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Theory of Optimal Fiscal Unions

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Abstract

I propose a political-economy model of optimal fiscal unions where the threat of secession imposes a limit on fiscal redistribution between regions. Fiscal transfers take place indirectly, through centralized fiscal policy. I argue that the stability of fiscal unions depends on the nature of economic shocks. My analysis thus presents a fiscal-federalism counterpart to the theory of optimum currency areas. However, I show that both the correlation of shocks across regions and their persistence over time are important. Negatively correlated temporary shocks allow greatest gains from inter-regional risk sharing and therefore asymmetric shocks need not threaten the stability of integration.
Keywords: Fiscal federalism, Risk sharing, Disintegration, Median voter, Optimum Currency Areas.

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1 Introduction

Small open economies, and sub-regions of larger economies, are inherently vulnerable to idiosyncratic shocks. This has been underscored poignantly by the on-going economic and financial crisis: Iceland, Ireland, Latvia, Hungary and most notably Greece have been experiencing through severe economic turbulence during the last two years. Countries and regions that participate in wider integration arrangements, however, can often rely on direct or indirect support from their integration partners. Countries with formal federal structure often operate explicit systems of fiscal transfers between regions to redistribute tax revenue, equalize incomes and/or to counter adverse effects of asymmetric shocks. When such explicit fiscal federalism is not present, transfers often occur nonetheless because (some) taxes and automatic stabilizers are centralized. The EU, despite being a rather loose union, is no exception. and It operates a scheme whereby member countries can obtain loans financed by bonds issued by the European Community rather than the country itself: this allows countries in distress to raise emergency funds even when their cost of borrowing would normally be prohibitively high. The most recent example of this was a 6.5 billion euro loan to Hungary in October 2008 which helped it avert the kind of meltdown that Iceland was experiencing at approximately the same time. And as the example of Greece demonstrates, the EU can also facilitate direct financial aid to a member state in distress.[1] In this context, it is not surprising that Iceland responded to its financial troubles by reactivating its application for accession to the EU.

The importance of idiosyncratic shocks for the viability of economic integration has been recognized in the theory of optimum currency areas (OCA henceforth), building on the seminal contribution of Mundell (1961).[2] That theory argues that *monetary* integration is feasible if the participating regions or countries are subject to symmetric shocks, or if they possess effective adjustment mechanism to deal with the adverse effects of asymmetric shocks. One such mechanism is fiscal federalism: a system of fiscal transfers that offers the participating regions/countries insurance against asymmetric shocks. The effectiveness of such redistribution systems in various countries and unions has been ainalyzed, for example, by Sachs and Sala-i-Martin (1992), Asdrubali et al. (1996), Person and Tabellini (1996a,b), Obstfeld and Peri (1998), Sorensen and Yosha (1998), and Becker and Hoffmann (2006).

However, those studies, and the OCA literature in general, fail to consider the political feasibility of fiscal redistribution and of the political constraints that limit their extent and application. This is an important omission: regions can secede if they feel that continuing integration – and the fiscal transfers that such integration

[1] Indeed, Article 122 of the Lisbon treaty specifically paves the way for an EU bail-out of a distressed member state: "When a [member country] is in difficulties or is seriously threatened with severe difficulties caused by exceptional occurrences beyond its control, the Council, on a proposal from the Commission, may grant union financial assistance to the member state concerned."

[2] For more recent and more formal discussion, see Alesina and Barro (2002), Alesina, Barro and Tenreyro (2002), and Alesina and Stella (2010).

necessitates – are not in their best economic interest. In Europe, such disagreements over the extent of fiscal redistribution helped fuel internal tensions in Italy, Germany, United Kingdom, Spain and Belgium and contributed to the break-ups of the former Czechoslovakia and Yugoslavia. More recently, the reluctance of European countries to offer a formal bail-out to Greece has lead to speculations that Greece may be forced to abandon the euro and leave the eurozone.

To fill this gap, I construct a model of political economy of integration in the spirit of Bolton and Roland (1997). I model integration as a union with a centrally-provided public good. As long as integration continues, fiscal policy reflects the union median voter's preferences which, in turn, only depend on the aggregate effect of regional shocks. Thus, for example, regional shocks that exactly offset each other would leave the union fiscal policy unchanged. The two regions thus constitute an implicit fiscal union: fiscal redistribution occurs through centralized fiscal policy rather than through explicit inter-regional transfers. The regions, however, have the option to secede and implement their own optimal fiscal policy if the utility gains from doing so outweigh the one-off cost of secession. In contrast to Bolton and Roland (and others) who model the gains from integration or secession as constant over time, I consider the impact of region-specific shocks in a dynamic setting. The shocks alter income inequality and thus affect the median voter's preferred fiscal policy. The shocks need not be only output shocks (i.e. deviations from the trend growth rate): the analysis is general enough to allow also demographic shocks such as migration flows or natural disasters such as earthquakes. As a result, union that was previously stable can break-up following a particular regional shock, whether positive or negative. The opposite is also true; a region that preferred independence initially can come to prefer integration in the wake of a particular shock (as Iceland's application for EU membership demonstrates).

By conceiving the analysis in a dynamic setting, two aspects of shocks can be considered: not only their symmetry or correlation across regions but also their persistence over time. When the shocks are positively correlated, the regions' preferences over fiscal policy move together: they both favor raising or lowering the extent of redistribution at the same time. My model of fiscal integration thus confirms the main insight of the OCA theory. The political economy of fiscal federalism, however, is more complex that this initial similarity with the OCA theory suggest. When shocks are negatively correlated, fiscal-policy preferences diverge but the regions benefit from risk sharing: centralized fiscal policy implies that the region with a positive shock makes a net transfer to the regional hit by a negative shock. There is therefore a trade-off between the disutility due to divergent policy preferences and the gains from risk sharing. This is where persistence of shocks proves crucial. With temporary shocks, the disutility from having sub-optimal fiscal policy is short-lived and may be outweighed by the benefits of risk sharing. When shocks are permanent (assuming regions cannot commit to stay in the union before the shocks are realized), fiscal federalism ceases to offer inter-regional insurance and instead becomes a conduit for

largely deterministic and unidirectional inter-regional transfers. Either region can prefer to secede in such a case: the richer region in order to implement a less redistributive fiscal policy or the poorer region because it prefers an even greater extent of redistribution.

There is by now a rich body of literature analyzing the incentives that countries face to secede: see Alesina and Spolaore (1997 and 2003), Alesina, Spolaore and Wacziarg (2000), Alesina and Perotti (1998), Bolton and Roland (1997), Goyal and Staal (2004), Le Breton and Weber (2003) and Kessler, Lüelfesmann and Myers (2009). However, much of the literature (with the exception of Alesina and Perotti, 1998, see below) is static in nature: it considers the trade-off between heterogeneity of preferences and efficiency gains from integration (or efficiency loss from disintegration), without giving much thought to fhat actors might drive preferences further apart or closer together as time passes. My approach, in constrast, offers insights on unions that were originally stable but subsequently broke up as a result of particular economic events or shocks.

Motivated by the OCA theory, a new empirical literature has emerged during the last two decades assessing correlation of shocks among countries participating, or intending to participate, in a common-currency zone. Often, the objective is to assess the stability of European monetary integration (see Fidrmuc and Korhonen, 2003 and 2006) and compare it with existing monetary unions such as the US (Bayoumi and Eichengreen, 1993) or Germany (Funke, 1997).[3] Structural VAR methodology used in these studies allows one to measure the correlation of permanent (supply) and temporary (demand) shocks. Yet, these studies make little distinction between the two kinds of shocks and merely focus on discussing whether the correlation of either appears sufficiently high. My paper offers therefore an important insight for the OCA literature: my findings show that high correlation of permanent shocks is in fact much more critical for the stability of monetary unions than high correlation of temporary shocks.

The paper closest to this one is Alesina and Perotti (1998). They also consider fiscal integration between regions that are subject to idiosyncratic shocks. Their analytical framework, however, differs from the one presented here in the following important ways. First, they consider shocks that are permanent and perfectly negatively correlated across regions. Hence, their analysis does not allow the consideration of the more general case and hence they cannot make any inferences on the importance of either correlation or persistence of shocks for the political economy of fiscal integration. Second, they model shocks in a way that impies that they do not affect income distribution and therefore do not alter preferences over fiscal policy in the case of fiscal autonomy. Therefore, shocks in their model make the tax base stochastic but not the tax rate – again, under fiscal autonomy. Third, they assume that income distribution in each region is discontinuous: individuals below to three discrete income classes. This means that the median voter in the union is always the same,

[3]See also Artis and Okubo (2008, 2009).

regardless of the shocks. This, together with their assumption on the nature of shocks implies that the tax rate under fiscal centralization becomes stochastic: specifically, it is depends only on the shock of the region of the median voter. The tax base, in contrast, is costant under fiscal centralization: this is because the region-specific shocks are perfectly negatively correlated and therefore cancel each other. Hence, their main conclusion is essentially the same as that of the static political-economy literature discussed above: while fiscal integration offers some benefits in terms of risk sharing (tax base that it constant over time), this comes at the cost of increased heterogeneity in policy preferences (tax rate that changed depending on the shocks' realization).

Besides relying in inter-regional fiscal transfers, individuals can mitigate the effects of idiosyncratic shocks on their consumption profile by saving or borrowing, depending on the realization of the shocks. Similarly, countries/regions can run fiscal deficits or surpluses. These strategies are orthogonal to the issue at hand in my paper; they are also well understood in the economics literature and therefore I explicitly exclude them from my analysis.

The paper is structured as follows: Section 2 introduces the model. Section 3 discusses the regions' incentives for secession and shows how stability of integration is determined by the nature of shocks. Finally, Section 4 concludes.

2 The Model

I consider a union composed of two regions denoted by $k = a, b$; for simplicity, the regions are assumed to be of equal size. The aggregate output of region k at time t consists of a deterministic and a stochastic term:

$$Y_{k,t} = \bar{Y}_{k,t} + E_{k,t} \tag{1}$$

$\bar{Y}_{k,t}$ is the deterministic term and represents the region's potential output which I assume to be constant over time (adding a constant trend growth rate would represent a trivial modification which I do not pursue for the sake of simplicity). $E_{k,t}$ is the stochastic component of region k's output in period t; this term can be either positive or negative. The stochastic component is intended to capture any factors that are idiosyncratic to the region and cause its output to fluctuate over time. As such, it includes business cycle fluctuations due to demand or supply shocks, effects of climatic fluctuations and natural disasters or mobility of factors of production (notably migration of workers). I assume that the region-specific shocks are independent of each other but, as I discuss in more detail below, each shock can have spillover effect on the other region. Finally, the output of the union is given as the sum of regional outputs.

The region's output can be expressed in per-capita terms:

$$y_{k,t} = \bar{y}_{k,t} + \varepsilon_{k,t} \tag{2}$$

where $\bar{y}_k$ is the average income in the absence of any shocks and ε_k is the per-capita income shock. Note that the average income can change for a number of different reasons. For example, every individual's income can change in the same way (that is, every individual is subject to the same shock), or the region can experience an immigration or emigration flow that disproportionately involves low-income or high-income individuals; in the latter case, most individuals face no change to their incomes but the average (and median) income in the region changes.

I assume that the shock follows an AR(1) process

$$\varepsilon_{k,t} = \rho_k \varepsilon_{k,t-1} + \eta_{k,t} \tag{3}$$

where $\eta_{k,t}$ is white noise with a zero mean and variance σ_k^2, and the persistence parameter ρ_k is such that $0 \leq \rho_k \leq 1$. The union's average output is then

$$y_t = \frac{\bar{y}_a + \bar{y}_b}{2} + \frac{\varepsilon_{a,t} + \varepsilon_{b,t}}{2} = \bar{y} + \varepsilon_t \tag{4}$$

where, for notational purposes, parameters lacking a regional subscript are those pertaining to the union.

I assume that each individual receives a deterministic income stream every period: for individual i in region k, this is denoted as $\bar{v}_{ik}$. Individual incomes are assumed to take values between 0 and V. I make a few specific assumptions about the distribution of individual incomes. First, I assume that it is skewed so that the median income is always smaller than or equal to the average income in each regions and also in the union as a whole, $\bar{v}_{mk} \leq \bar{y}_k$ and $\bar{v}_m \leq \bar{y}$, where subscripts mk and m denote the median incomes in region k and in the union, respectively. Second, I assume that the distribution function, while skewed, is continuous.[4] Third, I assume that all individuals living in region k encounter the same shock, $\varepsilon_{k,t}$ so that individual i's actual income is thus $v_{ik,t} = \bar{v}_{ik} + \varepsilon_{k,t}$. While this assumption may be too restrictive, the results of my model would hold also when assuming that the individual shocks encountered by individuals in the same region are positively correlated, or even less restrictively, that the average and median incomes are subject to similar shocks. All of these assumptions imply that the shock's realization alters the skewness of income distribution and, in turn, it changes the region's preferred fiscal policy.

Furthermore, I assume that the union median income, $v_{m,t}$, is subject to the average shock, ε_t, and that it always lies strictly between the median incomes of the two regions. This, of course, does not mean that the union median voter herself is exposed to the average shock. Rather, the identity of the union median voter changes after every realization of shocks. Because income distributions are continuous, the new median voter's position in the union-wide income distribution will be such as if

[4]Hence, I specifically rule out discontinuos distributions such as the one assumed by Alesina and Perotti (1995).

her income were subject to the average shock.[5] Because of this assumption, my model differs from that of Alesina and Perotti (1998) is a crucial way. They assume that the union median voters stems always from the same country (specifically, they assume that one country is marginally larger) and therefore the union's tax rate responds only to the shock in one region.[6] In contrast, in my model, union's fiscal policy depends on the average economic condiditons in the union. In other words, it is the level of the median voter's income after the shocks are realized, not her nationality, that matters for fiscal redistribution.

Individuals derive utility from consumption of private and public goods. The former derives from individual income endowment, $v_{ik,t}$, and the tax rate, t. The tax rate is linear so that disposable income becomes $(1-t_t)v_{ik,t}$. For simplicity, I assume that there is no lending or borrowing, either by individuals or by the government. The latter implies that the govenment budget needs to balance every period. Public goods are thus financed by the total amount of tax revenue collected less the dead-weight cost of taxation that is assumed to be $\frac{t_t^2}{2}$:

$$g_t = (t_t - \frac{t_t^2}{2})y_t. \tag{5}$$

While individual income endowments differ, and therefore so do disposable incomes, each individual receives the same amount of the public good. Finally, private and public goods are assumed to be perfectly substitutable so that the utility function is linear in consumption.[7] The consumption, and utility, of individual i then is:

$$c_{ik,t} = (1-t_t)v_{ik,t} + (t_t - \frac{t_t^2}{2})y_t. \tag{6}$$

The tax rate is determined by a union-wide vote. I assume voting takes place each period after the regional shocks become known. Since voters' preferences are single-peaked, the optimal tax rate will be the rate maximizing the median voter's consumption:

$$t_t^*(y_t, v_{m,t}) = \frac{y_t - v_{m,t}}{y_t} \tag{7}$$

The tax rate thus depends on the skeweness of income distribution. The greater the difference between the average and median incomes, the higher the tax rate.

The regions' preferences over fiscal policy may differ from that chosen by the union median voter. In particular, each region's optimal tax rate is the rate that maximizes

[5] To be precise, the exact position of the union median depends on the difference in skeweness of income distributions in the two regions. This assumption is therefore a slight simplification consistent with the case where the two income distributions are similarly skewed.

[6] See equation (6) in their paper, noting that the regional shocks are assumed to be perfectly negatively correlated so that they cancel out in the denominator.

[7] An extension [to be completed] considers the case of concave utility function.

consumption of that region's median-income voter:

$$t^*_{k,t}(y_{k,t}, v_{mk,t}) = \frac{y_{k,t} - v_{mk,t}}{y_{k,t}}. \tag{8}$$

Fiscal policy is shaped by the region-specific shocks. In particular, the tax rate is counter-cyclical:

$$\frac{\partial t^*_t}{\partial \varepsilon_{k,t}} = -\frac{1}{2}\frac{y_t - v_{m,t}}{y_t^2} < 0$$

so that the tax rate rises during a recession and falls during recovery. This is because the shock alters the skewness of income distribution, as captured by the ratio $\frac{v_{m,t}}{y_t}$. On the other hand, the transfer is pro-cyclical:

$$\frac{\partial g_t}{\partial \varepsilon_{k,t}} = \frac{1}{4}t_t^2 > 0.$$

Hence, although the tax rate declines in response to a positive shock, this decline is not large enough to offset the effect of the increasing tax base.[8]

The region's preferred tax rate thus depends on that region's income distribution and the realization of the region-specific shock. Hence, unless the income distributions and shocks are identical in both regions, their preferred tax rates will be different from each other and both will, in turn, differ from the union tax rate. Therefore, without efficiency gains, economies of scale or other benefits due to integration, the regions would always prefer independence and fiscal autonomy to fiscal integration.

3 Shocking Aspects of Fiscal Integration

3.1 Integration vs Secession

The tax rate, derived in equation (7)maximizes the consumption of the union's median voter. The tax rates preferred by the two regional median voters are generally different from the union tax rate as well as from each other. This is so for two reasons: First, income distributions can be different in the two regions. Second, regions are subject to indiosyncratic shocks. Integration thus carries the cost of compromising over fiscal policy. On the other hand, integration carries two important benefits. First, it brings about efficiency gains and economies of scale because of absence of barriers to trade and flows of factors of production and gaining access to a larger market. Second, and this is particularly important in the context of my analysis, integration implies risk sharing: if the regional shocks are different, centralized fiscal

[8]The result indicating changing tax rates in response to shocks contradicts the well known Barro's (1979) proposition that agents prefer constant tax rates over time. However, this result is driven by the features of the present model, in particular the assumption of balanced budget every period, and endogenous determination of government expenditure.

policy indirectly facilitates redistribution between regions. Note that risk sharing and inter-regional redistribution to not take explicit form – the regions do not vote on or bargain about transfers. Instead, risk sharing occurs automatically because tax collection and fiscal transfers are determined at the union-wide level and reflect union-wide income distribution and the average of the two regional shocks. Moreover, risk sharing is only a side effect of fiscal policy: its main objective is redistribution from rich to poor. The rich region may continue making a net transfer to the poor one even if it is hit by a negative shock, as long as it remains richer than the other region – but the size of the net transfer is sensitive to the shock.

Each period, either region can decide whether they wish to remain in the union or secede. This decision takes place before the region-specific shocks are realized. Therefore, the decision is based on expectations of the current period's shocks, which in turn depend on past realizations of shocks and their persistence; I assume that the persistence of past shocks is common knowledge. The decision on fiscal policy, on the other hand, is made after the shocks have been revealed and therefore taxes and transfers reflect the actual realization of shocks in the current period. The union breaks up whenever at least one region votes for secession.

Secession comes at a cost $\lambda_{k,t} \leq 0$. This reflects the loss of efficiency gains from integration as well as the initial cost of creating a new regional government, military, etc. Note that the cost need not be symmetric: one of the region can find seccession less costly, for example because of such non-economic considerations as national pride, patriotism or historical legacies. The decision on whether to secede therefore depends on whether the region's median voter is better off under integration or under secession, taking into account the difference between the region's preferred fiscal policy and the union fiscal policy (which in turn depend on the realizations of region-specific shocks) and the efficiency loss due to secession. We can formalize this as follows (to simplify the notation, I use subscript k when referring to the region's own variables while $-k$ denotes variables pertaining to the other region):

Definition 1 *Region k has an incentive to secede if the median voter expects greater consumption under secession than under integration, i.e. secession brings about a positive expected gain from secession*

$$\Delta_{k,t} \equiv E_t \left[c_{mk,t} \left(\varepsilon_{k,t}, \lambda_{k,t} \right) - c^u_{mk,t} \left(\varepsilon_{k,t}, \varepsilon_{-k,t} \right) \right] > 0 \tag{9}$$

Here, $c^u_{mk,t} \left(\varepsilon_{k,t}, \varepsilon_{-k,t} \right)$ is the consumption of region k's median voter in case of continued integration. Given that the shocks are autocorrelated, (9) can be rewritten as follows:

$$\Delta_{k,t} \equiv c_{mk,t} \left(\rho_k \varepsilon_{k,t-1}, \lambda_{k,t} \right) - c^u_{mk,t} \left(\rho_k \varepsilon_{k,t-1}, \rho_{-k} \varepsilon_{-k,t-1} \right) > 0 \tag{10}$$

The outcome of the vote on secession therefore depends on the realization of previous period's shocks and their persistence.

In principle, equation (9) is necessary but not sufficient condition for secession. Whether secession occurs depends on the net present value of the gain from secession, $NPVS_{k,t} \equiv \sum_{s=0}^{\infty} \delta^s E_t \Delta_{k,t+s}$ (assuming secession is irreversible). The sufficient condition for secession then is $NPVS_{a,t} + NPVS_{b,t} > 0$, reflecting the fact that as long as at least one region prefers integration, it can offer concession to the other region to prevent it from seceding.[9] This, however, would introduce the possibility of strategic behavior, especially if $\lambda_{k,t}$ is not observable: either region could threten to leave the union in order to elicit concessions from the other region.The Irish referenda on Nice and Lisbor Treaties can be seen as examples of such behavior: both were initially rejected, only to be approved later after Ireland received important concessions. While interesting, such considerations are largely orthogonal to the question of the effect of shocks on integration. Therefore, I do not include them in this paper.

To evaluate the expected gain from secession, note that under integration the consumption of individual i in region a is:

$$c^u_{ik,t}\left(\varepsilon_{k,t}, \varepsilon_{-k,t}\right) = v_{ik,t} + \frac{1}{2}\frac{y_t - v_{m,t}}{y_t}\left[\left(y_t - v_{ik,t}\right) + \left(v_{m,t} - v_{ik,t}\right)\right] \tag{11}$$

Correspondingly, the consumption of region k's median voter under integration is:

$$c^u_{mk,t}\left(\varepsilon_{k,t}, \varepsilon_{-k,t}\right) = v_{mk,t} + \frac{1}{2}\frac{y_t - v_{m,t}}{y_t}\left[\left(y_t - v_{mk,t}\right) + \left(v_{m,t} - v_{mk,t}\right)\right]. \tag{12}$$

Finally, the consumption of region k's median voter under secession is the following (note that it incorporates the cost of secession, $\lambda_{k,t}$):

$$c_{mk,t}\left(\varepsilon_{k,t}, \lambda_{a,t}\right) = v_{mk,t} + \frac{1}{2}\frac{\left(y_{k,t} - v_{mk,t}\right)^2}{y_{k,t}} + \lambda_{k,t} \tag{13}$$

After substituting from equations (13) and (12), the expected gain from secession, $\Delta_{k,t}$ can be rewritten in the following manner:[10]

$$\Delta_{k,t} = E_t\left[\frac{1}{2}\frac{\left(v_{m,t} - v_{mk,t}\right)^2}{y_t} + \frac{1}{2}\left(y_{k,t} - y_t\right)\left(1 - \frac{v^2_{mk,t}}{y_k y_t}\right)\right] + \lambda_{k,t} \tag{14}$$

The first term in equation (14) reflects the differences in income distributions between the union as a whole and region k. The greater the difference, the greater the incentive for the region to leave. Note that the incentive to secede increases with the absolute distance: the poor region also gains from secession because it allows the region to implement its preferred fiscal policy. The second term captures the

[9] Bolton and Roland (1997) discuss bargaining over tax rate as union-preserving measure. Another possibility is to incorporate inter-regional transfers (Dixit and Londregan, 1998).

[10] Note that the variables pertaining to the union, $v_{m,t}$ and y_t, depend on both shocks, $(\varepsilon_{k,t}, \varepsilon_{-k,t})$, whereas $v_{mk,t}$ and $y_{k,t}$ only depend on $\varepsilon_{k,t}$.

difference in tax base (combined again with the income-distribution effect). The higher region k's mean income compared to the union's mean income, the greater the incentive to secede. Finally, the last term captures the cost of secession.

To see how the political mechanism works, consider first the following simple case. Suppose there are no region specific shocks, and the cost of secession is zero, $\lambda_{k,t} = 0$. Then, integration is never sustainable unless $v_{mk} = v_m$ and $y_k = y$ for both regions In equation (14), the first term is positive for any $v_{mk} \neq v_m$, whereas the second term is positive for the richer region with $y_{k,t} > y_t$. Therefore, in this case, the rich region will always want to secede; the poor region may or may not prefer to secede too depending on whether the income-inequality effect or the tax-base effect dominates.

3.2 Effects of Shocks

Next, I turn to the role played by the region-specific shocks. Voters in one or both regions may be induced to vote for secession either in response to the home-region's shock or because of the other region's shock — either shock can raise or reduce the incentive for secession captured by the expected gain from secession, $\Delta_{k,t}$.

To make the analysis tracable, two rather trivial assumptions are necessary:
A1 Region a is always richer than region b; this holds both for the median incomes as well as (weakly) for average incomes: $v_{ma,t} > v_{m,t} > v_{mb,t}$ and $y_{a,t} \geq y_t \geq y_{b,t}$. This is not to say that shocks cannot be large enough to reverse the relative ordering of the two regions. Rather, it merely states which ever region happens to be richer is labeled as region a. Note that this assumption implies that region a's median voter would prefer strictky lower extent of redistribution than the union median voter if she were pivotal, whereas the opposite is true for region b's median voter: $\frac{v_{ma,t}}{y} > \frac{v_{m,t}}{y} > \frac{v_{mb,t}}{y}$.
A2 The median income in either region does not exceed the union's average income: $v_{mk,t} < y_t$ (i.e.neither median voter would prefer $t_t^* = 0$ if pivotal in the union).

Because the vote on secession takes place before the shocks are realized, the decision is based on the expectations of the current-period shocks which in turn depend on the realizations of previous-period shocks and their persistance, $E_t\varepsilon_{k,t} = \rho_k\varepsilon_{k,t-1}$ and $E_t\varepsilon_{-k,t} = \rho_{-k}\varepsilon_{-k,t-1}$. I look at the impact of the other region's shock first:

Proposition 1 *(a) Assuming that the persistence parameter is not zero, $\rho_{-k} > 0$, positive shock in the other region at time $t-1$ reduces the home region's incentive to secede at time t, a negative shock increases the incentive to secede.*

$$\frac{\partial \Delta_{k,t}}{\partial \varepsilon_{-k,t-1}} < 0$$

(b) The effect is greater (in absolute value) for region a than for region b (ceteris paribus).

Proof. (a) Differentiating $\triangle_{k,t}$ with respect to $\varepsilon_{-k,t-1}$ while holding $\varepsilon_{k,t-1}$ constant yields:

$$\frac{\partial \triangle_{k,t}}{\partial \varepsilon_{-k,t-1}} = \left[\frac{1}{2} \frac{v_{m,t} - v_{mk,t}}{y_t} - \frac{1}{4} \frac{(v_{m,t} - v_{mk,t})^2}{y_t^2} - \frac{1}{4} \frac{y_t^2 - v_{mk,t}^2}{y_t^2} \right] \rho_{-k} \tag{15}$$

The RHS of equation (15) can be reduced to $4y_t^2(y_t - v_{m,t} + 2v_{mk,t})(v_{m,t} - y_t)\rho_{-k}$. The second term in parentheses is negative for both regions by assumption A2. Given that I assume that the inter-temporal correlation term is positive, the expression is negative for both regions. (b) Assumption A1 implies $v_{ma,t} > v_{mb,t}$, so that the absolute value of this expression is higher for region a than for region b. ■

The upshot of Proposition 1 is that for a given realization of the region's own shock, $\varepsilon_{k,t-1}$, either region is more likely to secede after a negative shock in the other region, $\varepsilon_{-k,t-1} < 0$. The intuition underlying this result is simple. For a given own shock, $\varepsilon_{k,t-1}$, a positive shock in the other region reduces the expected union tax rate (*tax-rate effect*) and raises the expected level of government spending (*transfer effect*). The transfer effect increases the consumption of median voters in both regions. The tax effect is different, though. The median voter in region a would prefer lower tax rate that than the union tax rate by assumption A1. A positive shock in region b decreases the expected union tax rate, and hence the expected disparity between the two tax rates shrinks. The transfer effect therefore also implies that the incentive for region a to vote for secession falls after a positive shock in region b. On the other hand, the region b's median voter's preferred tax rate under centralization is higher than the tax rate chosen by the union median voter. Thus, as the expected union tax rate falls, the expected disparity between the two tax rates widens even further. Hence, the tax effect and the transfer effect go in opposite directions for region b. The response of region b will therefore be smaller than the response of region a, even though the overall effect is positive for both regions.

Analyzing how the decision on secession is affected by the region's own shock is less straightforward. Differentiating $\triangle_{k,t}$ with respect to $\varepsilon_{k,t-1}$ while holding $\varepsilon_{-k,t-1}$ constant yields:

$$\frac{\partial \triangle_{k,t}}{\partial \varepsilon_{k,t-1}} = \left[-\frac{1}{2} \frac{v_{m,t} - v_{mk,t}}{y_t} - \frac{1}{4} \frac{(v_{m,t} - v_{mk,t})^2}{y_t^2} + \frac{v_{mk,t}}{y_{k,t}} - \frac{v_{mk,t}}{y_t} - \frac{1}{2} \frac{v_{mk,t}^2}{y_{k,t}^2} + \frac{1}{4} + \frac{1}{4} \frac{v_{mk,t}^2}{y_t^2} \right] \rho_k \tag{16}$$

The sign of this expression is analytically ambiguous. Therefore, I consider first a simplified case:

Proposition 2 *If mean incomes before shocks are the same in both regions, i.e.* $y_{a,t} = y_{b,t} = y_t$*, and sssuming that the persistence parameter is not zero,* $\rho_k > 0$*, then:*

(a) A positive shock in region a will increase this region's incentive to secede. A negative shock in region a will reduce this region's incentive to split off:

$$\frac{\partial \Delta_{a,t}}{\partial \varepsilon_{a,t-1}} > 0$$

(b) The response of region b depends on the difference between the median income in b and the union's median: $\frac{\partial \Delta_{b,t}}{\partial \varepsilon_{b,t-1}}$ *is positive for small* $(v_{mb,t} - v_{m,t})$ *and negative otherwise.*

Proof. For $y_{a,t} = y_{b,t} = y_t$, equation (16) can be rewritten as follows:

$$\begin{aligned}
\frac{\partial \triangle_{k,t}}{\partial \varepsilon_{k,t-1}} &= \left[-\frac{1}{2}\frac{v_{m,t} - v_{mk,t}}{y_t} - \frac{1}{4}\frac{\left(v_{m,t} - v_{mk,t}\right)^2}{y_t^2} + \frac{1}{4}\frac{y_t^2 - v_{mk,t}^2}{y_t^2} \right] \rho_k \\
&= \left[\frac{1}{4}\left(y_t^2 - v_{m,t}^2\right) + \frac{1}{2}\left(v_{mk,t} - v_{m,t}\right)\left(y_t - v_{mk,t}\right) \right] y_t^2 \rho_k
\end{aligned}$$

The first term of the expression in the second line above is always positive. The second term is positive for region a and negative for region b; this follows from assumptions A1 and A2. Hence, $\frac{\partial \triangle_{a,t}}{\partial \varepsilon_{a,t-1}}$ is positive, whereas $\frac{\partial \triangle_{b,t}}{\partial \varepsilon_{b,t-1}}$ can be either positive or negative. When $(v_{mb,t} - v_{m,t})$ is small in absolute value, the first term outweighs the second term, and the opposite is true for large $(v_{mb,t} - v_{m,t})$. ■

Corollary 3 *If the average incomes in the two regions are different,* $y_{a,t} \neq y_{b,t}$*, then the effect of the region's own shock on its incentive to secede is analytically ambiguous for both regions. Numerical simulations*[11] *with* $y_{a,t} > y_{b,t}$*, nevertheless, yield result identical to Proposition 2, i.e.* $\frac{\partial \triangle_{a,t}}{\partial \varepsilon_{a,t-1}}$ *is always positive whereas* $\frac{\partial \triangle_{b,t}}{\partial \varepsilon_{b,t-1}}$ *is positive for small* $(v_{m,t} - v_{mb,t})$ *and negative otherwise.*

The result described in Proposition 2 and Remark 3 again reflects the tax effect and the transfer effect. A positive shock in either region reduces the expected union tax rate and raises the expected amount of lump-sum transfer. In case of region A, the median voter's preferred tax rate is lower than the union's tax rate. After the shock, the expectations of both the union's tax rate and the region's tax rate fall. However, the region's own preferred tax rate falls by more, thus further increasing the difference between the two tax rates.[12] The union-wide transfer, on the other hand, rises in the wake of a positive shock. However, region a's tax base $y_{a,t}$ rises by more that the union's tax base y_t. This implies that region a would enjoy a greater increase in the level of the transfer in case of secession. Both these effects make secession more attractive for region a.

On the other hand, in case of region b, the median voter's preferred tax rate is above the union's tax rate. A positive shock results in the reduction of both the expected union's tax rate as well as the region b's expected tax rate. The expectation

[11] I performed numerical simmulations using $y = 10$ and $v_m = 7.5$. Regional shocks were given values between -3 and 3. The values for y_a, y_b, v_{ma} and v_{mb} varied around their respective means.

[12] Recall that the regions preferred tax rate fully responds to the home-region shock $\varepsilon_{k,t}$, whereas the union's tax rate responds to the average shock, $\varepsilon_t \equiv \frac{\varepsilon_{a,t} + \varepsilon_{b,t}}{2}$. Unless $\varepsilon_{a,t} = \varepsilon_{b,t}$, the region's tax rate fall by more than the union's tax rate in response to a positive home shock.

of the region's preferred tax rate falls by more and the difference in this case thus shrinks. The transfer effect on region b is similar the effect on region a described above. Hence, for region b the tax and trasfer effects go in opposite direction. Depending on how different the two regional income distributions are from each other, the overall effect can therefore be either positive or negative.

This result also implies that an independent country hit by a sufficiently large negative shock may respond to the shock by forming a fiscal union with another country – as Iceland seems to be doing in the wake of its financial and banking crisis in 2008. However, this will only be optimal for a relatively poor country if the difference in income distribution as reflected in the size of $(v_{m,t} - v_{mb,t})$ is not too large – otherwise the fiscal policy that would prevail in the union would be too far from its median voter's preferences.

3.3 Persistence and Correlation of Shocks

As discussed above, region specific shocks can alter incentives for secession, and thus potentially induce a break-up of the union. Stability of integration – and in turn the likelihood of disintegration – depends on the nature of shocks. So far, I considered only the response of each region to their own shock and to the shock affecting their union partner. Now I turn to the specific properties of the shocks: their persistence over time and correlation across regions.

Proposition 4 Persistence: *Assume the union is a-priori stable, i.e. neither region would vote for secession in the absence of shocks:*

$$\Delta_{k,t}\left(\rho_k \varepsilon_{k,t-1}, \rho_{-k} \varepsilon_{-k,t-1}\right)|_{\varepsilon_{k,t-1}=\varepsilon_{-k,t-1}=0} \leq 0$$

Then, assuming the other region's shock is white noise, $\rho_{-k,t-1} = 0$, for a positive value of own shock, $\varepsilon_{k,t-1} > 0$, there is a value of the persistence parameter $\bar{\rho}_k$ such that $\Delta_{k,t}\left(\rho_k \varepsilon_{k,t-1}, 0\right) \leq 0$ for every $\rho_k \leq \bar{\rho}_k$. Similarly, assuming the home region's shock is white noise, $\rho_{k,t-1} = 0$, for a negative other region's shock, $\varepsilon_{-k,t-1} < 0$, there is a value of the persistence parameter $\bar{\rho}_{-k}$ such that $\Delta_{k,t}\left(0, \rho_{-k} \varepsilon_{-k,t-1}\right) \leq 0$ for every $\rho_{-k} \leq \bar{\rho}_{-k}$. If $\bar{\rho}_k$ and $\bar{\rho}_{-k}$ are less then one, then secession takes place if $\rho_k > \bar{\rho}_k$ and $\rho_{-k} > \bar{\rho}_{-k}$, respectively.

Proof. The expected gain from secession rises for $\varepsilon_{k,t-1} > 0$ and/or $\varepsilon_{-k,t-1} < 0$ (and falls for $\varepsilon_{k,t-1} < 0$ and/or $\varepsilon_{-k,t-1} > 0$). As follows from equations (15) and (16), $\frac{\partial \triangle_{k,t}}{\partial \varepsilon_{k,t-1}}$ and $\frac{\partial \triangle_{k,t}}{\partial \varepsilon_{-k,t-1}}$ equal zero for $\rho_k = 0$ and $\rho_{-k} = 0$, respectively. Hence, if both shocks are white noise, they do not affect the expected gain from secession and hence they do not undermine the stability of integration. If either shock is persistent, $\rho_k > 0$ or $\rho_{-k} > 0$, then the following holds

$$\begin{aligned} \Delta_{k,t}\left(\rho_k \varepsilon_{k,t-1}, 0\right)|_{\rho_{k,t-1}>0, \varepsilon_{k,t-1}>0} &> \Delta_{k,t}|_{\rho_{k,t-1}=\rho_{-k,t-1}=0} \\ \Delta_{k,t}\left(0, \rho_{-k} \varepsilon_{-k,t-1}\right)|_{\rho_{-k,t-1}<0, \varepsilon_{-k,t-1}<0} &> \Delta_{k,t}|_{\rho_{k,t-1}=\rho_{-k,t-1}=0} \end{aligned}$$

By continuity, $\Delta_{k,t}\left(\rho_k \varepsilon_{k,t-1}, 0\right) \leq 0$ $\left(\Delta_{k,t}\left(0, \rho_{-k} \varepsilon_{-k,t-1}\right) \leq 0\right)$ holds for at least part of the interval $0 < \rho_k \leq 1$ $(0 < \rho_{-k} \leq 1)$. ■

The upshot of Proposition 4 is that if shocks are sufficiently shortlived, they do not provide sufficient incentive for either region to secede – or, in other words, the gain from seceding is so small that it is outweighed by the efficiency loss due to disintegration. Permanent or highly persistent shocks, on the other hand, can bring the union down.

So far, I have been assuming that the regional shocks are fully independent of one another, i.e. each shock only has repercussions for one region. In present-day open economies, this is unlikely to be the case: shocks have spillover effects because of trade, migration and investment flows, remittances from migrants who moved to the other region or because of divident payments on past investments. Therefore, I now assume the case when shocks, while originating independently, have positive spillover effects.

Proposition 5 Correlation: *Positive correlation of the shocks's effects across regions reduces the probability of secession, whereas negative correlation increases that probability, taking the persistence of shocks as given.*

Proof. Assume shocks' effects are correlated in that there is a spill-over between the regional shocks so that individual incomes in region k now also depend on the shock experienced by the other region, $\frac{\partial v_{ikt,}}{\partial \varepsilon_{-kt,}} = \gamma$. Then, for a given home-region shock, the shock in the other region affects the median voter's expected gain from secession in the following manner:

$$\begin{aligned}\frac{\partial \triangle_{k,t}}{\partial \varepsilon_{-k,t-1}} = & \left[\frac{1}{2}\frac{v_{m,t}-v_{mk,t}}{y_t} - \frac{1}{4}\frac{\left(v_{m,t}-v_{mk,t}\right)^2}{y_t^2} - \frac{1}{4}\frac{y_t^2 - v_{mk,t}^2}{y_t^2}\right]\rho_{-k} + \\ & \left[-\frac{1}{2}\frac{v_{m,t}-v_{mk,t}}{y_t} - \frac{1}{4}\frac{\left(v_{m,t}-v_{mk,t}\right)^2}{y_t^2} + \frac{v_{mk,t}}{y_{k,t}} - \frac{v_{mk,t}}{y_t} - \frac{1}{2}\frac{v_{mk,t}^2}{y_{k,t}^2} + \frac{1}{4} + \frac{1}{4}\frac{v_{mk,t}^2}{y_t^2}\right]\gamma\rho_k\end{aligned}$$

The first term corresponds to the expression for $\frac{\partial \triangle_{k,t}}{\partial \varepsilon_{-k,t-1}}$ when shocks are independent, as in equation (15), whereas the second term captures the spill-over effect of the other region's shock (cf. equation 16). As shown by Proposition 1, the term in the first brackets is negative, while by Proposition 2 and Remark 3 the term in the second brackets is positive (assuming $v_{mb,t} - v_{m,t}$ is sufficiently small). Hence, if the spillover effects of shocks are positive, $\gamma > 0$, so that the shocks become ex-post positively correlated, the second term mitigates the effect of the first term. On the other hand, if shocks are negatively correlated, both effects go in the same direction, thus increasing the probability of secession. ■

The last two propositions complement and qualify the key insight of the OCA literature. That literature only considers the correlation (symmetry) of shocks.. The

present paper adds another dimension: it points out the importance of persistence of shocks. In particular, unions can be stable despite negatively correlated shocks — as long as these shocks are sufficiently transient.

3.4 Implications and Discussion

Few additional observations can be made based on the present model:

Remark 1 Risk sharing: *Integration reduces the uncertainty about fiscal policy. Both the tax rate and the tax base are more volatile after secession than under integration. Integration thus helps smooth taxes and in turn reduces the volatility of disposable income and consumption. The potential benefits from risk sharing are at their greatest when shocks are negatively correlated.*

This result is easy to see – union tax rate and transfer are affected by the average shock, ε_t. After secession, regional fiscal instruments respond to the regional shocks and are therefore more volatile. Centralized fiscal policy stabilizes both the tax rate as well as the tax base. This is an important difference between the predictions of my model and Alesina and Perotti (1998): they argue that fiscal integration stabilizes the tax base but increases the volatility of the tax rate. Because agents are risk averse, the potential benefits from risk sharing are greatest when the shocks are negatively correlated: in this case the volatility of union's fiscal instruments is smallest. Note however, that when the shocks are persistent, the benefits from risk sharing have to be weighted against the effects of shocks upon diverging preferences regarding fiscal policy in the two regions. Therefore, the potential for risk sharing is greatest when shocks are negatively correlated and transient.

Remark 2 Uncertainty: *An increase in the variance of either shock, σ_k^2 increases the probability of disintegration only if the shocks are sufficiently persistent.*

High variance in case of persistent shocks implies greater likelihood that a sufficiently large shock will occur to prompt one of the region to split off. On the other hand, if shocks become more volatile but are generally transitory in nature, the potential benefits from risk sharing increase.

An increase in the variance of region specific shocks was probably one of the factors behind disintegration of several countries in Central and Eastern Europe. Abandoning the planned economy implied a substantial increase in the volatility of economic activity. In addition, implementation of radical economic reforms probably resulted in changes in correlation and persistence of shocks, and integration arrangements became unsustainable.[13]

[13] See Fidrmuc, Horvath and Fidrmuc (1998) for an empirical analysis of the break-up of Czechoslovakia.

Remark 3 Decentralization *may destabilize integration arrangements.*

Decentralization implies that regions are increasingly subject to different policies. For example, promoting the use of regional minority languages – such as French in Quebec, Catalan in Catalonia or Flemish in Flanders – restricts labor mobility across language boundaries. Similarly, regional policies promoting different industries make regions more vulnerable to asymmetric shocks. All these measures in turn reduce the spillovers of shocks across regions. This makes the union more fragile politically. Hence, the efforts to rescue troubled unions by increasing regional autonomy may prove futile, and federalization, or devolution, may indeed be merely a step toward the slippery slope of disintegration. This observation is in line with the argument that OCA criteria are endogenous in the degree of economic integration: countries joining a monetary union are more likely to form an OCA ex post than ex ante (Frankel and Rose, 1998). The endogeneity argument thus holds more generally, not only for monetary integration but also for fiscal unions. Moreover, increasing fiscal autonomy of regions directly reduces the potential for risk sharing – thus reducing the benefits of integration even further.

4 Conclusions

Unions composed of diverse regions often redistribute income across regions. These can be done explicitly, such as through the structural/cohesion funds in the EU or the fiscal-equalization system in Germany, or implicitly – and automatically – because of centralized taxation and centrally provided unemployment and welfare benefits. While monetary aspects of integration are well understood, fiscal integration has so far received only limited attention. I seek to fill this gap by identifying conditions under which it is optimal for regions to remain fiscally integrated rather than secede or seek fiscal autonomy. The underlying question, therefore, is complementary to that considered by the theory of optimum currency areas. In constrast to that theory, however, the results of my analysis suggest that two aspects of region-specific shocks are crucial: their correlation across regions and their persistence over time. Unions are especially vulnerable to secession when shocks are asymmetric and largely of permanent nature. In contrast, with asymmetric temporary shocks, any divergence of policy preferences stemming from the shocks' effects is only shortlived. Furthermore, in this case, integration allows regions an effective way to insure each other against idiosyncratic risks. In fact, the potential benefits from such risk sharing are at their greatest when shocks are temporary and negatively correlated as the resulting fiscal transfers allow both regions to smooth consumption over time.

These results offer important lessons for our understanding of the viability of deeper economic integration. Fiscal federalism is frequently highlighted as the solution to difficulties faced by unions failing the OCA criterion of symmetric shocks. However, such fiscal redistribution need not always be politically acceptable for the

participating countries. My results indicate that fiscal federalism is feasible either when shocks are positively correlated – so that the OCA criterion is fulfilled anyway – or when they are largely transient and therefore there is uncertainty about their future realization. With persistent or permanent shocks, the bulk of fiscal redistribution is driven by past shocks whose effects are already known. Mutual insurance then is only a minor aspect of fiscal federalism and fiscal redistribution becomes largely deterministic. A sufficiently large shock – whether positive or negative – can then spell the doom of such a union. Belgium or Italy are examples of countries where one region (Wallonia in Belgium and the Mezziogiorno in Italy) is persistently lagging behind the more successful region (Flanders and North Italy, respectively). In such a case, the incentive for secession can be considerable.

My results, importantly, also show that secession of fiscal autonomy need not always be sought by the relatively richer region. The poorer region may leave the union in order to increase the extent of redistribution. The break-up of Czechoslovakia, which was precipitated by Slovakia's drive for greater autonomy, is a fitting example.

Last but not least, a large negative shock may similarly induce a distressed country to join a wider fiscal union, as this would allow it to benefit from the higher tax base (and correspondingly greater provision of public goods) in that union. If the shock is sufficiently temporary, the fiscal union should be willing to extent membership to such a country. Iceland's recently resubmitted application for EU membership may be motivated in part by this kind of considerations.[14]

References

[1] Alesina, Alberto and Robert J. Barro (2002), "Currency Unions," *Quarterly Journal of Economics* 117 (2), 409-436.

[2] Alesina, Alberto, Robert J. Barro and Silvana Tenreyro (2002), "Optimal Currency Areas," *NBER Macroeconomics Annual* 17, 301-356.

[3] Alesina, Alberto and Roberto Perotti (1998), "Economic Risk and Political Risk in Fiscal Unions," Economic Journal 108 (449), 989-1008.

[4] Alesina, Alberto and Enrico Spolaore (1997), "On the Number and Size of Nations," *Quarterly Journal of Economics* 112 (4), 1027-56.

[5] Alesina, Alberto and Enrico Spolaore (2003), "War, Peace and Size of Countries," *Journal of Public Economics* 89 (7), 1333-1354.

[14] Other factors nevertheless played a role too, such as the desire to adopt the euro and thereby import exchange-rate stability.

[6] Alesina, Alberto and Enrico Spolaore (2003), *The Size of Nations*, MIT Press: Cambridge, MA.

[7] Alesina, Alberto, Enrico Spolaore and Romain Wacziarg (2000), "Economic Integration and Political Disintegration," *American Economic Review* 90 (5), 1276-1296.

[8] Alesina, Alberto, and Andrea Stella (2010), "The Politics of Monetary Policy," *Harvard Institute of Economic Research Discussion Paper 2183*, Harvard University.

[9] Artis, M.J. and T. Okubo (2008), "The Intranational Business Cycle: Evidence from Japan," CERP Discussion Paper No. 6686, CEPR, London.

[10] Artis, M.J. and T. Okubo (2009), "The UK Intranational Trade Cycle," CERP Discussion Paper No. 7152, CEPR, London.

[11] Asdrubali, Piedfederico, Bent E. Sorensen and Oved Yosha (1996), "Chanels of Interstate Risk Sharing: United States 1963-90," *Quarterly Journal of Economics* 111, 1081-1110.

[12] Barro, Robert J. (1979), "On the Determination of the Public Debt," *Journal of Political Economy* **87** (5), 940-971.

[13] Bayoumi, Tamim and Barry Eichengreen (1993), "Shocking Aspects of European Monetary Integration," in: F. Torres and F. Giavazzi eds., "Adjustment and Growth in the European Monetary Union," Cambridge University Press, Cambridge, UK.

[14] Becker, Sascha O., and Mathias Hoffmann (2006), "Intra- and international risk-sharing in the short run and the long run," European Economic Review 50, 777-806.

[15] Bolton, Patric and Gérard Roland (1997), "The Break up of Nations: A Political Economy Analysis," *Quarterly Journal of Economics* 112 (4), 1057-90.

[16] Bolton, Patric, Gérard Roland and Enrico Spolaore (1996), "Economic Theories of the Break-up and Integration of Nations," *European Economic Review* **40**, 697-705.

[17] Dixit, Avinash K., and John Londregan (1998), "Fiscal Federalism and Redistributive Politics," *Journal of Public Economics* 68 (2), 153-180..

[18] Fatás, Antonio (1998),"Does EMU need a fiscal federation?," *Economic Policy* 26, 163-203.

[19] Fidrmuc, Jan, Julius Horvath and Jarko Fidrmuc (1999), "Stability of Monetary Unions: Lessons from the Break Up of Czechoslovakia," *Journal of Comparative Economics* 27 (4), 753-781.

[20] Fidrmuc, Jarko and Iikka Korhonen (2003), "Similarity of supply and demand shocks between the euro area and the CEECs," *Economic Systems* 27(3), 313-334.

[21] Fidrmuc, Jarko and Iikka Korhonen (2006), "Meta-analysis of the business cycle correlation between the euro area and the CEECs," Journal of Comparative Economics 34(3), 518-537.

[22] Frankel, Jeffrey A., and Andreio K. Rose (1998), "The Endogeneity of the Optimum Currency Criteria," *Economic Journal* 108 (July), 1009-1025.

[23] Funke, Michael (1997), "The Nature of Shocks in Europe and Germany," *Economica* **64**, 461-69.

[24] Goyal, S. and K. Staal (2004), "The Political Economy of Regionalism," *European Economic Review* 48, 563-593.

[25] Kenen, Peter B. (1995), "The Theoryof Optimum Currency Areas: An Eclectic View," in Mundell and Swoboda, eds., "Monetary Problems of the International Economy," Chicago, University of Chicago Press.

[26] Kessler, Anke, Christoph Lüelfesmann and Gordon M. Myers (2009), "The Architecture of Federations: Constitutions, Bargaining, and Moral Hazard," CEPR Discussion Paper No. 7244, CEPR, London.

[27] LeBreton, Michel and Shlomo Weber (2003), "The Art of Making Everybody Happy: How to Prevent a Secession," *IMF Staff Papers* 50 (3), 403-435.

[28] McKinnon R.I. (1963), "Optimum Currency Areas," *American Economic Review* 53, 717-725.

[29] Mundell R.A. (1961), " A Theory of Optimum Currency Areas," *American Economic Review* 51,657-665.

[30] Obstfeld, Maurice and Giovanni Peri (1998), "Regional non-adjustment and fiscal policy, " *Economic Policy* 26, 205-259.

[31] Person, Torsten and Guido Tabellini (1996a), "Federal Fiscal Constitutions: Risk Sharing and Moral Hazard," *Econometrica* **64** (3), 623-646.

[32] Person, Torsten and Guido Tabellini (1996b), "Federal Fiscal Constitutions: Risk Sharing and Redistribution, "*Journal of Political Economy* **104** (5), 979-1009.

[33] Sachs, Jeffrey and Xavier Sala-i-Martin (1992), "Fiscal Federalism and Optimum Currency Areas: Evidence for Europe from the United States", in: Canzoneri, Grilli and Masson eds., *Establishing a Central Bank: Issues in Europe and Lessons from the US*, Cambridge University Press, Cambridge, UK.

[34] Sala-i-Martin, Xavier (1992), "Transfers," NBER Working Paper No. 4186, Cambridge, MA.

[35] Sorensen, Bent E. and Oved Yosha (1998), "International Risk Sharing and European Monetary Unification," *Journal of International Economics* 45, 211-238.