A Volatility-based Theory of Fiscal Union Desirability*

Jaime Luque†
University of Wisconsin - Madison

Massimo Morelli‡
Columbia University

Jose Tavares§
NOVA School of Business and Economics and CEPR

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Abstract

Heterogeneous countries may rationally choose to form a currency union first and a fiscal union later. Given the sovereignty loss costs involved in the formation of a fiscal union, we indeed find reasonable conditions on the determinants of volatility for sequencing in the deepening process of European integration. Changes in the distribution of expected income shocks determine the need for reassignment of political weights to restore unanimous support for the European integration. The bargaining space depends on countries’ relative income, size, and cross correlation of shocks.

Keywords: Fiscal Union; Common currency; Bargaining space; Voting Weights; Heterogeneous countries.

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†Email: jluque@bus.wisc.edu
‡Email: mm3331@columbia.edu
§Email: jtavares@fe.unl.pt.
1 Introduction

A set of heterogeneous countries (in terms of income and population size) can display a sequential path of integration, both in terms of widening and in terms of deepening. The sequential widening admission process that took place in Europe from 1957 to the 90s\(^1\) has to do with the limited availability of commitment to transfers or side payments between countries not yet bound by a common set of institutions. Similarly, the adoption of a single currency can be seen as a first step of substantial deepening of the economic integration process, and the question is why again did Europe choose only that step, while now the further steps of fiscal and political union are being advocated.\(^2\)

We are going to argue that the decision to form a currency union without further steps can be rationalized when volatility of income shocks is relatively low, as it was perceived to be at the time of the creation of the ECB. However, the realization that the volatility of income shocks is much higher than the initial expectations, can suffice to make the subsequent deepening steps necessary ones for the survival of the union. The illustration of this argument will require to consider three regimes, namely policy independence, monetary union and fiscal union, focusing on how the preferences of different countries of different income and size for such regimes vary with volatility.

By a fiscal union we mean here a mechanism that involves some measure of counter-cyclical transfers across countries or regions.\(^3\) Our goal in this paper is to highlight that a fiscal union may be essential to sustain the benefits of a common currency in a scenario of increased volatility. However, we show that there needs to be negotiation over the political

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\(^1\) See e.g. Morelli (2012).

\(^2\) See e.g. Sibert (1992), Sims (1999) and Bottazzi and Manasse (2002) for standard macro arguments in favor of the inseparability of monetary and fiscal policy, leading to the conjecture that going for monetary union alone could lead to dangerous decoupling.

\(^3\) For an early and powerful argument in favor of the inter-regional transfer role of fiscal policy, see Kenen (1969). This concept is substantially different from the idea of a “fiscal stability union” debated by the EU leaders, or from the fiscal compact. As Paul Krugman in New York Times (December 10, 2011) puts it: “Rather than creating an inter-regional insurance mechanism involving counter-cyclical transfers, the version on offer would constitutionalize pro-cyclical adjustment in recession-hit countries, with no countervailing measures to boost demand elsewhere in the eurozone. Describing this as a “fiscal union,” as some have done, constitutes a near-Orwellian abuse of language.”
weights in the new institution. We highlight the role of heterogeneity in income per capita and population size, both in terms of positive analysis of country preferences, and in terms of normative analysis of the type of reallocations of decision power that would make a fiscal union consensus feasible. We find that, given their policy independence threat point, countries with a large relative income and a large relative size will demand a higher decision weight in the fiscal union.

The consensus bargaining space (CBS) consists of the set of all vectors of country weights that guarantee a higher utility to all countries in the fiscal union relative to going back to independent policy making. After this characterization, we present some simulations that illustrate how the bargaining space of a two-country union changes when we change the correlation between shocks and the countries’ relative income and size. The likelihood of consensus for a fiscal union decreases in the degree of heterogeneity between countries’ income and size, and increases the more negative is the correlation between countries’ shocks. We also illustrate that, for a union formed by countries heterogeneous in income and size, and with different shock correlations, there are voting weights in the non-empty bargaining space that make all countries better off when adding a fiscal union.

When volatility is relatively low for all countries, it is typically impossible, as we show, to obtain unanimous support in favor of a fiscal union. Any proposal in this sense would be defeated. After a few years of monetary policy unification, however, as documented in Table 1 in Section 6, volatility increased dramatically for most of the European countries, and their preferences towards maintaining the common currency have shifted. Our model will allow us to predict (1) which countries should be unhappy with the common currency (that is, the status quo); (2) how these countries rank the other options, namely fiscal

\footnote{Even though the consensus rule is the most likely to be considered, we also consider (in the Appendix) an alternative scenario where the support by a fraction \( \alpha \) of countries is sufficient to form the fiscal union. Then, if the \( \alpha \)-majority is achieved, all countries must accept the union. See Jehiel and Scotchmer (2001) for an equilibrium analysis of different constitutional rules of admission.}

\footnote{See also Persson et al. (1997) for a discussion of different preferences over deepening of European policy-making in diverse policy areas. Alesina et al. (2005), while they do not look at voting rights specifically, they study how some constitutional rules affect incentives to deepen an international union.
union and independent policy making; (3) the extent to which these countries are willing to lose political weight if the fiscal union is unanimously adopted; (4) given the realizations of different country volatilities, whether a low volatility group would accept a fiscal union with high political weights, or rather break up and enter in an institutional agreement on their own.

**Related literature**

The pioneering work of Gordon (1983) presented a now classic argument highlighting the insurance benefits of a common fiscal policy. The ensuing literature concentrated on the possible negative co-movement of output across jurisdictions, as it created incentives to share a fiscal policy. See for instance, Bolton and Roland (1997) and Alesina and Spolaore (1997) for pure interregional redistributive models where the threat of secession by the rich imposes a binding constraint on federal fiscal policy. Persson and Tabellini (1996a) investigate the trade-off between risk sharing and redistribution when jurisdictions are asymmetric as far as aggregate risk parameters are concerned.\(^6\)

Acquiring access to a more stable tax base became the linchpin of the discussion on fiscal unions. Alesina and Perotti (1998) have labelled such an incentive “economic risk”, but have then raised the possibility that a reduction in the volatility of the tax base, which decreases economic risk, might be associated with higher volatility of the tax rate for a given allocation of decision power. The latter might actually raise what the authors call “political risk”, discouraging the establishment of a common fiscal policy. The mechanism is simple: faced with non-synchronous fluctuations in output over time, countries or regions decrease economic risk by sharing budgetary decisions and stabilizing the tax base; however, the non-synchronous shocks may lead the larger country – which holds decision power - to

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\(^7\) In a companion paper, Person and Tabellini (1996b), the authors have focused on the trade-off between interregional risk sharing and the presence of moral hazard in local government behaviour. See Casella (1992a, 2001) for different formalizations of the main issues at stake, and Ruta (2005) for a survey.
respond to a negative shock by imposing a higher tax rate on the union. In sum, in fiscal unions with heterogeneous jurisdictions, economic insurance and political risk may be part of the same bundle. Relative to the traditional literature, the model in Alesina and Perotti (1998) reduces the range of parameters for which a fiscal union is desired. Even with shocks that are negatively and perfectly correlated, the country with less decision power may want to avoid the fiscal union.

Our model examines how the allocation of voting power across jurisdictions interacts with heterogeneity in population size and income per capita to determine the likelihood of unanimous adhesion to a fiscal union. This is in the tradition of constitutional design exemplified by Buchanan and Tullock (1967) and Curtis (1972). We incorporate economic and political fundamentals and show that there are allocations of voting rights that enlarge the set of parameters for which fiscal unions are formed. In a sense, we enlarge the parameter set so that Gordon (1983) and Alesina and Perotti (1998) can be seen as particular cases of a broader discussion.

The voting weights in collective decision making are always a central part of treaties (e.g. the Nice Treaty, the Lisbon Treaty, etc) - see Felsenthal and Machover (2001) and references therein-. One can find work on voting weights reallocations for the prospect of widening of the Union, see e.g. Sutter (2000) and Barsan-Pipu and Tache (2009). However, the issue of the weights ascribed to countries of differing size and economic conditions has never been explicitly related to the implications for fiscal unification. We contribute to the literature on fiscal federalism by explicitly discussing the relationship between voting arrangements on the one hand, and the decision between embarking on a joint fiscal policy and abandoning the common policy (currency) on the other.

A related strand of literature focuses on the distribution of voting weights among the countries entering a monetary union. Casella (1992b) examines the range of feasible weights between two different countries in a monetary union and her main conclusion is that a small country typically will require and obtain a larger weight in the common monetary policy
decision making with respect to its size. In contrast, our analysis of fiscal union formation in presence of a common policy asserts that the country with a larger relative size will demand a higher decision weight given its independent policy making threat point. In other words, the assignment of political weights when going from independent policy making to the formation of a monetary union follows a completely different logic with respect to the assignment of political weights necessary to go from a monetary union to a more integrated union that features a common fiscal policy as well.

Alesina and Barro (2002) analyze the trade-off between volume of trade and price stability for the formation of a currency union and for the optimal number of countries in a currency union. In a two-countries economy, Alesina and Barro identify the country that has more to gain from giving up its monetary policy as a small country with a history of high inflation and high correlation with its trading partner. On the other hand, our paper takes the country’s benefits of belonging to a monetary union as a parameter, whereas we open the black box of the formation of a fiscal union. In contrast to the result of Alesina and Barro, we show that the likelihood of a fiscal union increases the smaller is the correlation between shocks, and the smaller the heterogeneity in income and size between countries. This finding suggests that the effects of country size and shocks correlation move in opposite directions when comparing the formation processes of a monetary union and a fiscal union.

In this paper we do not consider that countries can share risks using financial instruments. But it should be clear that the financial markets are not necessarily a perfect substitute for a fiscal union. In fact, Celentani et al. (2004) show how a set of decentralized fiscal entities can manipulate relative prices, leading to an inefficient risk sharing, even if

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8See Cooper and Kempf (2004) for the question when the correlation of shocks is a useful metrix for evaluating the welfare gains from a monetary union. A related model is Dixit and Lambertini (2003), where in addition to a monetary union the authors also consider separate fiscal policies of the member countries. See also Dixit (2000) and Fuchs and Lippi (2006) as models in which the monetary union characteristics are optimal. As Fuchs and Lippi point out, the optimal monetary policy in a currency union does involve some self-enforcing transfers that can perform functions similar to that advocated for by a fiscal union, but, as shown in Farhi and Werning (2012), the need for fiscal insurance mechanism remains even when considering optimal monetary policy.
countries have access to a sequentially complete financial structure of assets. These authors point out that the creation of a fiscal union can recover the efficiency of risk sharing. Thus, they argue, a fiscal union plays an important role and is necessary even if countries have access to complete markets. Similar arguments have been recently put forward by Farhi and Werning (2012), who also show that indeed volatility can increase as a consequence of the formation of a currency union without a common fiscal policy.  

The paper is organized as follows. Section 2 presents the model. Section 3 presents our theory of volatility for the formation of a fiscal union. Section 4 concludes.

2 Model

2.1 Road map

The structure of the model we are about to describe has the following ingredients:

- **Integration benefits**: – Any economic union of countries, is typically motivated by the existence of beneficial exploitation of economies of scale, cooperation and coordination gains, and reduction of transaction costs. Since the degree to which these benefits apply vary with the type of union and integration depth, this must be a critical ingredient for the rationalization of different integration decisions. Denote by $g^0$ the overall benefit of the initial level of economic integration before the consideration of currency or fiscal union (to fix ideas, think of time 0 here as the 90s in Europe, before the currency union). We will then denote by $g^c > g^0$ the overall benefits obtained when making the extra currency union step.

- **Volatility**: – The other parameter to consider is the volatility of income shocks

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9 See Luque and Taamouti (2012) for empirical evidence that the adoption of the Euro has changed the effect of Eurozone countries’ economic fundamentals on per capital Gross Domestic Product (GDPpc) growth rate volatility (economic uncertainty).

10 An economic union can take several forms, see Belassa (1961).

11 See Mundell (1961), Alesina and Barro (2002), and Baldwin and Wyplosz (2006) for a survey of all the extra common benefits coming from monetary integration.
(details below). Given that in an economic union with no fiscal nor monetary policy integration each country has two policy instruments to counter shocks whereas in a currency union each country has discretion only on fiscal policy (and only if away from a "debt ceiling" corner), it is natural to assume that the volatility of disposable incomes across countries in the union is lower than in a currency union, and this difference will be captured by the inequality $\sigma^c > \sigma^0$ in the notation to follow below.\(^{12}\)

- **Fiscal union:** As mentioned in the introduction, by a fiscal union we mean here a mechanism that involves some measure of counter-cyclical transfers across countries or regions. Given this basic nature, creating a commitment mechanism to certain types of transfers, the fiscal union makes no difference in terms of economies of scale, and it is not obvious whether $g$ should be at all affected. Therefore, for simplicity we will assume that the overall benefit of economic integration remains the same, $g^f = g^c$. The decision to form a fiscal union depends on the realization of volatilities. As we explain in Section 3, countries prefer to form a monetary union and not adding a fiscal union dimension if volatility is low for all (or some) countries, as in the 90’s. However, when volatility jumps for some countries, as it was the case in the 2000’s, there is more support in favor of a fiscal union. In this case, if sufficient countries prefer to add a fiscal dimension to the status quo, it may be in their interest to compensate countries with low volatility through economic and political incentives, and make them approve the creation of the fiscal union.

- **Negotiation of political weights:** Whenever a union reaches the subgame in which the creation of a fiscal union is recognized to be beneficial, consensus on such a step can be obtained through a modification of the political weights in the common decisions, for example with respect to the current relative weights assigned by the Nice treaty or Lisbon Treaty to the member countries for the various types of common

\(^{12}\)Beside the intuitive argument in the text about one instrument versus two, other subtle arguments showing that volatility should be expected to increase in a currency union can be found in Farhi and Werning (2012). See also empirical findings in Luque and Taamouti (2012).
decisions. So our last step will be to show how such expected modifications of political weights may depend on individual country characteristics.

2.2 Countries’ characteristics and utility across regimes

Consider a set of $M$ countries with fixed frontiers and population. As a measure of a country’s economic activity, we use “income”, a summary of its economic performance affected by shocks. Countries may differ in terms of population size and income. Let country $i$’s pre-tax income be $Y_i \in R_+$; assume that all individuals in country $i$ have the same income, shutting down therefore the issue of internal redistribution. Country $i$’s population is denoted by $N_i \in R_+$. Total population is therefore $N = \sum_{i=1}^{M} N_i$. The relative population size of country $i$ in the union is $n_i = N_i/N$ with $n_i \neq 0$.

All countries are subject to idiosyncratic random productivity shocks that change their income levels. We interpret shocks as medium to long term shocks to productivity, not yearly cyclical fluctuations. Country $i$’s after shock income level is denoted by $X_i = Y_i(1 + \varepsilon_i)$. Let $\varepsilon = (\varepsilon_1, ..., \varepsilon_M)$ denote a vector of shocks for this economy. The vector $\varepsilon$ is drawn by Nature according to an $M$-dimension distribution $Pr(\varepsilon)$. We denote by $C$ the space of symmetric matrices $[\rho_{ij}]_{M \times M}$ of pair-wise correlation coefficients with generic element $\rho_{ij}$. A state $\omega = (C, (Y_i, N_i)_{i=1,\ldots,M})$ is a vector of shock correlations and country incomes and sizes. The state space is denoted by $\Omega = C \times R_+^M \times R_+^M$. We say that, given $\omega \in \Omega$, there is possibility of reversal for a country $i$ if there exists a vector of shocks $\varepsilon = (\varepsilon_i)_{i=1}^M$ such that $Y_i > y$ and $X_i < x$, where $y = \sum_{i=1}^{M} n_i Y_i$ denotes the average income per capita in the union, before shocks are realized, and $x = \sum_{i=1}^{M} n_i X_i$ denotes the pre-

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13As pointed out in the Introduction, the purpose of the current study is to analyze the “country incentives” to add a fiscal union dimension to an existing set of international institutions. The “class incentives” in countries with heterogeneous internal income levels have been studied, e.g. by Casella (2001), Persson and Tabellini (1996a,b), Barbera and Jackson (2006), and Morelli, Yang and Ye (2012), and references therein. There is a basic feasibility trade-off: when allowing for internal heterogeneous incomes it is difficult to allow for asymmetric population sizes and country incomes in the analysis of strategic institutional choice. In this paper the elimination of internal heterogeneities allows us to introduce the relevant heterogeneities across countries.

14Migration issues among countries are absent here. For a fiscal union model with migration see Ortuno-Ortin and Sempere (2006).
tax, after-shock average income of the union. In other words, a reversal turns a pre-shock relatively rich country into a relatively poor country after the shock, when compared to the union’s average income. A reversal can be due to a negative correlation coefficient among country shocks, given differences in pre-shock incomes.

Assume a logarithmic utility for the representative agent:

$$V_i^k = \ln(g_i^k X_i),$$

where the coefficient $g_i^k$ captures the multiplier advantages accruing to country $i$ from being in a union of type $k$. As suggested in the presentation of the road map above, the three regimes considered are the independent policy making regime ($k = 0$); the currency union ($k = c$); and the fiscal union, where both monetary policy and fiscal policy are centralized ($k = f$). To be precise, the above simple expression of utility applies to $k = f$ only in the absence of taxes, but since taxes and transfers are an essential component of a fiscal union, the argument of the logarithm will have to include consideration of such tax-transfer schemes. Once the linear transfer system is in place, the utility of the representative agent of country $i$ is altered as follows:

$$V_i^f(T(\varepsilon)) = \ln(g_i^f) + \ln \left((1 - T(\varepsilon))X_i + (T(\varepsilon) - \frac{1}{2}T(\varepsilon)^2)x\right)$$

where $T(\varepsilon)$ denotes the tax rate that is chosen in the union as a function of shocks $\varepsilon$. The term $(1 - T(\varepsilon))X_i$ is the after-tax income after the shock is realized and the common tax is imposed. The term $(T(\varepsilon) - \frac{1}{2}T(\varepsilon)^2)x$ corresponds to the amount received after tax rebates.

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15 Reversals between pairs of EU countries were relatively frequent in the case of Belgium, France, Germany, Netherlands, U.K. and Denmark. Reversals with respect to the EU average income also occur: such was the case for Belgium (1973, 1977, 1979), Germany (1974), Finland (1995), Ireland (1997), and Italy (2007). de Grauwe (2010) documents how country relative unit labor costs, an indicator of competitiveness, suffer reversals in a ten year period leading up to 2010. This evidence is supportive of our view that there is scope for income reversals in the medium to long-run.

16 Any concave utility function would serve our purposes of representing risk aversion.

17 The possibility of heterogeneous benefits, e.g. $g_i^k > g_j^k$, comes from the possibility that for example country $i$ trade more with their monetary union counterparts or exports more outside the union.
which depends on the average income $x$ in the fiscal union, as well as on the deadweight loss $\left(-\frac{1}{2}T(\varepsilon)^2\right)$ generated by the tax system.\textsuperscript{18}

For normalization purposes, we assume henceforth that $g_i^0 = 1 \; \forall i$, and the second assumption already hinted in the road map is that $g_i^c = g_i^f > 1 \; \forall i$. The parameter $g_i^k$, when greater than 1, always increases income, but also amplifies shocks.

Denote by $\sigma_i^k < 1$ the standard deviation of shocks for country $i$ in regime $k = 0, c, f$, with the assumption that $\sigma_i^0 < \sigma_i^c = \sigma_i^f$.\textsuperscript{19}

In summary, the basic assumption of the model is that going from an economic union with independent fiscal and monetary policies to a currency union or fiscal union determines two effects, namely an increase in coordination and efficiency benefits captured by a higher $g$ coefficient for all, but, on the other hand, an increase in pre-tax or pre-transfer income shocks (see Fahri and Werning (2012) for the most recent model generating such a consequence from a currency union).

### 2.3 Time line

At time -1 the $M$ countries had decided to form a currency union, perhaps because of the belief that $\sigma^c$ would not increase. We focus on time 0, when the global economy changes and the perception of volatility changes (the prediction of $\sigma_i^c$ is revised upward for many countries or all).\textsuperscript{20} Uncertainty is resolved at date 1, when random productivity shocks change countries’ income levels.

\textsuperscript{18}The quadratic deadweight loss prevents the poor individual from imposing a tax rate that fully expropriates the rich. This is a standard assumption in the literature.

\textsuperscript{19}To reiterate, the productivity shocks in regime $c$ and regime $f$ are assumed to be the same because the only thing $f$ adds to $c$ is the possibility of commitment to side payments, but the economic shocks pre-tax are unchanged. On the other hand, the variance of pre-tax income shocks in regime 0 is lower because the independent central banks can already absorb part of the idiosyncratic shocks through exchange rate adjustments.

\textsuperscript{20}The change in volatility occurring at date 0 is assumed to be an unanticipated change. This is consistent with assuming that at date -1 the relevant players were "myopic" with respect to the possibility of volatility changes due to the introduction of the common currency, but would also be consistent with other assumptions: for example it is conceivable that the signers of the monetary union at date -1 attached some positive probability to the event of an increased volatility, but decided to postpone dealing with the consequences of such a change only in case it would occur.
At date 0, either all countries agree to remain in regime c, or there are only two other options, namely they can all unanimously shift to regime f, or else they can return to independent policy making (sometimes we will call the return to independent policy making in short "autarky", even though the countries can still trade freely and do all the other things they did in the economic union before the creation of the Euro). The simplifying assumption here is that all the $M$ countries are necessary for either type of common policy union, and else, if one country decides to go back to independent monetary and fiscal policy, the possibility of a common policy disappears also for the other remaining countries. This strong assumption can be relaxed, along similar lines as in Maggi and Morelli (2006), but certainly the case of all or none would apply to at least some minimum set of crucial countries, hence we might as well make it for our assumed number $M$ of countries (and, if necessary, call them crucial).

In case of a unanimous decision to form a fiscal union, the countries need to agree on how to decide the additional taxes and transfers. The choice (or commitment to) a tax-transfer system is a choice made at time 0, which acts as insurance in anticipation of time 1 realization of the shocks.

Denoting by $T_i(\varepsilon)$ the preferred ex post tax rate of country $i$, one way to describe the bargaining problem at time zero is to imagine that at time zero the $M$ countries have to agree, if they want a fiscal union, on a vector of probabilities with which each member will determine the linear tax system in period 1. In other words, we consider that, if a fiscal union is formed, the tax rate is chosen by a random dictator mechanism. In a decision by a random dictator mechanism what matters is the frequency with which country $i$ decides, or the “weight” $p_i$ country $i$ has in the decision system. The weights must obviously satisfy $p_i \in [0, 1]$ for all $i$, and $\sum_{i=1}^{M} p_i = 1$. For a given system $(p_1, ..., p_M)$ of proportional weights, expected utility in a fiscal union under such weights is given by

$$E[V_i^f(\varepsilon)] = p_i E[V_i^f(T_i(\varepsilon))] + \sum_{j \neq i} p_j E[V_i^f(T_j(\varepsilon))]$$

(expected utility in a fiscal union under such weights is given by

\[ \text{expected utility} = p_i \text{expected utility for country } i \text{ for tax rate } T_i(\varepsilon) \] + \[ \sum_{j \neq i} p_j \text{expected utility for country } j \text{ for tax rate } T_j(\varepsilon) \] )
3 Equilibrium

3.1 Expected utilities from different regimes

At date 0 countries realize that there has been an increase in the volatility parameter and face the uncertainty of shock realizations at date 1. In order to obtain simple close form solutions for the expected utility, let us assume that, for each country $i$, the random productivity shock $\varepsilon_i$ follows a discrete distribution\(^{21}\) and can take two possible values, $\varepsilon_i \in [0, 1]$ and $-\varepsilon_i$.\(^{22}\) For any pair of countries $(i, j)$ with shocks $(\varepsilon_i, \varepsilon_j)$, there are four possible realizations $(\varepsilon_i, \varepsilon_j), (-\varepsilon_i, -\varepsilon_j), (\varepsilon_i, -\varepsilon_j)$ and $(-\varepsilon_i, \varepsilon_j)$. We assume that, for any pair of countries, asymmetric shocks, $(\varepsilon_i, -\varepsilon_j)$ and $(-\varepsilon_i, \varepsilon_j)$, occur with the same probability, denoted as $q_{ij}^a \equiv \Pr(\varepsilon_i, -\varepsilon_j) = \Pr(-\varepsilon_i, \varepsilon_j)$. Likewise for symmetric shocks, $(\varepsilon_i, \varepsilon_j)$ and $(-\varepsilon_i, -\varepsilon_j)$, which occur with probability $q_{ij}^s \equiv \Pr(\varepsilon_i, \varepsilon_j) = \Pr(-\varepsilon_i, -\varepsilon_j)$.\(^{23}\) Clearly, we must have that $q_{ij}^a + q_{ij}^s = 1/2$ and $E(\varepsilon_i) = 0$. With this normalization it is easy to show that $\sigma_i = \varepsilon_i$, so that the explanation given in words above for why independent policy making reduces pre-tax income volatility is simply captured by a reduction in the size of the income shocks themselves, once again because of the possibility of exchange rate adjustments.

Of course the overall distribution $\Pr(\varepsilon)$ must be consistent with the two-dimensional distributions proposed for all pairs.\(^{24}\)

The following lemma easily follows:

**Lemma 1:** Country $i$’s expected utility from a currency union is increasing in $g_i^c$ and in the pre-shock per-capita income, and decreasing in the volatility of its own shock, as

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\(^{21}\)Similar results and figures are obtained when using a continuous distribution, such as the multivariate normal. However, in the latter case, closed form solutions cannot be obtained.

\(^{22}\)We require after shock income to be non-negative and so take the lower bound of $\varepsilon_i$ to be $-1$. By symmetry we take the upper bound of $\varepsilon_i$ to be 1.

\(^{23}\)In terms of the relationship between these parameters $q$ we now introduce because of the discretization assumption and the $\rho$ matrix defined earlier, it can be shown that $q_{ij}^A = (1 - \rho_{ij})/4$. See Luque, Morelli, Tavares (2011).

\(^{24}\)Notice that there are many $M$-dimensional distributions consistent with a single set of two-dimensional distributions. See Stoyanov (1996, p. 53) for examples showing that pairwise independence does not imply joint independence.

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follows:

$$E[V_i^c(\varepsilon_i)] = \ln g_i^c + \ln Y_i + \frac{1}{2} \ln(1 - (\sigma_i^c)^2)$$  

(4)

Analogously, country $i$’s expected utility if reverting to independent policy making is increasing in the pre-shock per-capita income and decreasing in the volatility of its own shock, as follows:

$$E[V_i^0(\varepsilon_i)] = \ln Y_i + \frac{1}{2} \ln(1 - (\sigma_i^0)^2)$$  

(5)

From the first order condition of $V_i^f(T(\varepsilon))$ with respect to $T(\varepsilon)$, country $i$’s preferred ex-post tax rate is given by

$$T_i(\varepsilon) = \begin{cases} 
1 - \frac{X_i}{x} & \text{if } X_i < x \\
0 & \text{otherwise} 
\end{cases}$$  

(6)

The lower the country $i$’s after shock income relative to the average income, the higher its period 1 preferred tax rate in the fiscal union. Observe that the term $X_i/x$ makes the preferred tax rate for a given country depend on the income and population of all other countries in the union. In particular, it is possible to show that country $i$’s desired ex post tax rate is (weakly) decreasing in its relative size and relative income.

To compute the expected utility for a country from a fiscal union, note that country $i$’s expected utility in the fiscal union when country $i$ determines the tax rate ex-post is

$$E[V_i^f(T_i(\varepsilon)))] = \sum_{\varepsilon \in \{\varepsilon_i, -\varepsilon_i\}^M} \Pr(\varepsilon) \left( \ln g_i^f + \ln \left( \frac{X_i(2 - X_i)}{2x} + \frac{x}{2} \right) \right)$$  

(7)

whereas the expectation in case some other country $j$ is the dictator ex-post is

$$E[V_i^f(T_j(\varepsilon)))] = \sum_{\varepsilon \in \{\varepsilon_i, -\varepsilon_i\}^M} \Pr(\varepsilon) \left( \ln g_i^f + \ln \left( \frac{X_j(2X_i - X_j)}{2x} + \frac{x}{2} \right) \right)$$  

(8)

We now change the relative country incomes and relative country sizes to illustrate how
expected utilities (7) and (8) change. We then provide some intuition on how the decision weights in a two-country fiscal union should be assigned, for different relative incomes and sizes, so that a country prefers the fiscal union to independent policy making.

Figure 1: We take $A_i = A_j = 0$, $g_i = g_j = 0$, and $g_i = g_j = 1$.

Figure 1 depicts expected utilities (7), (8) and (5) as a function of relative incomes, for equal country sizes. When country $i$ decides on the tax rate, its expected utility in the fiscal union is always above its expected utility in autarky because country $i$ will never be expropriated. Country $i$ chooses a positive tax rate when it is after-shock poorer, and a zero tax rate when it is after-shock richer, as the optimality condition (6) shows. When country $i$’s relative income increases, its expected utility in the fiscal union, as country $i$ decides on the tax rate, decreases but converges to a value $\ln g_i$ above country $i$’s expected utility in autarky. If it is the case that country $j$ is the one that decides on the tax rate, then country $i$’s expected utility in the fiscal union is closer to autarky levels when is relatively
very poor, and thus not expropriated by \( j \). However, country \( i \) becomes worse off than under independent policy making as its relative income increases.

![Figure 2](image)

**Figure 2**: We take \( \sigma_i^A = \sigma_j^A = 0.6 \), \( \sigma_i^{g_i} = \sigma_j^{g_j} = 0.815 \), \( \rho = -0.5 \) and \( g_i = g_j = 1.45 \).

Figure 2 shows how, for different country relative sizes but same incomes, country \( i \)’s expected utilities in the fiscal union change when both country \( i \) or country \( j \) decide. Country \( i \)’s expected utility in the fiscal union when \( i \) decides the tax rate is above autarky levels, and decreases the larger is country \( i \)’s relative size, as the tax base of the union becomes more and more composed of country \( i \)’s income. This makes country \( i \) choose a lower and lower tax rate in order to avoid the deadweight loss of taxation. In the limit, country \( j \) has a negligible size in the union, and the tax rate chosen by country \( i \) is 0. Its expected utility converges to a value \( \ln g_i^f \) above the expected utility under independent policy making. In Figure 2 we also can see that country \( i \)’s expected utility when country \( j \) decides on the tax rate decreases from \( n_i = 0 \) to a scenario when \( n_i \) gets closer to 1,
and then it increases\textsuperscript{25} and converges to a line that is below but parallel to country $i$’s expected utility in autarky, as $n_i \to 1$ ($T_j \to 1 - \frac{X_j}{X_i}$). Notice that when country $i$ is very small ($n_i$ close to 0), the tax base is almost entirely composed by country $j$’s income, so country $j$ chooses an almost zero tax rate. This makes country $i$’s utility in the fiscal union close to but slightly above its autarky level (where the benefit of the common policy is absent). On the other hand, when country $i$’s relative size is very large ($n_i$ close to 1), all tax base is composed by country $i$’s after-shock income, and optimality tells us that country $j$ expropriates at a non-negative rate $T_j = 1 - \frac{X_j}{X_i}$.

The previous analysis reveals that:

**Lemma 2**: Countries with a large relative income and a large relative size will demand a higher decision weight in the fiscal union given their autarky threat point.

The result follows a standard convex analysis. Country $i$ prefers the fiscal union to autarky if the convex combination $p_i E[V_i^f(T_i(\varepsilon)))] + (1 - p_i) E[V_i^f(T_j(\varepsilon)))]$ at a given point (relative income or relative size) is above the autarky level $E[V_i^a(\varepsilon_i)]$. Figure 1 shows that the larger is country $i$’s relative income, the closer must be country $i$’s weight to 1 for country $i$ to be better off in the fiscal union than in autarky. In Figure 2 we can see that $E[V_i^f(T_i(\varepsilon)])]$ is always decreasing in size and approaching the expected utility level in autarky, requiring the weight $p_i$ to be closer to 1 the larger is country $i$’s relative size.

### 3.2 The role of volatility

We can now focus on the key role of the shock volatility parameter. Countries agreed to have a common monetary policy, in a context of low volatility; at some later date, it became clear that the system was subject to a greater volatility than before; countries came to face the choice between abandoning the status quo and reverting to autarky, or adding the fiscal policy dimension to the monetary union, with an “appropriate” distribution of

\textsuperscript{25}It is easy to see that $\frac{d(V_i^f(T_i(\varepsilon)))}{dn_i} < 0$ for all $n_i \in [0, 1]$, whereas $\frac{d(V_i^f(T_j(\varepsilon)))}{dn_i} < 0$ if $2X_i < X_j$, and $\frac{d(V_i^f(T_j(\varepsilon)))}{dn_i} > 0$ if $2X_i > X_j$. For the parameters chosen in Figure 2, we see that $2X_i < X_j$ occurs when $(\varepsilon_i, \varepsilon_j) = \{(\bar{\varepsilon}, \bar{\varepsilon}), (\bar{\varepsilon}, -\bar{\varepsilon})\}$ and that $2X_i > X_j$ occurs when $(\varepsilon_i, \varepsilon_j) = \{(-\bar{\varepsilon}, \bar{\varepsilon}), (-\bar{\varepsilon}, -\bar{\varepsilon})\}$.

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voting weights. Let us define at date 0, for each country \( i \), three thresholds:

- \( \hat{\sigma}_i \) will denote the volatility of shocks that makes country \( i \) indifferent between the status quo and the fiscal union;

- \( \tilde{\sigma}_i \) will denote the threshold at which country \( i \) is indifferent between staying in the monetary union and reverting to independent policy making;

- \( \tilde{\sigma}_i \) will denote the threshold that makes country \( i \) indifferent between fiscal union and reverting back to independent policy making.

Country \( i \)'s expected utility in a currency union is decreasing and concave in \( \sigma_i \), while the expected utility with independent policy making is a straight line. These two facts guarantee that \( \tilde{\sigma}_i \), at which country \( i \) is indifferent between them, is uniquely determined.

In order to have \( \hat{\sigma}_i \) and \( \tilde{\sigma}_i \) also uniquely defined, we need the single crossing property to hold between, respectively, functions (3) and (4), and (3) and (5). This occurs when 
\[
\frac{dE[V_f(\varepsilon)]}{d\sigma_i} < 0 \quad \text{and} \quad \frac{d^2E[V_f(\varepsilon)]}{d(\sigma_i)^2} < \frac{d^2E[V_c(\varepsilon)]}{d(\sigma_i)^2} < 0, \quad \text{for all} \quad \sigma_i \in [0,1].
\]
Heterogenous countries may have different volatility thresholds. All volatility thresholds depend in a continuous manner on the weights, and on the relative size and income.

The following proposition establishes how volatility affects preferences over the different regimes:

**Proposition 1:** For a set of realizations \((Y_i, N_i)_{i \in I}\), there are three thresholds \( \hat{\sigma}_i, \tilde{\sigma}_i \) and \( \tilde{\sigma}_i \) such that:

a) \( \hat{\sigma}_i < \tilde{\sigma}_i < \tilde{\sigma}_i \).

b) if \( \sigma^*_i < \hat{\sigma}_i \), the status quo currency union is preferred to fiscal union, which in turn is preferred to autarky.

c) if \( \hat{\sigma}_i < \sigma^*_i < \tilde{\sigma}_i \), the fiscal union is preferable to currency union alone, which in turn is preferred to autarky.

d) if \( \tilde{\sigma}_i < \sigma^*_i < \tilde{\sigma}_i \), the fiscal union is preferred to autarky, which in turn is preferred to the currency union.
e) if $\bar{\sigma}_i < \sigma_i^c < 1$, autarky is preferred to the fiscal union, which in turn is preferred to the status quo currency union.

Figure 3 illustrates the three thresholds for a country $i$ in a two countries economy with $N_i = N_j$,

$$Y_i = Y_j, \text{ and } p_i = p_j.$$  

Being in a currency union when coming to time zero is consistent with $\sigma_i^c$ being estimated at time -1 to be less than $\bar{\sigma}_i$ for all $i$. Consider an upwards shift in some of the $\sigma_i^c$ at time 0 that makes at least one of the countries have $\sigma_i^c > \bar{\sigma}_i$. Now, given $(Y_i, N_i)$ and the new $\sigma_i^c$, we can characterize four different relevant scenarios, in the absence of additional economic or political incentives, as far as the distribution of country preferences over regimes is concerned.

**Proposition 2:** We can identify the following regions characterizing all the possible consequences of changes in the perceived volatility of shocks at time 0 in the currency
Union.  

**Region 1:** Countries remain in a currency union at time 0 if all countries have $\sigma^c_i < \bar{\sigma}_i$ and there is at least two countries $i$ and $k$ with $\sigma^c_i \in (\bar{\sigma}_i, \bar{\sigma}_i)$ and $\sigma^c_k < \bar{\sigma}_k$, respectively.

**Region 2:** Countries form a fiscal union if all countries have $\sigma^c_i \in (\bar{\sigma}_i, \bar{\sigma}_i)$.

**Region 3:** The union reverts to autarky if there is at least two countries $i$ and $k$ with $\sigma^c_i < \bar{\sigma}_i$ and $\sigma^c_k \in (\bar{\sigma}_k, \bar{\sigma}_k)$.

**Region 4:** The union reverts to autarky if there is at least one country with $\sigma^c_i > \bar{\sigma}_i$.

In Region 1, at least one country prefers a fiscal union, but there is no unanimity in support of that move. Since all countries prefer status quo currency union to autarky, the regime remains in status quo. Notice that, if sufficient countries are in region $\sigma^c_i \in (\bar{\sigma}_i, \bar{\sigma}_i)$, where they prefer fiscal union to the status quo, it may be in their interest to compensate countries with $\sigma^c_i < \bar{\sigma}_i$ through economic and political incentives, and make them approve the creation of the fiscal union.

In Region 2, the fiscal union is formed since there is unanimity. Notice that even if all countries have $\sigma^c_i \in (\bar{\sigma}_i, \bar{\sigma}_i)$, so that all prefer autarky to the status quo, they unanimously prefer the fiscal union.

In Region 3, country $i$ prefers to remain in status quo, and country $k$ prefers to move to the fiscal union. Thus, without further compensation, no unanimity is attained and the union reverts to autarky. Similarly to region 1 above, if enough countries have $\sigma^c_i \in (\bar{\sigma}_i, \bar{\sigma}_i)$, they could use economic and political incentives to convince countries with $\sigma^c_i < \bar{\sigma}_i$ to vote in favor of the fiscal union.

In Region 4, country $i$ has $\sigma^c_i > \bar{\sigma}_i$, so it prefers autarky to both status quo and fiscal union. Again, by a similar argument as above, only if there are sufficiently many countries with $\sigma^c_i \in (\bar{\sigma}_i, \bar{\sigma}_i)$ to compensate countries with $\sigma^c_i > \bar{\sigma}_i$, and eventually countries with $\sigma^c_i < \bar{\sigma}_i$, will the unanimous creation of the fiscal union be possible.

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26 In principle one could imagine that some global events can determine changes also in $\sigma^0_i$, and in that case the proposition would have to be restated in terms of the consequences of changes in the perceived "difference" between the volatility with and without a currency union.
In Regions 3 and 4 we observe the interesting trade-off pointed out in the Introduction: *without a fiscal union, high volatility kills the common currency.* Next, we pose a simple example that illustrates this trade-off:

**Example:** Let there be three countries, namely 1, 2 and 3. For simplicity we assume that all countries have the same volatility, $\sigma$, but individual thresholds are different. These are $\hat{\sigma}_1 = 0.6$, $\hat{\sigma}_2 = 0.35$, $\hat{\sigma}_3 = 0.1$, $\tilde{\sigma}_1 = 0.8$, $\tilde{\sigma}_2 = 0.7$ and $\tilde{\sigma}_3 = 0.45$. Now, consider the situations “before” and “after” bad news arrive and volatility $\sigma^c$ increases. “Before” the news, $\sigma = 0.05$ and the three countries prefer the fiscal union to the status quo, and the status quo to autarky. “After” the news, with $\sigma = 0.5$, the situation changes. Country 1 still has the same preferences as “before”, but countries 2 and 3 preferences change. Country 2 now prefers the fiscal union to status quo, and status quo to autarky. Now, country 3 prefers fiscal union to the status quo, but if the former regime is not unanimously supported, country 3 reverts to autarky, and makes status quo collapse. □

The question that we shall address in the next section is: Are there political incentives that the countries in favor of the fiscal union can use to convince those other countries that prefer a reversion to autarky? In terms of our previous example, the question can be reformulated as follows: What is the nature of the institutional design that provides the political incentives that bring country 1 to support the fiscal union?

### 3.3 Bargaining space

As shown above, there are instances (namely Regions 3 and 4 in Proposition 2) where an interesting trade-off arises between moving unanimously to fiscal union or reverting to autarky. Institutional design comes to the scene precisely at this point. By choosing the appropriate proposal weights, countries can provide the necessary incentive to convince all countries to adhere to the fiscal union. The mechanism that we propose is a simple assignment of a proposal weight to each of the countries in the fiscal union, so that the tax rate is decided in line with these specific weights. As indicated above, these weights (or
probabilities) are described by a vector \((p_i)_{i=1}^M\). Weights must be such that, for all countries, the expected utility in the fiscal union is at least equal to the expected utility in autarky. We are thus incorporating institutions into the picture, in the form of representation rights.

Let us define by \(p_i\) the country \(i\)’s minimum weight compatible with country \(i\) joining the fiscal union. Following the assumption of unanimity for the formation of the fiscal union, we denote by \(\bar{p}_i\) the country \(i\)’s maximum weight that is compatible with all the other countries joining the fiscal union. In the Appendix we characterize the expressions \(\bar{p}_i\) and \(p_i\) as functions of countries’ expected utilities in autarky and in the fiscal union. The consensus bargaining space (CBS) then corresponds to the difference between these upper and lower bounds, that is, \(\bar{p}_i - p_i\). A non-empty CBS (i.e., \(\bar{p}_i - p_i > 0\)) implies that the fiscal union improves upon autarky for all countries in the union. Observe that if \(\bar{p}_i - p_i > 0\) holds for one country, then it must hold for all countries, so the fiscal union improves upon the autarky regime for all countries.\(^{27}\) Let us now concentrate on the case of a two countries union. Our goal is to understand the role of income and size and the correlation of shocks for the formation of a fiscal union. This analysis is useful because we can easily compare our results to existing work, in particular, Alesina and Perotti (1998). Moreover, we can explore when there exist voting weights that preserve the benefits of a common policy while limiting the political risk of entering a fiscal union.

### 3.3.1 Correlation of shocks and political weights

Our analysis extends both Gordon (1983) and Alesina and Perotti (1998) to the whole range of possible shocks correlations \(\rho\) and voting weights \((p_i)\) parameters. Gordon (1983) develops the classical one-dimensional analysis highlighting the role of negative cross-correlation of shocks on risk sharing possibilities between countries. He showed that when \(\rho < 0\) a fiscal union is a way to provide economic insurance. The more negative the value of \(\rho\), the

\(^{27}\) In the Appendix we show what changes when considering the possibility of formation of a fiscal union with a supermajority rule instead of requiring unanimity.
higher the benefits of common insurance.\textsuperscript{28} Alesina and Perotti (1998) extend Gordon’s framework by letting one country, which they assume marginally larger than the other, to always decide on the fiscal instrument, thus introducing what these authors term as “political risk”.

![Figure 4: Bargaining Space](image)

Figure 4: We set \( Y_i/Y_j = 1, N_i/N_j = 1, \) and \( g_i = g_j = 1.45. \)

Figure 4 illustrates how the bargaining space between two countries \( i \) and \( j \) changes when the correlation between country’s shocks change in our model. This figure illustrates the argument in Alesina and Perotti (1998) that “political risk” may overwhelm “economic risk”. This reverses the classical result in Gordon (1982), where a perfectly negative cross-correlation between shocks favors the formation of a fiscal union. In our model, the lower is the correlation between shocks, the larger is the bargaining space.\textsuperscript{29} However, we have non-empty bargaining space even with \( \rho > 0. \) In the context of Alesina and Perotti (1998),

\textsuperscript{28}In the same vein of Bolton and Roland’s (1997) political economy model of integration, Fidrmuc (2004) considers the impact of region-specific shocks in a dynamic setting, and shows that negatively correlated temporary shocks allow the greatest gains from inter-regional risk sharing.

\textsuperscript{29}At \( \rho = -1 \) the fiscal union is sustainable when \( p_i \in [0.45, 0.55] \). The bargaining space becomes empty when \( \rho \geq 0.7. \)
where it was always the same country that decided on the common tax rate (corresponding, in our setting, to $p_i = 1$), the fiscal union might not be possible due to the implicit political risk, even if $\rho = -1$ and economic insurance is most attractive. In contrast to Alesina and Perotti (1998), where institutional design was absent, our setup shows how voting weights need to be reassigned for the two countries to accept to join the union. In other words, what this picture brings forward is how a sensible redistribution of voting power, which decreases the likelihood of country $i$ deciding, guarantees ex-ante unanimity in favor of the fiscal union. Thus, the addition of the institutional dimension countered the “political risk effect” in Alesina and Perotti (1998). In a sense, by allowing for variable voting weights, countries in our setup insure against political risk as in Alesina and Perotti (1998).

It is easy to see that the threshold at which the bargaining space becomes non empty changes with relative income. For a given correlation of shocks, increasing country $i$’s relative income causes both the minimum and maximum country $i$’s voting weights to increase. The intuition is simple. A country $j$ that becomes relatively poorer demands a lower weight in the union since in this new situation the chances to expropriate country $i$ through transfers increase. On the other hand, given the higher probability of being partially expropriated, the richer country $i$ demands a higher weight in the union in order to keep its expected utility above the autarky level.

### 3.3.2 Voting weights and asymmetries in income and size

Previous results in the literature have focused on the correlation coefficient between country shocks to analyze the benefits of forming a union, for equal countries’ ex-ante income and population. Here, instead, we start with countries that are different in income and size, and characterize the bargaining space for different possible parameters. We pose the following question: given the unanimous voting rule, what are the income and size parameters that make a fiscal union possible?
Figure 5: We set $\rho = -0.5$.

Figure 5 shows how the bargaining space changes when relative incomes and population sizes change. We assume $\rho = -0.5$. The three dimensional graph shows that the less heterogeneous the countries, the larger the scope for agreement. The reasoning is as follows: when countries become dissimilar in income, the country with higher income demands higher weight in the union to avoid expropriation through the common tax. This in turn decreases the bargaining space. On the other hand, when countries become dissimilar in size, the country with a larger population is discouraged from imposing heavy taxes on its richer partners in the union, as this implies imposing deadweight losses on its own, large population.

### 3.4 Implications for Europe

At the time of the creation of the Monetary Union (EMU) in 1999, the context was one where the “great moderation”, associated with decreased economic volatility, made most
people convinced that the loss of control over money issue as a policy instrument was a non-issue. And, indeed, until the recent economic and financial crisis, the EU project was seen as the longest lived and deepest institutional agreement among heterogeneous countries.

That is no longer the case. In the wake of the crisis and the associated rise in volatility, an intense debate arose. The extreme options with of abandoning the euro versus reverting to the old currencies was brought to the fore in several of the countries that had adopted the common currency. The institutional framework of the Euro and even the European Union is seen as in flux. Interestingly, the options on the table are extreme: either all or part of the countries move towards fiscal union; or the Euro might collapse, and some countries will have to revert to independent policy making. As our theory suggests, it is precisely in the high volatility countries where we expect the fiscal union or autarky options to become more salient. The countries most affected by the economic crisis will rank an unanimous move to fiscal integration as the most preferable option. If that is not possible, autarky becomes an attractive second option. Importantly, the status-quo may no longer be viable.30

As our theory suggests, when volatility jumps for some of the countries in a monetary union, a fiscal union may be a necessary and sufficient institution to sustain the common currency and avoid reversion to autarky. When unanimity in favour of the fiscal union is not possible, some reassignment of political weights may be in order to convince the low volatility countries to join in. Current developments suggest a clear shift in political weights in favour of lower volatility countries such as Germany. Table 1 below documents the volatility of GDPpc growth in the twelve years before and the twelve years after the adoption of the Euro. With the exception of Germany and Finland, all countries experienced increases in volatility. This may be due to the fact that, subject to the same monetary policy, EMU countries lost the the possibility of using devaluation to smooth adverse shocks

30Bordo et al. (2011) analyse the history of several monetary unions and highlight that the EMU has one singular feature: unlike all other monetary unions, the adoption of a common currency and common monetary policy in Europe was not accompanied by moves toward fiscal integration of a comparable nature. See also de Grauwe (2011) for the implications of a fragile Eurozone for its governance.
Table 1: Volatility of real GDP per capita before and after the Euro (Base year is 1985)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Austria</td>
<td>1.66</td>
<td>4.24</td>
</tr>
<tr>
<td>Belgium</td>
<td>3.39</td>
<td>5.25</td>
</tr>
<tr>
<td>Finland</td>
<td>9.56</td>
<td>5.85</td>
</tr>
<tr>
<td>France</td>
<td>4.60</td>
<td>7.80</td>
</tr>
<tr>
<td>Germany</td>
<td>5.61</td>
<td>4.02</td>
</tr>
<tr>
<td>Greece</td>
<td>6.67</td>
<td>14.94</td>
</tr>
<tr>
<td>Ireland</td>
<td>16.29</td>
<td>63.35</td>
</tr>
<tr>
<td>Italy</td>
<td>10.63</td>
<td>13.49</td>
</tr>
<tr>
<td>Luxemburg</td>
<td>17.31</td>
<td>21.93</td>
</tr>
<tr>
<td>Netherlands</td>
<td>4.12</td>
<td>9.53</td>
</tr>
<tr>
<td>Portugal</td>
<td>19.38</td>
<td>23.00</td>
</tr>
<tr>
<td>Spain</td>
<td>9.54</td>
<td>18.91</td>
</tr>
</tbody>
</table>

Note: This table reports the volatility of real GDP per capita before and after the Euro (base year is 1985).

To their economies. As Table 1 documents EMU countries can be roughly divided into a high volatility group, which includes countries such as Greece, Ireland, Italy, Portugal and Spain, and a low volatility group, which includes Germany, Finland, and others. As our theory points out, if the low volatility countries do not lose much in terms of the benefit from lower transaction costs, when going it alone, they may create new institutional arrangements that exclude high volatility countries.

4 Final remarks

- We characterize the set of parameters that support a fiscal union for a set of countries that already share a common policy. Countries are heterogeneous in income and population, and subject to medium to long-term income shocks with a given correlation across economies. Our set-up relates to the classic literature on fiscal federalism, but allowing us to highlight the role of heterogeneities. The increase in volatility may lead countries to prefer reverting to autarky while others would rather move to a full fiscal union. Reallocations of decision power may be necessary to sustain a consensus.
in favour of a fiscal union. Countries with a large relative income and a large relative size will demand a higher decision weight in the fiscal union, given their autarky threat point.

- We provide a volatility-based theory for the formation of a fiscal unions when a common monetary policy is already present. We uncover a scenario where countries subject to high income volatility favour either moving to a fiscal union or reversion to autarky, the status-quo no longer being a desirable option. These high-volatility countries may be willing to relinquish decision power and redistribute political weights in favour of low-volatility countries, so that all can unanimously move towards a fiscal union.

- We characterize the bargaining space of a set of countries that decide between adding the fiscal union dimension or reverting to autarky. We show how the correlation of income shocks, relative population size, and relative income, interact with decision weights to define the feasibility set. In addition to the classical issues of economic risk and, more recently, political risk, the sustainability of a fiscal union is substantially enhanced when political weights are brought to the fore. The existence of a consensus can be guaranteed for a large set of shocks-distribution scenarios and heterogeneities among countries, far beyond what could be achieved without political reforms.

- We discuss how our model can be applied to understand the European response to the economic crisis and the questions on the future of the Euro. We observe that Euro countries have been differently affected by increases in volatility, they seem to differ as to the relative benefits of moving toward a fiscal union or reverting to autarky, and, last but not least, substantial changes in relative national voting weights are de facto occurring.
References


Appendix

Proofs

Proof of Lemma 1: First, notice that the expected value is $E(\varepsilon_i) = \varepsilon_i \Pr(\varepsilon_i) + (-\varepsilon_i) \Pr(-\varepsilon_i) = \varepsilon_i(1/2) + (-\varepsilon_i)(1/2) = 0$. The variance is $Var(\varepsilon_i) = E(\varepsilon_i^2) - E(\varepsilon_i)^2 = \frac{1}{2} \varepsilon_i^2 + \frac{1}{2} (-\varepsilon_i)^2 = \varepsilon_i^2$, so $\sigma_i = \varepsilon_i$. Now, since $\sigma_i = \varepsilon_i$ and $\Pr(\varepsilon_i = \varepsilon_i) = \Pr(\varepsilon_i = -\varepsilon_i) = 1/2$, we have that $E[V_i^c(\varepsilon_i)] = \frac{1}{2} \ln(Y_i(1+\sigma_i)) + \frac{1}{2} \ln(Y_i(1-\sigma_i))$, which can be rewritten as $E[V_i^c(\varepsilon_i)] = \ln(Y_i) + \frac{1}{2} \ln(1-\sigma_i^2)$. With independent policy making, note that the multiplier $g$ is taken out because assumed equal to one, and the other difference is simply the lower $\sigma$. ■

Proof of Proposition 1: All items immediately follow using the intermediate value theorem, making use of the single crossing property, which guarantees that the three thresholds are uniquely defined. In particular, to find each threshold, we need to find two values for $\varepsilon_i$, for which the difference between the two functional forms that determine it takes different signs. For example, for $\bar{\sigma}_i$, take $\sigma_i = \sigma_i^0 < 1$, so $E[\rho[V_i^c(\varepsilon_i)]] - E[V_i^0(\varepsilon_i)] > 0$, and $\sigma_i = 1 - \delta$, with $\delta > 0$ sufficiently small, for which $E[\rho[V_i^c(\varepsilon_i)]] - E[V_i^0(\varepsilon_i)] < 0$. Recall that $E[V_i^0(\varepsilon_i)]$ is constant in $\sigma_i$ (see (5)), and that $E[\rho[V_i^c]] \to -\infty$ as $\delta \to 0$ (see (4)). The other two thresholds can be found using the same procedure. ■

Characterization of the bargaining space

Recall that the weights $(p_i)_{i=1}^M$ must satisfy $p_i \in [0,1]$ for all $i$, and $\sum_{i=1}^M p_i = 1$. Now, in the instances where country $i$ does not decide, which occurs with probability $1 - p_i$, the other $M - 1$ countries will decide given some weights, which we denote by $(p_{ij}')_{j\neq i}$, such that $\sum_{j\neq i} p_{ij}' = 1$.\footnote{Here, $p_{ij}'$ denotes the weight with which country $j$ chooses the tax rate when country $i$ does not choose it.} Observe that $p_j = (1 - p_i)p_{ij}'$. We thus have that $p_i + (1 - p_i)(\sum_{j\neq i} p_{ij}') = 1$. Thus, weights (or probabilities) are described by a vector $(p_i, (p_{ij}')_{j\neq i})_{i=1}^M$.

- Minimum weight of country $i$ compatible with country $i$ joining the fiscal union: We
denote by $p_i$ the minimum weight (or probability) with which country $i$ decides the tax rate, given the vector of weights $(p'_{ij})_{j \neq i}$, that is compatible with the same country $i$ being at least as well off in the union as in autarky. Formally,

$$p_i(\omega, (p'_{ij})_{j \neq i}) \in \arg \min p_i \text{ such that } p_i E[V_i^f(T_i(\varepsilon))] + (1 - p_i) \sum_{s \neq i} p'_{is} E[V_i^f(T_s(\varepsilon))] \geq E[V^0_i] \quad (9)$$

Using equality in (9), we find that

$$p_i(\omega, (p'_{ij})_{j \neq i}) = \frac{E[V_i^0] - \sum_{s \neq i} p'_{is} E[V_i^f(T_s(\varepsilon))]}{E[V_i^f(T_i(\varepsilon))] - \sum_{s \neq i} p'_{is} E[V_i^f(T_s(\varepsilon))]} \quad (10)$$

- **Maximum weight of country $i$ compatible with country $j$ joining the fiscal union:** We denote by $p_{ij}$ the maximum value of country $i$’s weight ($p_i$), such that country $j$ is at least as well off in the union as in autarky, for given state $\omega$ and other country weights $(p'_{ij})_{j \neq i}$. Formally,

$$p_{ij}(\omega, (p'_{ij})_{j \neq i}) \in \arg \max p_{ij} \text{ such that } p_{ij} E[V_j^f(T_i(\varepsilon))] + (1 - p_{ij}) \sum_{s \neq i} p'_{is} E[V_j^f(T_s(\varepsilon))] \geq E[V^0_j] \quad (11)$$

Let us denote by $\lambda_{ij}$ the country $i$’s shadow value associated with constraint (11).

- **The bargaining space of a two countries union,** for a given realization $\omega$, is the difference $\bar{p}_{ij}(\omega, (p'_{ij})_{j \neq i}) - p_i(\omega, (p'_{ij})_{j \neq i}) > 0$. Notice that unanimity is necessary in a two countries scenario for the bargaining space to be non-empty. However, when there are more than two countries in the union, formation of the fiscal union by some majority rule might be considered. Let us now characterize the bargaining space of a set of $M > 2$ countries, given some qualified majority of votes.

- **Qualified majority:** Let us recall our previous notation. We denote the threshold of
votes by $\alpha \in [0,1]$. If the percentage of votes in favor of the fiscal union is above this threshold $\alpha$, then the fiscal union will be formed. For instance, if $\alpha = 1$, then the fiscal union requires unanimity, whereas if $\alpha = 0.5$ the fiscal union requires simple majority.\footnote{We do not address the issue of choosing the majority rule since we think that it would make this paper too cumbersome. Future research on this should be related to the work by Barbera and Jackson (2004).} Let us denote by $\hat{S}_i(\gamma)$ the set of countries composed by country $i$ and those countries $j \neq i$ with a shadow value $\lambda_{ij}$ on their respective participation constraint (11) smaller or equal than a given threshold $\gamma$. Formally, $\hat{S}_i(\gamma) \equiv \{j \neq i : \lambda_{ij} \leq \gamma\} \cup \{i : (9) \text{ holds}\}$. Since constraints (11) and (9) hold for the constructed set $\hat{S}_i(\gamma)$, all countries in $\hat{S}_i(\gamma)$ will prefer ex-ante a fiscal union to autarky. By construction, it is easy to see that

**Remark:** A fiscal union is formed given the majority $\alpha$ if there exists a threshold $\gamma$ and a country $i$ for which $\frac{|\hat{S}_i(\gamma)|}{M} \geq \alpha$.

For each $\alpha$ there exists a minimum $\gamma$ such that the inequality in the previous remark hold. Let us denote by $S_i(\alpha)$ the set of countries, including country $i$, that satisfy the qualified majority $\alpha$. By construction this set is $S_i(\alpha) \equiv \hat{S}_i(\gamma)$.

- **Bargaining space for an $M>2$ countries union, given a qualified majority rule**: Let us now consider the more general case with $M > 2$ countries. We will see how the majority rule $\alpha$ will affect the design of the bargaining space. For a given majority $\alpha$, state $\omega$, and weights $(p'_{ij})_{j \neq i}$, let us denote by $\bar{p}_i(\alpha, \omega, (p'_{ij})_{j \neq i})$ the maximum value of the proportional proposal right that the union can assign to country $i$, providing that the set $S_i(\alpha)$ is non-empty (recall that all countries in the set $S_i(\alpha)$ are least as well off in the fiscal union as in autarky). Then, $\bar{p}_i(\alpha, \omega, (p'_{ij})_{j \neq i})$ equals $\min_{j \in S_i(\alpha)} \bar{p}_{ij}$, and is the value of $\bar{p}_{ij}$ associated with the country $j$ that faces the highest shadow value attached to restriction (11) among all countries in $S_i(\alpha)$. Thus, it might be that, at the resulting $\bar{p}_i$, some countries in $S_i(\alpha)$ find their constraint (11) not binding. We
find that \( \bar{p}_i(\alpha, \omega, (p_{ij}')_{j \neq i}) \) is

\[
\bar{p}_i(\alpha, \omega, (p_{ij}')_{j \neq i}) = \min_{j \in S_i(\alpha)} \left\{ \frac{E[V^p_j] - \sum_{s \neq i} P'_{is} E[V^f_j(T_s(\epsilon))]}{E[V^f_j(T_i(\epsilon))] - \sum_{s \neq i} p_{is}' E[V^f_j(T_s(\epsilon))]} \right\}
\]

(12)

Conditionally on the \( \alpha \)-qualified majority rule that all countries in \( S_i(\alpha) \) must have an expected utility level above their value in autarky, we can assert the following:

**Remark:** If \( \bar{p}_i(\alpha, \omega, (p_{ij}')_{j \neq i}) - p_i(\omega, (p_{ij}')_{j \neq i}) > 0 \) occurs for one country \( i \in S_i(\alpha) \), then the fiscal union forms given majority \( \alpha \), at realization \( \omega \).

We denote by \( P_i(\alpha, \omega, (p_{ij}')_{j \neq i}) \) the space of all vectors \((p_i(\alpha, \omega), (p_{ij}')_{j \neq i})\) such that \( p_i(\alpha, \omega) \in [p_i, \bar{p}_i] \neq \emptyset \). Then, for a given realization \( \omega \) and a majority \( \alpha \) of countries in favor of the fiscal union, the fiscal union forms if there exists at least one country \( i \) with \( P_i(\alpha, \omega, (p_{ij}')_{j \neq i}) \neq 0 \). Since, in that case, (9) is satisfied for all countries in \( S_i(\alpha) \), the union is ex-ante Pareto improving (in the usual sense) only for those countries in the set \( S_i(\alpha) \). Those countries outside \( S_i(\alpha) \) prefer autarky. Secession could be avoided by some constitutional commitment, or by voting on the formation of the fiscal union under unanimity requirement (choosing \( \alpha = 1 \)). Finally, notice that if the space \( P(\alpha, \omega) = \cup_i P_i(\alpha, \omega, (p_{ij}')_{j \neq i}) \) is empty, there is no set of assigned proportional proposal rights that satisfy the incentive compatibility constraint for every country given the threshold \( \alpha \).