Monetary and Fiscal Unification in the EU:
A Stylized Analysis

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Abstract

The Economic and Monetary Union (EMU) implies a considerable change in monetary and fiscal policy design in the European Union. With the aid of a two-country version of the Alesina and Tabellini (1987) model, this paper provides a stylized analysis of monetary and fiscal policy interaction in the EMU. It is shown how macroeconomic outcomes are affected by common monetary and fiscal policies and how outcomes depend on the commitment ability of the ECB when implementing its monetary policy. Moreover, it is analyzed how asymmetries between countries affect outcomes when entering EMU.

Key-words: EMU, ECB, Monetary Policy, Fiscal Policy

JEL-code: E24, E58, E62, E63

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Introduction

The countries of the European Union (EU) that will join the Economic and Monetary Union (EMU) will delegate the design of monetary policy from the former national central banks to the new common, European Central Bank (ECB). Moreover, with the proceeding of economic integration also the efforts to increase fiscal convergence and integration have gained importance. The Maastricht Treaty of 1991 on EMU provides a blueprint for the establishment of a monetary union in the EU and a framework for fiscal integration, harmonization and convergence in the EU. EMU, therefore, implies a considerable change in the design and interaction of monetary and fiscal policy in the EU. This paper investigates the design and interaction of monetary and fiscal policy in a monetary union and analyzes how the establishment of a monetary and fiscal union might affect macroeconomic variables.

We consider different policy regimes and focus upon the output and inflation performance and fiscal variables in the different regimes. Starting point is a setting with national autonomy in both monetary and fiscal policy. This setup is a stylized representation of the pre-EMU situation. Next, we analyze a setting where countries decide to replace national monetary autonomy and to form a monetary union with a centralized monetary authority, the ECB, that controls the supply of the common currency, the Euro. We first consider outcomes when national fiscal autonomy remains. We compare outcomes under a regime where the ECB can commit its monetary policies towards the private sector with the case where it cannot do so. In the first case the ECB can be considered as having a high degree of independence whereas in the second case it has been unable to achieve a clear degree of independence. From this perspective, this paper complements earlier studies on ECB monetary policy and economic performance in the EMU by Alesina and Grilli (1993), von Hagen and Süppel (1994) and Martin (1995) that have been carried out in the context of the Barro and Gordon (1983) model.

Finally, a setting is considered where also national fiscal autonomy vanishes and national fiscal authorities are replaced by a federal fiscal authority that controls taxation in the EU. While fiscal autonomy is still high at the start of the EMU, it is conceivable that in the EU federal fiscal policies will become increasingly important in the future. The European Commission (1993) studied in detail such fiscal federalism dimensions of the EMU. In our stylized representation of an EU with federal taxation and government spending, the federal fiscal authorities decide upon taxation in the EU. Fiscal transfers enable to redistribute resources in the EU to stimulate development in stagnating parts or more generally to promote any other policy goal that requires redistribution of resources.

To analyze the interaction of monetary and fiscal policies under EMU, the model of monetary and fiscal policy interaction of Alesina and Tabellini (1987) is extended to a two-country monetary union setting. In this manner more insight results on the interaction of monetary and fiscal policy under EMU. The versatility of the approach by Alesina and Tabellini witnesses also a number of recent studies that extend the analysis to a two-country setting. van Hoose (1992) studies the institutional setting of a two-country European Monetary System (EMS). Agell et.al. (1996) study exchange rate and fiscal policy discretion and commitment in a small country that participates in a managed exchange rate system like the EMS. In addition it is shown how binding borrowing constraint -such as the one imposed by the Maastricht Treaty- affect the outcomes. Martin (1995) models a two-speed monetary union in which one country initially is outside EMU because it has positive inflation and output targets that, however, gradually converge to those of the EMU countries. Beetsma and Bovenberg (1995) study the effects of EMU on the interaction of monetary and fiscal policy. Banerjee (1997) studies in detail the interaction of national fiscal authorities and the ECB and considers a large number
of alternative EMU scenarios.

Our paper aims to complement these studies and focuses on a few aspects of EMU that have been left unexplored or not studied in full detail earlier. It remains more closely to the original framework as pioneered by Alesina and Tabellini (1987) and van Hoose (1992) than the other studies mentioned who all extended the original with additional features, interactions and mechanisms. While interesting and certainly relevant such extensions necessarily complicate these analyses significantly and require at some point a compromise between simplicity and transparency -as inherent in the original framework- and relevance. Our analysis adds two innovations to the existing literature. First, we consider the consequences of fiscal unification under EMU when the countries that form a monetary union decide to centralize also fiscal policy. In this manner the analysis contributes -in a stylized manner albeit- to the recurrent debates on the need to harmonize tax systems and fiscal policies and to develop federal fiscal policies in the EU. Second, the effects of some asymmetries between the countries that form a monetary union are analyzed. Two possible asymmetries are focused upon: (i) differences of commitment ability of the former national monetary authorities, (ii) differences in fiscal preferences. The implications of these asymmetries that bear also relevance in the context of the EMU, are studied in section 5.

The structure of the paper is as follows: section 2 extends the Alesina and Tabellini (1987) closed-economy model to a two-country setting with national autonomy in monetary and fiscal policy design. Section 3 analyzes outcomes when the countries decide to form a monetary union and compares the outcomes under EMU with the outcomes under national monetary policy as derived in section 2. Section 4 introduces fiscal federalism in the EMU and considers its effects on macroeconomic performance. In section 5 we consider the effects of structural asymmetries between the countries that decide to enter the EMU. A short conclusion summarizes our main results.

2. National Autonomy in Monetary and Fiscal Policy Design

To study the interaction between monetary and fiscal policy in the EMU, we extend the elegant framework of Alesina and Tabellini (1987) to a two-country EU. The Alesina and Tabellini (1987) analysis studies the interaction of monetary and fiscal policy in the context of a closed economy. It is shown how output, inflation and taxation are the outcome of the interaction between the monetary authority, who determines the rate of inflation, the fiscal authority, who controls (distortionary) taxation of private sector output, and the private sector with a centralized trade union that sets the nominal wage. A distinction is made between two equilibria: in the equilibrium with discretionary monetary policy the monetary player is unable to credibly commit its policy towards the private sector. In the commitment equilibrium, on the other hand, the monetary authority is able to commit its monetary policy.

Starting point of our analysis is the pre-EMU situation with national currencies and national monetary policy autonomy\(^1\). Consider an EU that consists of two parts or countries whose relative sizes (e.g. in terms of trend output) are given by \(\gamma\) and \(1 - \gamma\), respectively. As in Alesina and Tabellini (1987) and van Hoose (1992), output, \(y\), which is taxed at a rate \(\tau\), is produced by competitive firms that use labor input as the sole variable input in the production process. With capital being fixed, aggregate supply in

\(^1\)Alternatively, we could interpret this regime as representing a two-speed monetary union that consists of a core and a peripheral part of the EU. A two-speed monetary union in which EU countries retain national monetary policy autonomy but engage in a process of monetary and economic convergence has been proposed by a number of economists and politicians as an alternative to a too rapid unification process that may prove unsustainable in the long run.
that case is a function of relative real unit labor costs:

\[ y = \alpha(p - w - \tau) \]  
\[ y^* = \alpha(p^* - w^* - \tau^*) \]  

in which \( p \) denotes the output price level and \( w \) the nominal wage. Variables are in logarithms and refer to deviations from the initial equilibrium where output is at its natural rate and which has been normalized to zero for convenience. Foreign variables are indicated with an asterisk.

Nominal wages in both countries are set by national trade unions that try to minimize deviations of real wages from their real wage targets and \( \bar{\omega} \) and \( \bar{\omega}^* \):

\[
\min_{\omega} V^T = \frac{1}{2} (w - p - \bar{\omega})^2 \]  
\[
\min_{\omega^*} V^{T^*} = \frac{1}{2} (w^* - p^* - \bar{\omega}^*)^2 . \]

Losses, therefore, are minimized if,

\[
w = p^e + \bar{\omega} \]
\[
w^* = p^{e*} + \bar{\omega}^* . \]

in which the superscript \( e \) refers to the expectation of a variable.

Defining the inflation rates as, \( \pi \equiv \frac{dp}{dt} \) and \( \pi^* \equiv \frac{dp^*}{dt} \), output in both countries can also be written as a function of inflation rates,

\[
y = \alpha(\pi - \pi^e - \tau - \bar{\omega}) \]  
\[
y^* = \alpha(\pi^* - \pi^{e*} - \tau^* - \bar{\omega}^*) . \]

(4) shows two important sources of unemployment in the model: firstly, real wage claims by the trade unions, implying \( \bar{\omega} > 0 \), drive a wedge between real wages and productivity of labor and output below the (zero) equilibrium level of output. Secondly, also high taxes drive down output and increase unemployment. Note that the inflation rates in both countries are linked by the assumption of purchasing power parity, according to which the inflation differential equals the rate of depreciation, \( x \), implying that \( x = \pi - \pi^* \).

In the absence of government debt,\(^3\) government expenditures are financed by ordinary taxes and seignorage revenues. The government budget constraint equates government spending, \( G \), with ordinary taxes, \( T \), plus seignorage revenues, \( M \equiv \frac{dM}{dt} \), that the central bank receives when increasing the supply of base money, \( M \), in the economy. Expressed as fractions of domestic output, \( Y \), the government budget constraints read,

\[
\frac{G}{Y} = \frac{T}{Y} + \frac{M}{Y} \]  
\[
\frac{G^*}{Y^*} = \frac{T^*}{Y^*} + \frac{M^*}{Y^*} . \]

\(^2\)See also Alesina and Tabellini (1987). Both countries are assumed to have access to the same production technologies, resulting in symmetric values for \( \alpha \). Relaxing this assumption would complicate considerably the analytical expressions in the remainder, without producing further insights.

\(^3\)As Alesina and Tabellini (1987), our analysis ignores the intertemporal dimension of the government budget implied by government debt. The absence of government debt can alternatively be interpreted as a situation where policymakers wish to raise an amount of \( g \) of government expenditures in the form of either taxes or seignorage. See van Aarle, Bovenberg and Raith (1997) for the interaction between the ECB and national fiscal authorities and the problem of government debt stabilization under EMU.
Approximating -as in Alesina and Tabellini (1987)- seignorage revenues as fraction of output by the rate of inflation, and defining the government expenditures to output, \( g = \frac{G}{Y} \), and taxes to output, \( \tau = \frac{T}{Y} \), ratios, we can rewrite (5) as,

\[
\begin{align*}
g &= \tau + \pi \\
g^* &= \tau^* + \pi^*
\end{align*}
\]

The fiscal authorities in both countries set the tax rate so as to minimize their loss functions that are assumed to depend on inflation, output, and deviations of government spending from their exogenously given target values, \( \bar{g} \) and \( \bar{g}^* \),

\[
\begin{align*}
\min_t V^F &= \frac{1}{2}\{\pi^2 + \delta_1 y^2 + \delta_2 (g - \bar{g})^2\} \\
\min_t V^{F^*} &= \frac{1}{2}\{\pi^{*2} + \delta_1^* y^{*2} + \delta_2^* (g^* - \bar{g}^*)^2\}
\end{align*}
\]

Government expenditures are determined residually from the government budget constraints, defined in (6). Because the fiscal authorities are subject to electoral discipline, we assume in the remainder of the analysis that the preferences of the fiscal authorities in (7) also reflect the underlying social preferences. We also consider similar loss functions for the national monetary authorities,

\[
\begin{align*}
\min_y V^M &= \frac{1}{2}\{\pi^2 + \mu_1 y^2 + \mu_2 (g - \bar{g})^2\} \\
\min_y V^{M^*} &= \frac{1}{2}\{\pi^{*2} + \mu_1^* y^{*2} + \mu_2^* (g^* - \bar{g}^*)^2\}
\end{align*}
\]

We assume that the fiscal authorities care relatively more about output stabilization and the fiscal spending objective than the monetary authorities, implying that \( \delta_1 \geq \mu_1 \), \( \delta_1^* \geq \mu_1^* \), \( \delta_2 \geq \mu_2 \) and \( \delta_2^* \geq \mu_2^* \).

We derive the reaction functions of the fiscal authorities and monetary authorities in both countries by minimizing the loss functions of the monetary and fiscal authorities subject to the respective output (4) and government budget (6) constraints. Using the rates of inflation and taxation that result, we derive output and government spending and which are given in Table 1a,

<table>
<thead>
<tr>
<th>Country 1</th>
<th>Country 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \bar{g} - g = \frac{\delta_1 \alpha^2}{\delta_1 \alpha^2 + \delta_2(\bar{\omega} + \bar{g})} )</td>
<td>( \bar{g}^* - g^* = \frac{\delta_1 \alpha^2}{\delta_1 \alpha^2 + \delta_2(\bar{\omega}^* + \bar{g}^*)} )</td>
</tr>
<tr>
<td>( y = -\frac{\delta_2}{\delta_1 \alpha^2}(g - \bar{g}) )</td>
<td>( y^* = -\frac{\delta_2^<em>}{\delta_1 \alpha^2}(g^</em> - g^*) )</td>
</tr>
<tr>
<td>( \pi = \mu_2(g - \bar{g}) )</td>
<td>( \pi^* = \mu_2^<em>(g^</em> - g^*) )</td>
</tr>
<tr>
<td>( \tau = -\bar{\omega} + \frac{\delta_2}{\delta_1 \alpha^2}(g - \bar{g}) )</td>
<td>( \tau^* = -\bar{\omega}^* + \frac{\delta_2^<em>}{\delta_1 \alpha^2}(g^</em> - g^*) )</td>
</tr>
</tbody>
</table>

The inflation rates in Table 1a were derived under the assumption that the monetary authorities were able to credibly commit ex ante their monetary policies towards the
private sector. Monetary policy, however, is in principal subject to a time-inconsistency problem because the monetary authority is tempted to increase output by creating an unanticipated increase in the rate of inflation after wage contracts have been signed. The private sector when realizing this time-inconsistency problem will adjust its inflationary expectations such as to internalize this time-inconsistency problem in their decision making process. With rational economic agents, the time-inconsistency problem, therefore, gives rise to an inflationary bias in the economy in case the monetary authority is unable to commit towards the private sector. Rogoff (1985) showed that conservative central bankers that attribute low value to output stabilization, i.e. that have a low $\mu_1$, on the one hand, improve welfare as conservativeness alleviates the inflationary bias in the economy. On the other hand, in the presence of random output shocks some flexibility is efficient and a too conservative Central Bank produces inefficient outcomes. Table 1b gives inflation, taxation, government spending and output under monetary policy discretion in both countries.

Table 1b
Outcomes with National Monetary Policies: Monetary Policy Discretion

| Country 1 | | | | |
|-----------|---|---|---|
| $g - g = \frac{\delta_1 \alpha^2}{\delta_1 \alpha^2 (1 + \mu_2 + \frac{\mu_2 \delta_2}{\delta_1}) + \delta_2} (\bar{\omega} + \bar{g})$ | | | |
| $y = -\frac{\delta_2}{\delta_1 \alpha^2} (g - \bar{g})$ | | | |
| $\pi = (\mu_2 + \frac{\mu_2 \delta_2}{\delta_1}) (g - \bar{g})$ | | | |
| $\tau = -\bar{\omega} + \frac{\delta_2}{\delta_1 \alpha^2} (\bar{g} - \bar{g})$ | | | |
| Country 2 | | | |
| $g^* - g^* = \frac{\delta_1 \alpha^2}{\delta_1 \alpha^2 (1 + \mu_2 + \frac{\mu_2 \delta_2}{\delta_1}) + \delta_2} (\bar{\omega} + \bar{g}^*)$ | | | |
| $y^* = -\frac{\delta_2}{\delta_1 \alpha^2} (\bar{g} - \bar{g}^*)$ | | | |
| $\pi^* = (\mu_2 + \frac{\mu_2 \delta_2}{\delta_1}) (\bar{g} - \bar{g}^*)$ | | | |
| $\tau^* = -\bar{\omega}^* + \frac{\delta_2}{\delta_1 \alpha^2} (\bar{g} - \bar{g}^*)$ | | | |

Both under monetary policy commitment (Table 1a) and monetary policy discretion (Table 1b), we see that government spending is below its target. Moreover, output, inflation, taxes, the rate of depreciation and welfare losses are all directly related to the deviation of government spending from its target. Comparing Table 1a and 1b we find the first of the two main results from the Alesina and Tabellini (1987) analysis: inflation, output and government spending are higher and taxes are lower under discretionary monetary policies than under monetary policy commitment. The higher rate of inflation under monetary policy discretion implies higher seignorage revenues that can be used to increase government spending and to lower taxes that on their turn increase output. From an initial position where $\delta_1 = \mu_i, i = \{1, 2\}$, welfare losses are lower under monetary policy commitment than under monetary policy discretion, because the positive welfare effect from lower inflation dominates the negative effects from

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4In addition, as first argued by Jensen (1992), also the fiscal authority may face a time-inconsistency problem in the present setup because unanticipated tax cuts increase output. Fiscal policy discretion therefore produces lower taxes, lower government spending and higher inflation while output is not affected ex post. Our analysis ignores the fiscal time-inconsistency problem and focuses on the time-inconsistency problem of the monetary authorities. Implicitly, we assume that the fiscal authorities always succeed in implementing their policies with commitment. Banerjee (1997) studies monetary and fiscal policy discretion and commitment in the EMU and shows how outcomes are affected when considering different assumptions about the abilities of monetary and fiscal authorities to commit monetary and fiscal policies towards the private sector.
lower government spending and lower output. When lowering the values of \( \mu_i \), however, at some point welfare under monetary policy discretion starts to exceed welfare under monetary policy commitment. Upon partial differentiation of the expressions for government spending, output, inflation and taxation w.r.t. the preference weights of the policymakers it is straightforward to show also the second main result of the Alesina and Tabellini (1987) analysis: with monetary policy discretion, a more conservative monetary authority, implying a decrease in \( \mu_i \), reduces inflation, government spending and output and increases taxation. In addition, if \( \mu_i = \delta_i \) where \( i = \{1, 2\} \), welfare losses are lower with a more conservative monetary authority, whereas welfare losses can be higher with a more conservative monetary authority if \( \mu_i \neq \delta_i \). Social welfare first increases with a more conservative monetary authority that attributes smaller weights to output and government spending. At some values of \( \mu_1 \) and \( \mu_2 \), the positive effect from lower inflation, however, starts to be outweighed by the loss of seignorage that has to be compensated by higher taxation which depresses output and/or lowers government spending.

3. Establishing a Monetary Union

From a setting with national autonomy in monetary and fiscal policy design we now shift our attention to a setting where both countries decide to form a monetary union, the EMU. Under EMU, national currencies cease to exist and exchange rate changes are ruled out by definition. National monetary policies will be replaced by the common monetary policy of the ECB. Representatives of the participating countries will have a (weighted) vote in the decision making process inside the ECB and in this way on its monetary policies. Given our earlier assumption in that goods markets of both countries are highly integrated, a monetary union implies that a common price level, \( p_E \), prevails in both countries that grows at the common rate of inflation. Defining the common rate of inflation, \( \pi_E = \frac{dp_E}{dt} \), we can rewrite aggregate supply in both countries as a function of inflation, inflation expectations of the trade unions, their real wage targets and the level of distortionary output taxation that the fiscal authorities choose,

\[
\begin{align*}
y &= \alpha(\pi_E - (\pi_E)^e) - \tau - \bar{\omega} \quad (9a) \\
y^* &= \alpha(\pi_E - (\pi_E)^e) - \tau^* - \bar{\omega}^* \quad (9b)
\end{align*}
\]

The ECB sets the common rate of inflation such as to minimize its loss function that is assumed to depend on the common rate of inflation, average output, \( y^A \), and the deviation of average government spending, \( g^A \), from its target level, \( \bar{g}^A \),

\[
\min_{\pi_E} V^E = \frac{1}{2} \left\{ (\pi_E)^2 + \mu_1^E (y^A)^2 + \mu_2^E (g^A - \bar{g}^A)^2 \right\} \quad (10)
\]

Average output and government spending (targets) are defined as \( y^A = \gamma y + (1-\gamma) y^* \) and \( g^A = \gamma g + (1-\gamma) g^* \) where \( \gamma \) and \( 1-\gamma \) denote again the relative sizes of both countries. That the ECB is assumed to care about average output and average government spending can be understood when considering the ECB as a coalition of the former national Central Banks in the EU whose individual objectives are weighted by the relative country sizes, \( \gamma \) and \( 1-\gamma \).

Under EMU the government budget constraint relates government spending to ordinary taxes plus seignorage revenues received from the ECB. Seignorage revenues of the ECB equal the increase of the supply of Euro(pan) base money, \( M^E = \frac{dM^E}{dt} \). The ECB redistributes its seignorage revenues to both countries according to their shares in the

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5See in particular Alesina and Grilli (1993) and the text of the Maastricht Treaty for a more detailed account of the internal decision making process in the ECB.
ECB which are denoted by $\theta$ and $1 - \theta^6$. As fractions of domestic output the dynamic government budget constraints now read,

\[
\frac{G}{Y} = \frac{T}{Y} + \frac{\theta M^E}{Y} \quad \text{(11a)}
\]
\[
\frac{G^*}{Y^*} = \frac{T^*}{Y^*} + \frac{(1 - \theta) M^E}{Y^*} \quad \text{(11b)}
\]

Denoting again fractions of GDP by lower case variables and approximating ECB seignorage as a fraction of EU GDP by the European rate of inflation, implying that $\pi^E \equiv \frac{M^E}{Y^E}$, and noting that EU output $Y^E \equiv Y + Y^*$ and $\gamma \equiv \frac{Y}{Y^E}$, we rewrite (11) as,

\[
g = \tau + \frac{\theta}{\gamma} \pi^E \quad \text{(12a)}
\]
\[
g^* = \tau^* + \frac{1 - \theta}{1 - \gamma} \pi^E \quad \text{(12b)}
\]

To relate the fractions of the ECB seignorage that both countries receive to the size of their economies, we have to scale them down by the fractions, $\gamma$ and $1 - \gamma$, that measure the relative sizes of both countries in the EU economy. If countries receive a share in ECB seignorage according to their size, $\theta$ equals $\gamma$ and $1 - \theta$ equals $1 - \gamma$, other distribution functions, however, are also conceivable$^7$.

The monetary policy of the ECB has both a stabilization dimension as inflationary surprises affect output in both economies according to (9), and also a revenue dimension as higher inflation implies higher seignorage revenues for both countries, according to (12). Like the (former) national monetary authorities, the ECB may face time-inconsistency problems with the implementation of its monetary policy. In the context of the EMU it is often argued that the ECB might be subject to additional commitment problems if the no bail out provision of highly indebted countries is not credible. In that case, the ECB will be effectively forced to monetize partly the deficits of these countries such as to prevent an EMU-wide financial crisis. To strengthen the credibility of no bail out of undisciplined and insolvent governments by the ECB, a high degree of ECB independence and the fiscal stringency criteria were put into the Maastricht Treaty. To analyze such time-inconsistency problems in EMU, we compare outcomes under a regime where the ECB is able to commit its monetary policy towards the EU private sector with outcomes under the time-consistent discretionary regime where it cannot do so. An independent ECB is more likely to establish credibility and to sustain a commitment equilibrium, whereas a dependent ECB may not be able to implement its monetary policy with commitment.

Monetary policy of the ECB is found when minimizing (10) subject to the output equations (9) and the government budget constraints (12). Fiscal policies are found when minimizing the respective loss functions (7) subject to their individual output (9) and government budget (12) equations. With the use of these policy reaction functions, the equilibrium in the commitment case can be written as,

\footnote{The Protocol belonging to the Maastricht Treaty determines in Article 33 that seignorage of the ECB is redistributed to the EU countries in proportion to their shares in the ECB capital. Article 29 determines the shares of the EU countries in the capital of the ECB to be weighted averages of the shares of the EU countries in total EU population and the shares of the EU countries in total EU GDP.}

\footnote{An example might illustrate (12). Consider an EU in which country 1 is larger than country 2, e.g. $\gamma = \frac{1}{2}$. When ECB seignorage is equally distributed, implying $\theta = \frac{1}{2}$, $\gamma$ equals $\frac{1}{2}$ and $1 - \gamma$ equals $\frac{3}{2}$. Seignorage revenues in that case are redistributed from country 1 to country 2 because its ECB share is smaller than its size, implying that $\frac{1 - \gamma}{\gamma} > 1$.}
Table 2a
Outcomes in a Monetary Union: Monetary Policy Commitment

<table>
<thead>
<tr>
<th>Country 1</th>
<th>( \bar{g} = \delta_1 \alpha^2 (\delta^<em>_1 \alpha^2 (1 + (1 - \theta) \mu^E_2) + \delta^</em>_2) (\delta^*_1) )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( y = -\frac{\delta^<em>_1}{\delta^</em>_2} ) (( \bar{g} - g ))</td>
</tr>
<tr>
<td></td>
<td>( \pi = \pi^E = \mu^E_2 (\gamma (\bar{g} - g) + (1 - \gamma) (g^* - g^*)) )</td>
</tr>
<tr>
<td></td>
<td>( \tau = -\omega + \frac{\delta^<em>_2}{\delta^</em>_1 \alpha^2} (\bar{g} - g) )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country 2</th>
<th>( \bar{g}^* = \delta^<em>_1 \alpha^2 (\delta^</em>_1 \alpha^2 (1 + (1 - \theta) \mu^E_2) + \delta^<em>_2) (\delta^</em>_1) )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( y^* = -\frac{\delta^<em>_1}{\delta^</em>_2} ) (( \bar{g}^* - g^* ))</td>
</tr>
<tr>
<td></td>
<td>( \pi^* = \pi^E = \mu^E_2 (\gamma (\bar{g} - g) + (1 - \gamma) (g^* - g^*)) )</td>
</tr>
<tr>
<td></td>
<td>( \tau^* = -\omega^* + \frac{\delta^<em>_2}{\delta^</em>_1 \alpha^2} (\bar{g}^* - g^*) )</td>
</tr>
</tbody>
</table>

in which \( \Delta^c = (\delta^*_1 \alpha^2 + \delta^*_2) (\delta^*_1 \alpha^2 (1 + (1 - \theta) \mu^E_2) + \delta^*_2) + \delta_1 \alpha^2 \theta (\delta^*_1 \alpha^2 + \delta^*_1) \) \( + \delta^*_2 \). Table 2a gives the outcomes under EMU when the ECB can commit its monetary policy. As mentioned, binding agreements or reputational forces enable to sustain the commitment equilibrium. If such features are absent, the case arises where the ECB is unable to commit its monetary policy towards the private sector. It is straightforward as well to calculate the equilibrium with discretion in which the ECB fails to commit itself. Solving, as before, the first-order conditions of all players we can derive the reaction functions of the fiscal authorities in both countries and the ECB in the no-commitment case. Table 2b gives the outcomes under EMU when the ECB implements monetary policy with discretion.

Table 2b
Outcomes in a Monetary Union: Monetary Policy Discretion

<table>
<thead>
<tr>
<th>Country 1</th>
<th>( \bar{g} = \delta_1 \alpha^2 (\delta^<em>_1 \alpha^2 (1 + (1 - \theta) \mu^E_2) + \delta^</em>_2) (\delta^*_1) )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( y = -\frac{\delta^<em>_1}{\delta^</em>_2} ) (( \bar{g} - g ))</td>
</tr>
<tr>
<td></td>
<td>( \pi = \pi^E = (\mu^E_2 + \frac{\mu^E_2 \delta^<em>_2}{\delta^</em>_1}) \gamma (\bar{g} - g) + (\mu^E_2 + \frac{\mu^E_2 \delta^<em>_2}{\delta^</em>_1}) (1 - \gamma) (g^* - g^*) )</td>
</tr>
<tr>
<td></td>
<td>( \tau = -\omega + \frac{\delta^<em>_2}{\delta^</em>_1 \alpha^2} (\bar{g} - g) )</td>
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</tbody>
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<table>
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<tr>
<th>Country 2</th>
<th>( \bar{g}^* = \delta^<em>_1 \alpha^2 (\delta^</em>_1 \alpha^2 (1 + (1 - \theta) \mu^E_2) + \delta^<em>_2) (\delta^</em>_1) )</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>( y^* = -\frac{\delta^<em>_1}{\delta^</em>_2} ) (( \bar{g}^* - g^* ))</td>
</tr>
<tr>
<td></td>
<td>( \pi^* = \pi^E = (\mu^E_2 + \frac{\mu^E_2 \delta^<em>_2}{\delta^</em>_1}) \gamma (\bar{g} - g) + (\mu^E_2 + \frac{\mu^E_2 \delta^<em>_2}{\delta^</em>_1}) (1 - \gamma) (g^* - g^*) )</td>
</tr>
<tr>
<td></td>
<td>( \tau^* = -\omega^* + \frac{\delta^<em>_2}{\delta^</em>_1 \alpha^2} (\bar{g}^* - g^*) )</td>
</tr>
</tbody>
</table>

in which \( \Delta^d = (\delta^*_1 \alpha^2 + \delta^*_2) (\delta^*_1 \alpha^2 (1 + (1 - \theta) \mu^E_2) + \delta^*_2) + \delta_1 \alpha^2 \theta (\delta^*_1 \alpha^2 + \delta^*_1) \) \( + \delta^*_2 \). A comparison between outcomes under ECB monetary policy commitment (Table 2a) and discretion (Table 2b), does not provide an unambiguous picture on the differences between both regimes for the individual countries. From the perspective of the individual countries, outcomes under a monetary union, moreover, can be compared...
with outcomes under national monetary policy autonomy, by comparing Tables 1 and 2. It is seen that outcomes under a monetary union are in principal quite different from those under national monetary policy autonomy because the change from national monetary policy to a common monetary policy affects also national fiscal policies and thereby output and welfare of the individual countries. Outcomes under EMU depend not only on national fiscal preferences and real wage targets -like under national monetary policy autonomy- but also on those of the foreign economy. In addition, preferences of the ECB rather than those of the national monetary authorities determine outcomes under EMU. An important role also plays the seignorage redistribution channel that depends on the distribution and size parameters, $\theta$ and $\gamma$.

Calculating EU averages, however, provides a more clear picture in case we assume that $\delta_i = \delta^*_i$, $i = \{1, 2\}$. It is straightforward to show that in that case the basic results of the closed economy of Alesina and Tabellini (1987) apply also to the monetary union case. In particular, EU wide inflation, average output and average government spending are lower and average taxes are higher under ECB monetary policy commitment than under monetary policy discretion. Also, it is straightforward to show that a more conservative ECB -implying a decrease in $\mu^F_i$- reduces EU wide inflation, average output and average government spending and increases average taxation with discretionary monetary policy. Also, from an initial position where $\mu^F_i = \delta_i = \delta^*_i$, $i = \{1, 2\}$, average welfare losses are lower with a more conservative monetary authority, Welfare losses, however, can be higher with a more conservative monetary authority in an initial position where $\mu^F_i \neq \delta_i = \delta^*_i$, $i = \{1, 2\}$. A more conservative ECB implies lower inflation and therefore higher average taxes and lower average output and average government spending under EMU. From an initial position where $\mu^F_i = \delta_i = \delta^*_i$, $i = \{1, 2\}$, the positive welfare effects from lower inflation exceed the welfare costs from lower average output and average government spending. When decreasing , however, at some point the balance reverses and a more conservative ECB starts to deteriorate average welfare in the EU. Therefore, the basic results of the closed economy analysis of Alesina and Tabellini also apply to a monetary union when we consider average government spending, output, taxation and welfare.

4. Fiscal Federalism in the EMU

A growing degree of harmonization of tax rates and tax systems has been achieved in the EU and it is likely that in the future issues of fiscal federalism will become more important and pressing. In particular, the question has to be addressed to which extent control over taxation and government spending will be centralized at the federal EU level rather than at a national and regional level as currently. The arguments from the theory of fiscal federalism indicate that a higher degree of centralization of taxation and government spending than is currently seen in the EU is likely to be efficient because of important externalities and economies of scale and scope in raising tax revenues and providing public goods. At present the EU budget only represents 1.2% of the EU GDP whereas the federal budget in existing monetary unions (e.g. United States, Canada, Switzerland and Germany) amounts to 30 to 40% of GDP. A federal EU budget will perform three important functions: an allocative function, a redistributional function and a stabilization function. Currently, a large share of the EU budget is devoted to control allocation in the agricultural sector. The remainder of the budget is largely directed to the EU Structural Funds which are redistributive grant mechanisms designed to foster convergence and cohesion in the EU. Their redistributive power is currently fairly limited because of their small size and a further increase in the EU budget will be necessary to foster real convergence in the EU. In addition, a more substantial EU budget will in-
crease the importance of the EU budget as an automatic stabilizer of asymmetric shocks in the EMU, a role which is virtually absent currently\(^8\).

If the EU evolves into a true federation, the European Union institutions control the European tax system and government spending. In an -admittedly- simplified manner, fiscal federalism can be analyzed in our simple model by introducing a European Fiscal Authority (EFA)\(^9\) that chooses a common output tax, \(\tau^E\), and redistributes the revenues from this common output tax to the two national fiscal authorities in a proportion \(\{\phi, 1-\phi\}\). Under EMU and federal fiscal policies in the EU, a country receives, therefore, a share from the federal tax revenues, \(T^E\), and a share from the seignorage revenues of the ECB. As fractions of output the government budget constraints under monetary and fiscal unification in the EU become,

\[
\frac{G}{Y} = \frac{\phi T^E}{Y} + \frac{\theta M^E}{Y} \quad \text{(13a)}
\]

\[
\frac{G^*}{Y^*} = \frac{(1-\phi)T^E}{Y^*} + \frac{(1-\theta)M^E}{Y^*} \quad \text{(13b)}
\]

Denoting again fractions of GDP by lower case variables and approximating ECB seignorage as a fraction of EU GDP by the European rate of inflation, we can rewrite (13) as,

\[
g = \frac{\phi \tau^E}{\gamma} + \frac{\theta \pi^E}{\gamma} \quad \text{(14a)}
\]

\[
g^* = \frac{1-\phi \tau^E}{1-\gamma} + \frac{1-\theta \pi^E}{1-\gamma} \quad \text{(14b)}
\]

where \(\tau^E \equiv \frac{T^E}{Y}\). With tax rates being determined by the EU rather than national fiscal authorities, output (9) changes to,

\[
y = \alpha(\pi^E - (\pi^E)^c - \tau^E - \bar{\omega}) \quad \text{(15a)}
\]

\[
y^* = \alpha(\pi^E - (\pi^E)^c* - \tau^E - \bar{\omega}^*) \quad \text{(15b)}
\]

Similar to the case of the ECB, it is assumed that the federal fiscal authority seeks to minimize its loss function which is a function of inflation, average output and average government spending in the EU,

\[
\min_{\tau^E} V^E = \frac{1}{2} \left\{ (\pi^E)^2 + \delta^E (y^A)^2 + \delta^E (g^A - \bar{g}^A)^2 \right\} , \quad \text{(16)}
\]

in which \(\delta^E\) and \(\delta^E\) denote the relative weights that the common fiscal authority attaches to reducing the output gap of the EU economy and the level of government spending in the EU, respectively. With the monetary policies of the ECB still resulting from minimizing its loss function in (10) -now subject to (14) and (15), we can derive outcomes under a regime of commitment of the ECB its monetary policy,

\(^8\)See in particular European Commission (1993) and CEPR (1993) for a much more detailed account of the many issues in fiscal federalism in the EU.

\(^9\)Much like the ECB might be looked upon as a coalition of the (former) national monetary authorities that coordinate and implement a common monetary policy, this European Fiscal Authority might be looked upon as a coalition of the national fiscal authorities that design a common fiscal policy. In that perspective, it might be similar to the current ECOFIN in which the ministers of finance and economic affairs of the EU countries regularly meet to coordinate fiscal and economic policies. Like in the case of the ECB, the ultimate policies of the EFA are likely to involve an intricate bargaining process between the EU countries.
### Table 3a

**Outcomes in a Monetary Union and Fiscal Union: Monetary Policy Commitment**

<table>
<thead>
<tr>
<th>Country 1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( g - g = \frac{\delta_f \alpha^2 (1+\theta)\mu_f}{\delta F \alpha^2 (1+\mu_f) + \delta_f^2} (\phi \omega + \frac{(1-\gamma)\omega^*}{\gamma} + g) )</td>
<td></td>
</tr>
<tr>
<td>(- \frac{1}{\gamma} \frac{\delta_f \alpha^2 (1+\theta)\mu_f E}{\delta F \alpha^2 (1+\mu_f + \frac{\mu_f^E}{\delta_f^2}) + \delta_f^2} \left( \frac{1}{1-\gamma} \omega + \frac{(1-\gamma)\omega^*}{\gamma} \right) )</td>
<td></td>
</tr>
<tr>
<td>( y = \alpha(1-\gamma)(\omega^* - \omega) - \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \pi = \pi^E = \mu_f E (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \tau = \tau^E = -(\gamma \omega + (1-\gamma)\omega^<em>) + \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^</em>-g^*)) )</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country 2</th>
<th></th>
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<tbody>
<tr>
<td>( g^* - g^* = \frac{\delta_f \alpha^2 (1+\theta)\mu_f}{\delta F \alpha^2 (1+\mu_f) + \delta_f^2} (\phi \omega + \frac{(1-\gamma)\omega^*}{\gamma} + g) )</td>
<td></td>
</tr>
<tr>
<td>(- \frac{1}{\gamma} \frac{\delta_f \alpha^2 (1+\theta)\mu_f E}{\delta F \alpha^2 (1+\mu_f + \frac{\mu_f^E}{\delta_f^2}) + \delta_f^2} \left( \frac{1}{1-\gamma} \omega + \frac{(1-\gamma)\omega^*}{\gamma} \right) )</td>
<td></td>
</tr>
<tr>
<td>( y^* = -\alpha\gamma(\omega^* - \omega) - \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \pi^* = \pi^E = \mu_f E (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \tau^* = \tau^E = -(\gamma \omega + (1-\gamma)\omega^<em>) + \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^</em>-g^*)) )</td>
<td></td>
</tr>
</tbody>
</table>

Similarly, we can also calculate the outcomes in a monetary and fiscal union in case the ECB implements the common monetary policy with discretion,

### Table 3b

**Outcomes in a Monetary and Fiscal Union: Monetary Policy Discretion**

<table>
<thead>
<tr>
<th>Country 1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( g - g = \frac{\delta_f \alpha^2 (1+\theta)\mu_f}{\delta F \alpha^2 (1+\mu_f) + \delta_f^2} (\phi \omega + \frac{(1-\gamma)\omega^*}{\gamma} + g) )</td>
<td></td>
</tr>
<tr>
<td>(- \frac{1}{\gamma} \frac{\delta_f \alpha^2 (1+\theta)\mu_f E}{\delta F \alpha^2 (1+\mu_f + \frac{\mu_f^E}{\delta_f^2}) + \delta_f^2} \left( \frac{1}{1-\gamma} \omega + \frac{(1-\gamma)\omega^*}{\gamma} \right) )</td>
<td></td>
</tr>
<tr>
<td>( y = \alpha(1-\gamma)(\omega^* - \omega) - \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \pi = \pi^E = \mu_f E (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \tau = \tau^E = -(\gamma \omega + (1-\gamma)\omega^<em>) + \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^</em>-g^*)) )</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( g^* - g^* = \frac{\delta_f \alpha^2 (1+\theta)\mu_f}{\delta F \alpha^2 (1+\mu_f) + \delta_f^2} (\phi \omega + \frac{(1-\gamma)\omega^*}{\gamma} + g) )</td>
<td></td>
</tr>
<tr>
<td>(- \frac{1}{\gamma} \frac{\delta_f \alpha^2 (1+\theta)\mu_f E}{\delta F \alpha^2 (1+\mu_f + \frac{\mu_f^E}{\delta_f^2}) + \delta_f^2} \left( \frac{1}{1-\gamma} \omega + \frac{(1-\gamma)\omega^*}{\gamma} \right) )</td>
<td></td>
</tr>
<tr>
<td>( y^* = -\alpha\gamma(\omega^* - \omega) - \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \pi^* = \pi^E = \mu_f E (\gamma(g - g) + (1-\gamma)(\gamma^<em>-g^</em>)) )</td>
<td></td>
</tr>
<tr>
<td>( \tau^* = \tau^E = -(\gamma \omega + (1-\gamma)\omega^<em>) + \frac{\delta E}{\delta F^2 \alpha^2} (\gamma(g - g) + (1-\gamma)(\gamma^</em>-g^*)) )</td>
<td></td>
</tr>
</tbody>
</table>

A monetary union implies that a country can no longer control its inflation rate but instead adopts the common rate of inflation as determined by the ECB. Moreover, seignorage redistribution occurs if the ECB seignorage is not redistributed proportional.
to the size of the countries that form the monetary union. A monetary and fiscal union implies that a country also has no longer control over its rate of output taxation but instead adopts a common tax rate that is set by the federal fiscal authority. In addition, fiscal revenues are redistributed if the revenue distribution is not proportional to the size of the countries that form the monetary union. Clearly, the instrument of fiscal redistribution is a very powerful instrument in the hands of the federal fiscal authority to pursue its fiscal policy objectives and has a direct effect on macroeconomic outcomes under EMU.

A monetary union and in particular a monetary union plus fiscal union imply a much more complicated interaction between both countries as compared to the case with national monetary policy autonomy in section 2. This witnesses e.g. the fact that we are no longer able to sign unambiguously the partial derivatives of the various variables w.r.t. the model parameters without imposing further restrictions. Under EMU we find that compared with national monetary policy autonomy, not only changes in the domestic real wage and government spending target affect domestic outcomes but also changes in the foreign targets affect the domestic economy. These spillovers result under EMU because monetary policy of the ECB reacts changes in both domestic and foreign targets. Therefore, seignorage revenues are affected and by that taxation, government spending and output in both countries. This interaction of monetary and fiscal policies in the EU is further intensified in a monetary and fiscal union. There, not only the common monetary policy reacts to domestic and foreign wage and government spending targets but so does the common fiscal policy.

5. Structural Asymmetries and Their Consequences on EMU

It is interesting to compare the three institutional configurations that were considered in section 2 -the pre-EMU situation with national monetary policy autonomy, or alternatively a two-speed monetary union-, section 3 -a monetary union with national fiscal policy autonomy- and section 4 -both a monetary and fiscal union in the EU-. In particular, we like to compare the outcomes of these regimes in the presence of structural asymmetries between the EU countries since the EU countries are currently far from homogeneous regarding economic structure, macroeconomic performance and policy preferences. These structural asymmetries are likely to show some degree of persistence in the transition towards a full monetary union in Europe, moreover. Here, we focus on the effects of two important asymmetries that could exist between the two countries that participate in the EMU: (i) differences in the commitment ability of their national monetary authorities, (ii) differences in fiscal preferences. The first asymmetry is of crucial importance when a monetary union is formed, the second when a monetary and fiscal union is introduced.

Consider the formation of a monetary union between country 1 and 2 in a situation where the monetary authorities of country 1 are able to credibly commit their monetary policies towards the private sector whereas the monetary authorities in country 2 are not. As such, country 1 could represent a group of 'core' countries around Germany that have established a strong low inflation commitment in their monetary policies whereas country 2 could represent the group of 'peripheral' Mediterranean countries that have a less solid low inflation reputation. Consequently, with national monetary policy autonomy, country 2 features a higher inflation rate than country 1. Therefore, it relies relatively more on seignorage revenues and relatively less on ordinary taxes to finance government spending than country 1. From such an initial situation it is interesting

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10It is indeed often argued that a 'two-speed' monetary union is preferable for the peripheral Southern European countries. For these countries it is efficient to rely relatively more on seignorage revenues
to study the effects for both countries from entering a monetary union. This asymmetry in commitment ability of the national monetary authorities can best be analyzed from an initial setting where the countries are symmetric in all other respects. Otherwise, the analysis is blurred by the effects of other differences between both countries. Also, the expressions become increasingly difficult to handle if more asymmetries are analyzed at the same time and the effects when moving from national monetary policy autonomy to a monetary union in that case can take any direction in principle. Therefore, we impose the following symmetry conditions: $\delta_1 = \delta_1^*, \delta_2 = \delta_2^*, \mu_1 = \mu_1^E, \mu_2 = \mu_2^E$, $\omega = \omega^*, g = g^*$ and $\theta = \gamma$, implying that policy weights, government spending targets and real wage targets coincide and that ECB seignorage is redistributed according to the size of the EU countries.

For country 1 it is in particular interesting to compare outcomes under national monetary policy commitment with outcomes under a monetary union where the ECB implements the common monetary policy with discretion. It is indeed often asserted and feared in Germany that the ECB may suffer from commitment problems and will not have the high anti-inflation credibility of the Bundesbank. From the perspective of country 2, on the other hand, it is particularly interesting to analyze how it is affected when it enters a monetary union with an ECB that can implement the common monetary policy with commitment. It is straightforward\textsuperscript{11} from Tables 1 and 2 to calculate in both cases the effects when moving from national monetary policy autonomy to a monetary union for country 1 under the assumption that its (former) national monetary authority was able to implement its monetary policy with commitment whereas the ECB fails to do so and relies on discretionary monetary policies. A monetary union with discretionary monetary policies of the ECB results in higher inflation in country 1, which is welfare deteriorating, but also in lower taxes, higher output and higher government spending which are welfare improving. The net welfare effect is, therefore, ambiguous. In this particular setting of otherwise symmetric countries, the effects for country 2 moving from a setting with national monetary policy discretion to an EMU in which the ECB implements the common monetary policy with commitment are exactly opposite to those of country 1 moving from national monetary commitment to a monetary union with monetary policy discretion of the ECB. Therefore, government spending, output and inflation will all be lower in country 2 after entering the monetary union, taxation will be higher and the net welfare gain also ambiguous. The asymmetry in the ability with which their national monetary authorities can commit the monetary policies towards the private sector is seen to have asymmetric effects on both countries when entering a monetary union.

A second asymmetry we are interested in are differences in fiscal structures. The fiscal structure of both countries is summarized by the fiscal targets and preference weights \{$g, g^*, \delta_1, \delta_1^*$\}. Differences in these fiscal structures are important both when a monetary union is established and also when in addition fiscal unification is carried out in the EU. First, we consider the formation of a monetary union between the two countries which are assumed to be symmetric in all respects, except that country 2 has a higher government spending target, implying that $\delta_1 = \delta_1^*, \delta_2 = \delta_2^*, \mu_1 = \mu_1^E, \mu_2 = \mu_2^E$, $\omega = \omega^*, \theta = \gamma$ and $g < g^*$. Assume, moreover, that both countries do not differ in their commitment ability towards the private sector and that the ECB also features the same commitment ability as the former national monetary authorities. It is straightforward to calculate the effects of this second asymmetry when EMU is implemented. The higher government spending target of country 2, implies more inflationary policies of the ECB.

\textsuperscript{Details of all calculations in this paper are available for the interested reader upon request.}
Therefore, inflation in country 1 is higher after entering the EMU. With the proportional redistribution of ECB seigniorage, country 1 then has more seigniorage revenues than under national monetary policy autonomy. This enables an increase in government spending and a lowering of tax revenues which increases output on its turn. The effects of the differences in government spending targets are -besides other parameters- a function of the size parameter $\gamma$: if $\gamma$ gets larger, the importance of country 1 in the EU increases and the effects from entering a monetary union with country 2 that has a higher government spending target decrease. Its larger size implies that its own preferences have a larger influence in the design of ECB monetary policy.

In case EMU evolves from a monetary union to a monetary and fiscal union, the preference weights of the federal fiscal authority $\{\delta^F_1, \delta^F_2\}$ determine the outcomes, rather than the national preference weights. A third asymmetry can therefore be identified if the fiscal preferences differ. Therefore, it is interesting to explore how the preference weights of the national and federal fiscal authorities affect outcomes under EMU. In particular, we assume that both countries are symmetric except that the fiscal authorities in country 2 attach a higher weight to government expenditure stabilization than the fiscal authorities in country 1. Moreover, we assume that the common fiscal authority features the same weight to government spending as the fiscal authority of country 2. Therefore, we consider the case where $\delta_1 = \delta^*_1 = \delta^F_1$, $\mu_1 = \mu^*_1 = \mu^F_1$, $\mu_2 = \mu^*_2 = \mu^F_2$, $\omega = \omega^*$, $\theta = \gamma = \phi$, $g = g^*$ and $\delta_2 = \delta^F_2 > \delta_2$. It is important to realize that in this case, countries receive a proportional share in seigniorage and tax revenues under fiscal union and there is no effective redistribution of seigniorage and tax revenues. A comparison between an EMU with national fiscal autonomy and an EMU that features also a fiscal union, then provides us with insight how fiscal unification could affect outcomes in both countries. It is relatively straightforward to calculate the effects on government spending, taxation, output and inflation in both countries from fiscal unification in this case. The effects are unambiguous and of the same direction both with and without commitment in the design of the common monetary policy by the ECB. The effects are of course strongest for country 1: under a fiscal union, taxes and government spending unambiguously increase and output declines compared to a monetary union with national fiscal autonomy. This is because now relatively more weight is attached to government spending in country 1 then before under national fiscal autonomy. An interesting indirect effect is provoked: the ECB sets a lower rate of inflation as it reacts to the higher weight in the fiscal player(s) objective functions that is now attached to government spending in country 1. The lower inflation under fiscal union has a negative side effect as both countries will have less seigniorage revenues available to cover government spending than before under monetary union with national fiscal autonomy. As a result of this secondary effect also country 2 is affected: government spending declines, taxes increase and output decreases in country 2 to make up for the loss in seigniorage revenues.

Conclusions

This paper studied the effects of monetary and fiscal unification in the European Union in the context of a highly stylized model on the interaction of monetary and fiscal policy, proposed by Alesina and Tabellini (1987). The model was extended to a two-country monetary union in which a common central bank, the ECB, determines the common monetary policy. An important aspect that was studied, concerned the implications of whether or not the ECB could commit its monetary policy towards the EU private sector. The possibility to extend EMU to a fiscal union was considered. Undoubtedly, fiscal federalism issues will become increasingly important with proceeding of economic

\[\text{Without this assumption the effects on both countries from fiscal unification can take any direction.}\]
and political integration and monetary unification as entailed by EMU. A stylized interpretation of the fiscal federalism issues was considered by introducing a federal fiscal authority in the EU that operates a European tax system and redistributes the proceeds to the individual countries, or regions if one likes. In an EMU that also features fiscal union, both seignorage and fiscal redistribution are seen to affect macroeconomic outcomes. Two possible asymmetries between EU countries were studied: (i) differences in the commitment ability of the national monetary authorities and (ii) differences in fiscal structures. It was shown how the first asymmetry affects both countries when they enter a monetary union where the ECB differs in commitment (in)ability from the (former) national monetary authorities. The second asymmetry proves to be important both when the monetary union is entered and when the monetary union is complemented by a fiscal union in which taxation is centralized. If the federal fiscal authority features different preference weights than the national fiscal authorities it will set a common tax rate that is (possibly much) different from the optimal national tax rates with all the consequences for output and government spending in the EU countries.

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