions.

References

Aguiar, M., Amador, M., Farhi, E., Gopinath, G., 2015. Coordination and crisis in monetary unions. Quarterly Journal of Economics, 130 (4), 1727–1779.

Bassetto, M., Hall, J., 2024. Discussion of "Fiscal federalism and monetary unions" by Berriel, Gonzalez-Aguado, Kehoe, and Pastorino. Journal of Monetary Economics, forthcoming.

Berriel, R., Gonzalez-Aguado, E., Kehoe, P.J., and Pastorino, E. 2023. Fiscal federalism and monetary unions. Working paper, Stanford University.

Besley, T., Coate, S., 2003. Centralized versus decentralized provision of local public goods:

A political economy approach. Journal of Public Economics, 87 (12), 2611–2637.

Blackwell, D., 1951. Comparison of experiments. In: Newman, J. (Eds.), Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability, vol. 2. University of California Press, Berkeley, pp. 93–102.

Cooper, R., Kempf, H., 2004. Overturning Mundell: Fiscal policy in a monetary union. Review of Economic Studies, 71 (2), 371–396.

Draghi, M., 2023. The next flight of the bumblebee: The path to common fiscal policy in the eurozone. Martin Feldstein Lecture, National Bureau of Economic Research.

Farhi, E., Werning, I., 2017. Fiscal unions. American Economic Review, 107 (12), 3788–834.

Fogli, A., Pastorino, E., 2021. Challenges and opportunities from the pandemic in Europe: The case of Italy. Policy Brief, Stanford Institute for Economic Policy Research.

Kehoe, P.J., Pastorino, E., 2017. Fiscal unions redux. Economic Theory, 64 (4), 741–76.

Kenen, P., 1969. The theory of optimum currency areas: An eclectic view. In: Mundell, R.A., Swoboda, A.K. (Eds.), Monetary Problems of the International Economy. Chicago University Press, Chicago, pp. 41–60.

Lockwood, B., 2002. Distributive politics and the costs of centralization. Review of Economic Studies, 69 (2), 313–337.

Lockwood, B., 2005. Fiscal decentralization: A political economy perspective. Economic Research Paper 721, University of Warwick.

Mundell, R., 1973. Uncommon arguments for common currencies. In: Johnson, H.G., Swoboda, A.K. (Eds.), The Economics of Common Currencies. Allen and Unwin, London, pp. 114–132.

Nicolini, J.P., Posadas, J., Sanguinetti, J., Sanguinetti, P., Tommasi, M., 2002. Decentralization, fiscal discipline in sub-national governments and the bailout problem: The case of Argentina. Research Department Working Paper No. R-467, Inter-American Development Bank.

Oates, W.E., 1972. Fiscal federalism. Harcourt Brace Jovanovich, New York.

Oates, W.E., 1999. An essay on fiscal federalism. Journal of Economic Literature, 37 (3), 1120–1149.

Saiegh, S., Tommasi, M., 1999. Why is Argentina's fiscal federalism so inefficient? Entering the labyrinth. Journal of Applied Economics, 2 (1), 169–209.

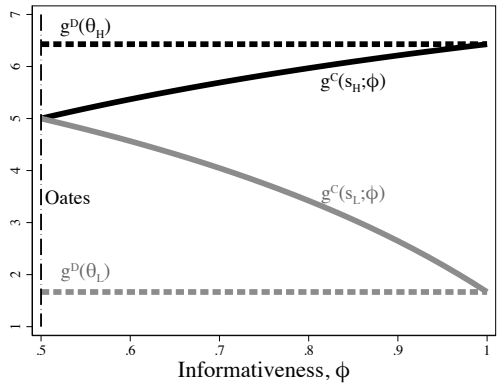
Tabellini, G., 2003. Principles of policymaking in the European Union: An economic perspective. CESifo Economic Studies, 49 (1), 75–102.

Waldfogel, J., 1993. The deadweight loss of Christmas. American Economic Review, 83 (5), 1328–1336.

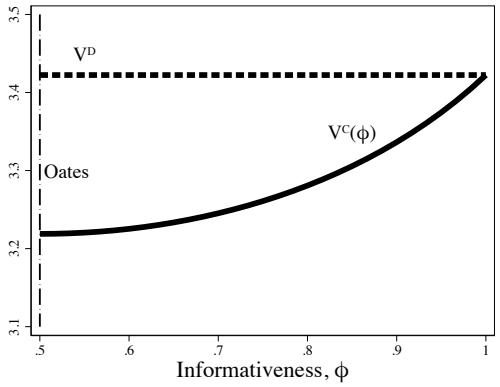
Figures

Figure 1: Generalized Decentralization Theorem with Correlated Preferences

(a) Government Spending



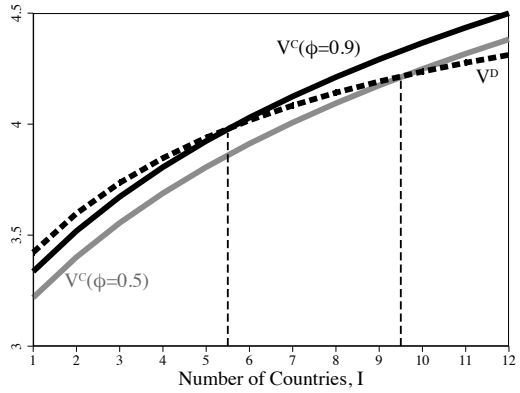
(b) Ex-Ante Welfare



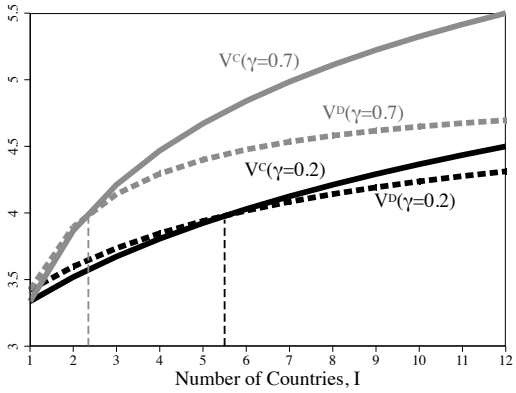
Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. In the left panel, $g^D(\theta_H)$ and $g^D(\theta_L)$ (respectively, $g^C(s_H;\phi)$ and $g^C(s_L;\phi)$) denote optimal government spending as a function of the informativeness ϕ of the preference signal in the decentralized (respectively, centralized) regime. In the right panel, V^D and $V^C(\phi)$ denote ex-ante welfare in the decentralized and centralized regime, respectively.

Figure 2: Ex-Ante Welfare with Correlated Preferences

(a) Comparisons for Varying Informativeness



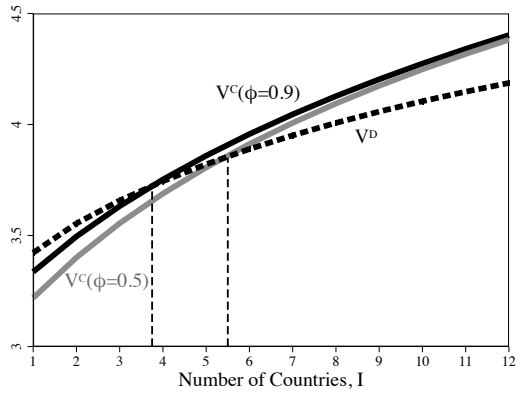
(b) Comparisons for Varying Externality



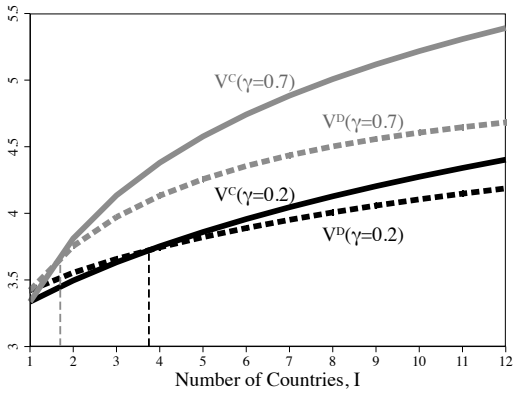
Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. In the left panel, the externality parameter γ is equal to 0.2 and the degree of informativeness ϕ of the preference signal is displayed in the graph. In the right panel, ϕ is equal to 0.9 and the value of γ is displayed in the graph.

Figure 3: Ex-Ante Welfare with Independent Preferences

(a) Comparisons for Varying Informativeness



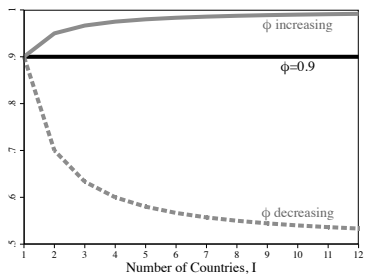
(b) Comparisons for Varying Externality



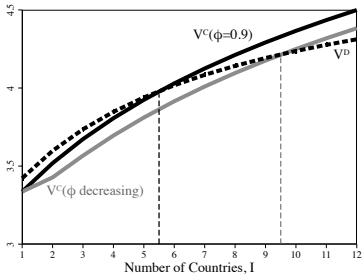
Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. In the left panel, the externality parameter γ is equal to 0.2 and the degree of informativeness ϕ of the preference signal is displayed in the graph. In the right panel, ϕ is equal to 0.9 and the value of γ is displayed in the graph.

Figure 4: Ex-Ante Welfare for Returns to Scale in Information with Correlated Preferences

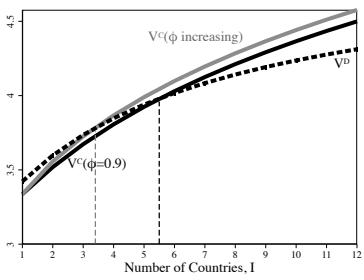
(a) Returns to Scale in Information



(b) Decreasing Returns to Scale



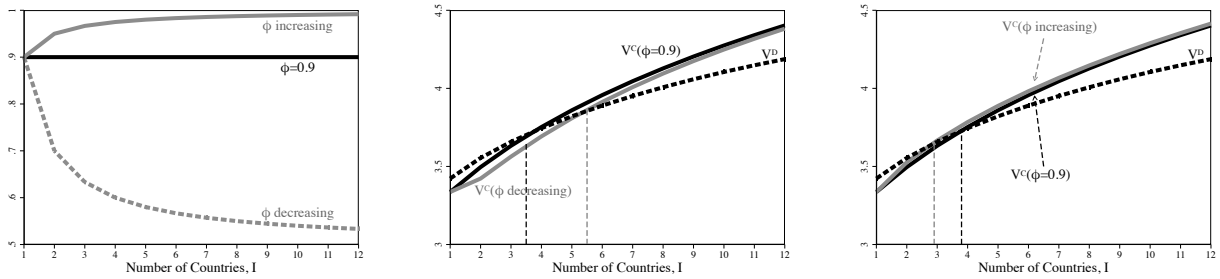
(c) Increasing Returns to Scale



Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. The externality parameter γ is equal to 0.2. In panel a), ϕ *decreasing* refers to the function $\phi = 0.5 + 0.4/I$ (dashed gray line) and ϕ *increasing* refers to the function $\phi = 1 - 0.9/I$ (solid gray line). In panel b), the solid black line refers to $\phi = 0.9$ and the gray line to $\phi = 0.5 + 0.4/I$. In panel c), the solid black line refers to $\phi = 0.9$ and the gray line to $\phi = 1 - 0.9/I$.

Figure 5: Ex-Ante Welfare for Returns to Scale in Information with Independent Preferences

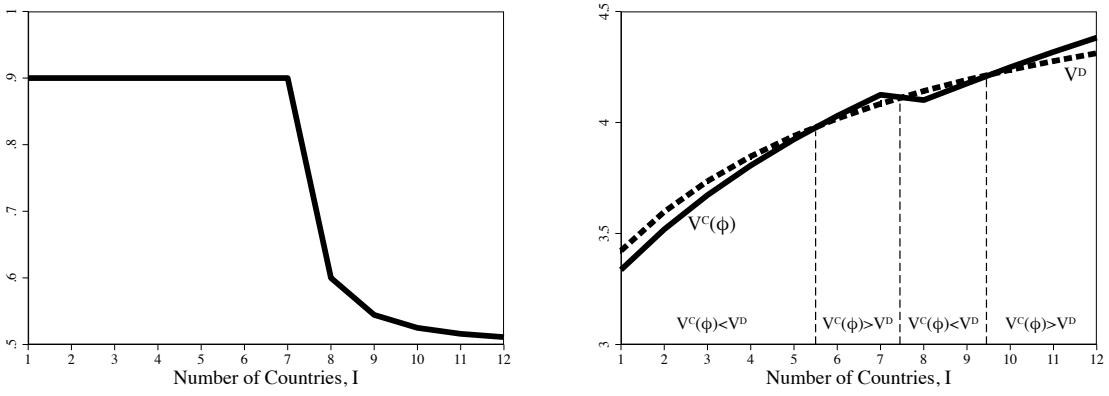
(a) Returns to Scale in Information (b) Decreasing Returns to Scale (c) Increasing Returns to Scale



Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. The externality parameter γ is equal to 0.2. In panel a), ϕ *decreasing* refers to the function $\phi = 0.5 + 0.4/I$ (dashed gray line) and ϕ *increasing* refers to the function $\phi = 1 - 0.9/I$ (solid gray line). In panel b), the solid black line refers to $\phi = 0.9$ and the gray line to $\phi = 0.5 + 0.4/I$. In panel c), the solid black line refers $\phi = 0.9$ and the gray line to $\phi = 1 - 0.9/I$.

Figure 6: Multiple Cutoffs for Optimal Fiscal Delegation with Correlated Preferences

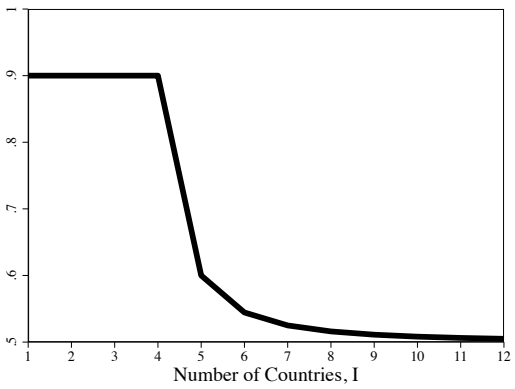
(a) Informativeness of Signals (b) Ex-Ante Welfare Comparisons



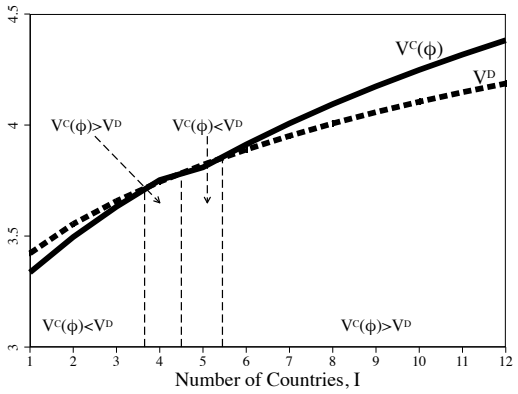
Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. The externality parameter γ is equal to 0.2. The informativeness of the signal is $\phi(I) = 0.9$ for $I \leq 7$ and $\phi(I) = 0.5 + 0.4/(I-6)^2$ otherwise.

Figure 7: Multiple Cutoffs for Optimal Fiscal Delegation with Independent Preferences

(a) Informativeness of Signals



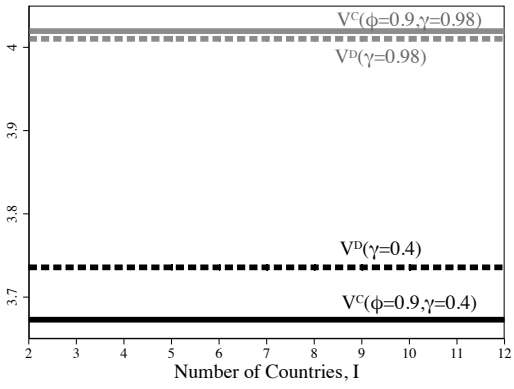
(b) Ex-Ante Welfare Comparisons



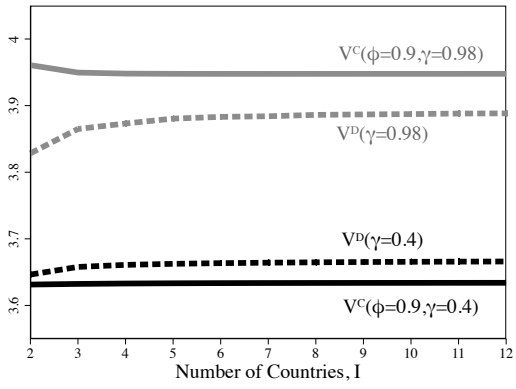
Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. The externality parameter γ is equal to 0.2. The informativeness of the signal is $\phi(I) = 0.9$ for $I \leq 4$ and $\phi(I) = 0.5 + 0.4/(I-3)^2$ otherwise.

Figure 8: Ex-Ante Welfare for Alternative Externality Function

(a) Correlated Preferences



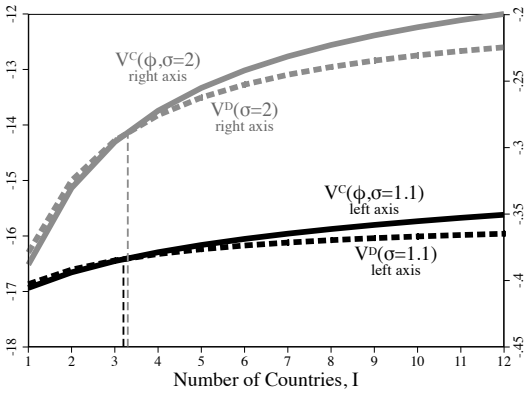
(b) Independent Preferences



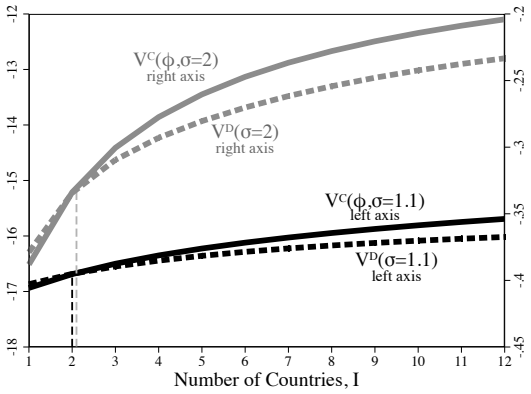
Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = \log(c)$ and $h(g) = \log(g)$. The degree of informativeness of the preference signal is $\phi = 0.9$ and the externality parameter is $\gamma = 0.4$ (black lines) or $\gamma = 0.98$ (gray lines).

Figure 9: Ex-Ante Welfare for CRRA Utility Function

(a) Correlated Preferences



(b) Independent Preferences



Note: The preference parameters are $\theta_H = 1.8$ and $\theta_L = 0.2$, the probability of a high preference is $q = 0.5$, and the endowment is $y = 10$. The functional forms for consumer utility are $u(c) = c^{1-\sigma}/(1-\sigma)$ and $h(g) = g^{1-\sigma}/(1-\sigma)$ with $\sigma = 1.1$ (black lines) and $\sigma = 2$ (gray lines). The degree of informativeness of the preference signal is $\phi = 0.9$ and the externality parameter is $\gamma = 0.4$.