Rules and discretion with common central bank and separate fiscal authorities

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Abstract

This paper evaluates the implications of international policy coordination under the setting of a common monetary authority and separate fiscal authorities. The paper considers a two-country framework with noncoordinated monetary and fiscal policies. The deviations of output, public expenditure, and inflation from target levels are obtained under symmetric and asymmetric regimes of rules and discretion. The expressions for output, inflation, and government expenditure deviation from target are also obtained under coordinating fiscal authorities and compared with similar expressions under insular fiscal policy making. © 2001 Elsevier Science Inc. All rights reserved.

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1. Introduction

The aim of this paper is to evaluate fiscal and monetary policy implications of a monetary union composed of two countries, with separate fiscal authorities. The Maastricht Accord has no provision for a single fiscal policy to complement the single monetary policy. Fiscal policy will remain in the hands of the national governments. Their individual and uncoordinated actions could make a large difference not only to the fiscal stance of the union as a whole, but also the macroeconomic performances e.g. the inflation performance. The analysis in this paper considers the effects on inflation, output and government expenditure when
the common monetary authority chooses a composite inflation rate for the two countries, the fiscal authorities choose the tax rates for their respective countries, and monetary policy is jointly and centrally managed. In the benchmark model, the monetary policy for the two countries is placed under a single monetary authority. This authority aims to achieve both countries’ goals and is responsible for defining the monetary policy for the union.

A two-country framework with a common monetary authority but separate fiscal authorities is considered. In the model, the fiscal authorities choose the taxes for each country. The monetary authority chooses a composite inflation rate, which is a weighted average of the endogenously determined inflation rates in the two countries. The implicit inflation rates are defined as the change in price levels in each country, with the previous year’s price level normalized to zero. It is assumed that the monetary and fiscal authorities do not cooperate in their choice of inflation and tax rates. The monetary authority chooses the inflation rate that minimizes its loss. Similarly, each fiscal authority chooses the level of taxes that minimizes its own loss. Each nation’s loss is represented as a weighted sum of squared deviations of inflation, output and public expenditure from their target levels. The expressions for the composite inflation, public expenditure and output are obtained.

The following cases are considered below:

(i) Discretion, in which monetary and fiscal authorities do not commit to the private sectors and thus act on their own discretion.
(ii) Commitment, in which the monetary and fiscal authorities make binding commitments to the private sector.
(iii) Monetary authority is discretionary, while the fiscal authorities act in a committed manner.
(iv) Monetary authority commits, while the fiscal authorities act in a discretionary manner.
(v) The monetary authority and a fiscal authority are committed, while the other fiscal authority is discretionary.

The model under consideration in this paper is a blend of Bryson, Jensen, and VanHoose (1993) and Duca and VanHoose (1990). In this paper, a common monetary authority sets a composite inflation rate. In contrast, Bryson et al. consider separate monetary authorities in each country which set inflation rates in their respective countries. My model assumes that a common monetary authority has been established. Thus, the fiscal authorities consider a common inflation rate in their respective budget constraints. As a result, the government budget constraints are a modified version of the budget constraint represented by Alesina and Tabellini (1987). In the Alesina and Tabellini case, the government budget is financed by direct taxes and the entire amount of money seigniorage in each country. In my model, each country’s budget is financed from direct taxes and from the fraction of the common money seigniorage available to each country.

Article 103 of the Maastricht Treaty instructs members to “coordinate (their economic policies) within the Council (of ministers).” This aspect of the Treaty is represented by the fiscal coordination scenario in the paper, whereby the fiscal authorities coordinate their choice of tax rates to minimize the joint social loss function for both countries. The European Council will monitor developments in member countries and make recommendations to
national governments when the latter’s policies deviate from the guidelines. If countries do not respond to the directives, the Council may recommend that the European Investment Bank stop lending to the country, require it to make noninterest bearing deposits with the Community and impose fines. The Stability and Growth pact, (1995), emphasizes the importance of maintaining sound government budgetary discipline as a means to strengthening the conditions for price stability and strong sustainable growth conducive to employment creation. The rules of the stability pact were aimed at keeping the budget deficits within 3% of GDP. According to the “excessive deficits” criteria, sanctions and fines would be imposed on member countries violating the 3% deficits to GDP criterion. In the context of my model, this corresponds to a situation in which the fiscal authorities act in a committed fashion and adhere to rules regarding the tax rates imposed in their respective countries.

The temptation to use monetary policy for short-term gains in employment or reductions in real value of government debt causes credibility problems vis-a-vis the private sector. This situation is represented by the monetary discretion scenario in the model developed in the paper. On the other hand, the central bank could be made independent of the government and the electorate and be given a reward for maintaining price stability. The monetary commitment scenario considered in the paper reflects the realization of this outcome. Allan Drazen (1989) shows that free capital markets and inflation convergence would force the European countries to restructure their tax revenue base, replacing inflation taxes with more direct taxes. My paper considers a tax effect and seigniorage effect, which reveals the likely impact on government spending.

The paper is organized as follows. The two-country framework with a common monetary authority is presented in section II. In section III.A and III.B, the solutions for inflation, output and public expenditure deviations under symmetric and asymmetric scenarios of rules and discretion are analyzed, respectively. This reveals the interactions among fiscal distortions and monetary and fiscal policy time-inconsistencies in a two-country monetary union. Section IV deals with the scenarios of rules and discretion under fiscal coordination. Concluding observations are made in section V.

2. Model

Following VanHoose (1992) and Bryson et al. (1993), the model is a two-country extension of the closed-economy framework of Alesina and Tabellini (1987). As in Bryson et al. (1993), the two fiscal authorities choose the respective tax rates for each country. The overall composite inflation rate is a choice variable for the monetary authority, but it can be expressed as a weighted average of the endogenously determined inflation rates in the two countries. Their individual inflation rates adjust endogenously to the monetary authority’s decision about the overall inflation for the union. The government budget constraint used in the model is a modified version of that used in Alesina and Tabellini (1987) and Bryson et al. (1993), in which the government expenditure (g) is represented as the ratio of nominal government spending to nominal income. A log linear production function is considered, such that output may be expressed in terms of the logarithm of equilibrium employment level.
The following two-country framework is as follows:

\[ \Pi_t^c = \phi \Pi_t + (1 - \phi) \Pi_t^* \]  

(1)

where \( \Pi_t^c \) is a composite inflation rate; and \( \Pi_t \) and \( \Pi_t^* \) are the endogenously determined inflation rates for the prices of goods produced in countries 1 and 2 respectively. In each country, workers consume a fraction, \( \beta \), of home country output and a fraction \( (1 - \beta) \) of foreign country output. A fraction \( \phi \) of country 1 inflation and a fraction \( (1 - \phi) \) of country 2 inflation contributes towards the composite inflation. The common monetary authority sets the composite inflation rate for the two countries. The fraction \( \phi \) is chosen proportional to the size or population of country 1 relative to country 2, so that more weight is attached to the endogenously determined inflation of the country having a larger population. The government budget constraints faced by the countries’ fiscal authorities are:

\[ g_t = \tau_t + \Omega \Pi_t^c \]  
\[ g_t^* = \tau_t^* + (1 - \Omega) \Pi_t^c \]  

(2a) \hspace{1cm} (2b)

where \( \Omega \) is the fraction of common monetary seigniorage allocated by the common monetary authority to country 1. The fraction would depend on the size of the country in the Union. These approximations to the government budget constraints follow Alesina and Tabellini (1987), by abstracting from the intertemporal dimension of the government budget constraint through the assumption that government expenditures are not financed by issuance of public debt.\(^1\) Government expenditures are determined once tax rates and money seigniorage have been chosen. Unlike Alesina and Tabellini, there is a common money seigniorage for the two countries, which is determined by the overall inflation rate set by the single central bank. The common monetary seigniorage is divided between the two countries. Government expenditure is financed partly from taxes and partly from the seigniorage revenues.

As in Duca (1987) and Duca and VanHoose (1990), the workers value real wages they earn in terms of the aggregate consumer price index, which accounts for the price level in both the countries, as they consume output from both the countries. In contrast, the firms value the real wages they pay in terms of the prices of the products which they produce. Thus, the aggregate consumer price index enters the labor supply functions while home price levels enter the labor demand functions. The labor supply functions for country 1 and 2 are expressed as in Duca and VanHoose (1990) in country 1 and 2 respectively:
where $w_t$ and $w^*_t$ represent the log of nominal wage in country 1 and 2 respectively. On the labor demand side, firms choose the quantity of labor employed to maximize their profits. As in Bryson et al. (1993), the domestic fiscal authorities tax the sales of domestic firms as well as foreign firms at the domestic tax rate, within its borders. Using the first-order condition for profit maximization, the labor demand functions are:

\begin{align}
l^*_t &= c(w^*_t - \hat{p}_t) \\
l^{*d}_t &= c(w^*_t - \hat{p}^*_t)
\end{align}

(3a) \hspace{1cm} (3b)

where $b = 1/(1 - a) > 0$ and $0 < a < 1$. Labor demand depends negatively on real wages and tax rates. The coefficient ‘a’ is obtained from the production function ($y = al$). The derivation of the labor demand functions is obtained in App. A of Bryson et al. (1993).

The aggregate supply functions for the two economies follow from a nominal wage contracting approach. The details of the calculation are available from the author upon request. First, labor supply is equated with labor demand to obtain the Walrasian, full-information wage. The contract wage is equal to the expected value of the full-information wage. The contract wage is then substituted into the labor demand function, and output is obtained by substituting the labor demand function into the log-linear production function ($y = al_t$):

\begin{align}
y_t &= (a/b + c)(b^2(\Pi_t - \Pi^r_t) + bc(\Pi_t - \hat{\Pi}^r_t) - b^2\beta(\tau_i - \tau^*_i) - bc\beta\tau_t) \\
&\quad - b^2(1 - \beta)(\tau^*_i - \tau^*_t) - bc(1 - \beta)\tau^*_t) \\
y^*_t &= (a/b + c)[b^2(\Pi^*_t - \Pi^*_t) + bc(\Pi^*_t - \hat{\Pi}^*_t) - b^2(1 - \beta)(\tau_i - \tau^*_i) - bc(1 - \beta)\tau_t] \\
&\quad - b^2\beta(\tau^*_i - \tau^*_t) - bc\beta\tau^*_t)
\end{align}

(4a) \hspace{1cm} (4b)

(5b) \hspace{1cm} (5b)

In Eq. (5), overall CPI inflation is $\hat{\Pi} = \beta \Pi + (1 - \beta)\Pi^*$. Taking expectations and rearranging terms we obtain: $\hat{\Pi}^e = (1 - \beta)z^e + \Pi^e$, where the real exchange rate depreciation is defined by: $z = \Pi^* + e - \Pi$, and $e$ is the rate of nominal exchange rate depreciation expressed in terms of home currency per unit of foreign currency. In case of a common currency, we can consider $e = 0$ (in logs). The domestic aggregate supply has a negative relationship both with the domestic and the foreign tax rates. The derived labor demand for domestic firms depend on sales at home and abroad. As a result, the domestic firms production may fall due to a rise in foreign tax rates. The nominal income equilibrium condition shows the relationship between nominal income and desired private nominal spending as well as government spending. Following Bryson et al. (1993), it may be represented as follows:

\begin{align}
P_t Y_t = [(1 - \tau_i) P_t Y_t]^{1-\theta}P_0^{-1}(1 - \tau^*_i) P^*_t Y^*_t]^{1-\beta}(EX P^*_t) - G_t
\end{align}

(6)
the degree of market integration and increases with greater integration of markets. Dividing
by $P_t Y_t$ on both sides of Eq. (6), and taking logs we get after simplification the implied real
exchange rate depreciation (similar to Bryson et al.):
\[
\begin{align*}
\tilde{z} &= \frac{1 - \beta}{\theta} [\Pi_t - \Pi_t^* - \tau_t + \tau_t^* + y_t - y_t^*] \\
&= \frac{(\theta + 1 - \beta)}{1 - \beta} (\Pi^* - \Pi) + y^* + (\tau - \tau^*) \tag{7}
\end{align*}
\]

The equilibrium conditions for domestic and foreign goods, which follow from above
nominal income equilibrium condition, are given by
\[
\begin{align*}
y &= \frac{(\theta + 1 - \beta)}{1 - \beta} (\Pi^* - \Pi) + y^* + (\tau - \tau^*) \tag{8a} \\
y^* &= \frac{(\theta + 1 - \beta)}{1 - \beta} (\Pi - \Pi^*) + y + (\tau^* - \tau) \tag{8b}
\end{align*}
\]

Substituting for the CPI inflation in Eq. (5a), we obtain the domestic aggregate supply
function in terms of the implicit real exchange rate depreciation:
\[
\begin{align*}
y_t &= (a/(b + c))\{(b^2 + bc)(\Pi_t - \Pi_t^*) - b^2\beta(\tau_t - \tau_t^*) - bc\beta\tau_t \\
&\quad - b^2(1 - \beta)(\tau_t^* - \tau_t^*) - bc(1 - \beta)\tau_t^* - bc(1 - \beta)\tilde{z}\} \tag{9a}
\end{align*}
\]

Similarly, the aggregate supply in country 2 may be expressed in terms of the expected real
exchange rate depreciation:
\[
\begin{align*}
y_t^* &= (a/(b + c))\{(b^2 + bc)(\Pi_t^* - \Pi_t^*) - b^2(1 - \beta)(\tau_t - \tau_t^*) - bc(1 - \beta)\tau_t \\
&\quad - b^2\beta(\tau_t^* - \tau_t^*) - bc\beta\tau_t^* + bc(1 - \beta)\tilde{z}\} \tag{9b}
\end{align*}
\]

Eqs. (9a) and (9b) are similar to Bryson et al. They differ from Alesina and Tabellini in
that both monetary and fiscal policies are subject to potential time inconsistencies. In terms
of Eq. (9), we notice that the higher the actual inflation rate is relative to the rate expected
by the private sector, the higher is output and employment. Again, the lower the actual tax
rate is relative to the expected tax rate, the higher is output.

Full-information output is the output obtained in the absence of any uncertainties, or, in
the context of Eq. (9), the output when inflation, tax and real exchange rate are equal to their
expected values.
\[
\begin{align*}
y^f &= \frac{a}{(b + c)} \{- bc\beta\tau_t - bc(1 - \beta)\tau_t^* - bc(1 - \beta)\tilde{z}\} \tag{10a} \\
y^* f &= \frac{a}{(b + c)} \{- bc(1 - \beta)\tau_t - bc\beta\tau_t^* + bc(-\beta)\tilde{z}\} \tag{10b}
\end{align*}
\]

The desired or target output level in each nation is assumed to be the level of full-information
output without any tax distortions. The taxes tend to reduce the level of output below its ‘natural’
level. The nondistorted output in each country may be expressed as follows:
The policy makers aim to minimize the deviation of actual output from the desired or nondistorted output. Combining Eqs. (9) and (11), we get the following expressions for deviations of output from the nondistorted or target level in countries 1 and 2, respectively:

\[
\tilde{y} = \frac{abc}{(b + c)} (1 - \beta) z \tag{11a}
\]

\[
\tilde{y}^* = \frac{abc}{(b + c)} (1 - \beta) z \tag{11b}
\]

The policy makers aim to minimize the deviation of actual output from the desired or nondistorted output. Combining Eqs. (9) and (11), we get the following expressions for deviations of output from the nondistorted or target level in countries 1 and 2, respectively:

\[
(y - \tilde{y}) = (ab/b + c)((b + c)(\Pi_i - \Pi_i^*) - b\beta(\tau_i - \tau_i^*) - c\beta\tau_i

- b(1 - \beta)(\tau_i^* - \tau_i^{*e}) - c(1 - \beta)\tau_i^* - c(1 - \beta)(z^e - z)) \tag{12a}
\]

\[
(y^* - \tilde{y}^*) = (ab/b + c)((b + c)(\Pi_i^* - \Pi_i^{*e}) - b(1 - \beta)(\tau_i - \tau_i^*) - c(1 - \beta)\tau_i

- b\beta(\tau_i^* - \tau_i^{*e}) - c\beta\tau_i^* + c(1 - \beta)(z^e - z)) \tag{12b}
\]

Similarly, the policy makers have a desired level of public expenditure, \((\tilde{g})\), which may be higher than the actual level of government spending \((g)\). The authorities aim to minimize the discrepancy between the actual and desired level of public expenditure, and this is incorporated in their loss functions. The common monetary authority seeks to minimize the following loss function:

\[
V_{MA} = \frac{1}{2} (\Pi^e)^2 + \mu_1 \left\{ \Psi \frac{1}{2} (y - \tilde{y})^2 + \frac{2 - \Psi}{2} (y^* - \tilde{y}^*)^2 \right\}

+ \mu_2 \left\{ \Psi \frac{1}{2} (g - \tilde{g})^2 + \frac{2 - \Psi}{2} (g^* - \tilde{g}^*)^2 \right\} \tag{13}
\]

where, \(\mu_1 > 0\), \(\mu_2 > 0\), and \(\tilde{g} = \text{target government spending} > 0\). Time indices have been omitted for notational convenience. The monetary authority seeks to minimize the deviation of common inflation rate, \(\Pi^e\), from a goal of zero, departures of output from nontaxed distorted output, and deviations of public expenditure from the target government spending. The loss weights on output and public spending deviations from target are assumed to depend on the relative size of the countries in terms of their population or output.

The fiscal authorities choose the tax rates in their respective countries to minimize the following loss functions:

\[
V_{FA} = \frac{1}{2} [(\Pi^e)^2 + \delta_1(y - \tilde{y})^2 + \delta_2(g - \tilde{g})^2] \tag{14a}
\]

\[
V_{*FA} = \frac{1}{2} [(\Pi^e)^2 + \delta_1^*(y^* - \tilde{y}^*)^2 + \delta_2^*(g^* - \tilde{g}^*)^2] \tag{14b}
\]

As in Alesina and Tabellini, the fiscal authorities are assumed to attach at least as much weight on the output and government spending objective relative to inflation as compared to
the monetary authority (i.e. $\delta_1, \delta_1^* \geq \mu_1$ and $\delta_2, \delta_2^* \geq \mu_2$). Therefore, the fiscal authorities’ concerns about output and public expenditure deviations from target levels are at least as great as those of the common monetary authority. The member countries in the EMU differ in respect to their economic structure, macroeconomic performance, and fiscal policy preferences. The effects on national macroeconomic performance due to asymmetries in the national fiscal preferences, $\delta_1 \neq \delta_1^*$, $\delta_2 \neq \delta_2^*$, and the desired levels of government spending, $g \neq g^*$ have been analyzed in the context of a two-country monetary union by B. Van Aarle and Huart (1999).

3. Policy making under rules and discretion

3.1. Symmetric policy making scenarios

In the initial setting, we consider a discretionary monetary authority which does not precommit to a given inflation rate. The fiscal authority of a country is assumed not to coordinate with either the common monetary authority or the fiscal authority of the other country. Under the symmetric discretionary setting, we also assume that neither of the fiscal authorities precommit to policy rules. In such a discretionary scenario, the actual values of inflation and taxes may not equal ex ante to their expected values. The single monetary authority chooses the common inflation rate, $\Pi_c$, to minimize its loss function. The fiscal authorities choose the tax rates in their own countries to minimize the loss functions in Eqs. (14a) and (14b), respectively. The time-consistent ex post solutions under monetary and fiscal discretion (MFD) for output deviation from nontaxdistorted level, public expenditure deviation from target, and the common inflation rate in the presence of noncoordinating monetary and fiscal authorities are given by:

\[
(y - \bar{y})^{MFD} = \frac{-abc \delta_2 \delta_2^*}{(b + c)\delta_2 \delta_2^* + abc[D\delta_1 \delta_2^* + D\delta_1^* \delta_2 + \Omega \delta_2^*(\mu_1 \delta_2 B + \mu_2 \delta_1 AD)]} (\beta \bar{g} + (1 - \beta) \bar{g}^*) \tag{15a}
\]

\[
(\bar{g} - g)^{MFD} = \frac{abc \delta_1 \delta_2^* D}{(b + c)\delta_2 \delta_2^* + abc[D\delta_1 \delta_2^* + D\delta_1^* \delta_2 + \Omega \delta_2^*(\mu_1 \delta_2 B + \mu_2 \delta_1 AD)]} (\beta \bar{g} + (1 - \beta) \bar{g}^*) \tag{15b}
\]

\[
(\Pi_c)^{MFD} = \frac{abc \delta_2^*(\mu_1 \delta_2 B + \mu_2 \delta_1 AD)}{(b + c)\delta_2 \delta_2^* + abc[D\delta_1 \delta_2^* + D\delta_1^* \delta_2 + \Omega \delta_2^*(\mu_1 \delta_2 B + \mu_2 \delta_1 AD)]} (\beta \bar{g} + (1 - \beta) \bar{g}^*) \tag{15c}
\]
where $A = 2\psi \Omega$

\[
B = \frac{2\psi ab}{\theta}
\]

and

\[
D = ab\beta + \frac{abc}{(b + c)\theta} (1 - \beta)^2 [1 + ab\beta - ab(1 - \beta)]
\]

The nondistorted or target output, $\bar{y}$, is expressed in terms of the real exchange rate depreciation, $z$. The domestic output deviation from nontaxdistorted level and the public expenditure deviation from target equal their foreign counterparts in this symmetric equilibrium.

We now consider the scenario in which the common monetary authority and the countries’ fiscal authorities precommit to their respective private sectors. In the context of the proposed European Monetary Union (EMU), the explicit price stability target of the European Central Bank supports monetary policy commitment. Fiscal commitment could be desirable under the Stability Pact Agreement of the EMU. In this case the solutions are obtained under the \textit{ex ante} assumption that actual values of inflation and taxes equal the expected values. The following solutions are obtained under monetary and fiscal commitment (MFC):

\[
(y - \bar{y})^{MFC} = \frac{-abc\delta_2\delta^*_2}{(b + c)\delta_2\delta^*_2 + abc[E\delta_1\delta^*_2 + E\delta_1\delta^*_2 + \Omega\delta^*_2(\mu_2\delta_1AE)]}
\]

\[
(b\bar{g} + (1 - \beta)\bar{g}^*) \quad (16a)
\]

\[
(\bar{g} - g)^{MFC} = \frac{abc\delta_1\delta^*_2}{(b + c)\delta_2\delta^*_2 + abc[E\delta_1\delta^*_2 + E\delta_1\delta^*_2 + \Omega\delta^*_2(\mu_2\delta_1AE)]}
\]

\[
(b\bar{g} + (1 - \beta)\bar{g}^*) \quad (16b)
\]

\[
(\Pi^C)^{MFC} = \frac{abc\delta^*_2\mu_2\delta_1AE}{(b + c)\delta_2\delta^*_2 + abc[E\delta_1\delta^*_2 + E\delta_1\delta^*_2 + \Omega\delta^*_2(\mu_2\delta_1AE)]}
\]

\[
(b\bar{g} + (1 - \beta)\bar{g}^*) \quad (16c)
\]

where, $E = \frac{abc}{(b + c)} \beta$

Superscripts MFD and MFC refer to reduced form solutions under Monetary and Fiscal Discretion and Monetary and Fiscal Commitment, respectively.

Comparing the solutions for output deviation from the non tax-distorted level, we observe that output in each country under monetary and fiscal discretion (MFD) is greater than that under monetary and fiscal commitment (MFC) under the restriction of $\beta \geq 0.5$. The restriction requires that in each country workers consume at least as much of home output as foreign output. The committed monetary authority has to honor its announced inflation...
rate. On the other hand, the discretionary monetary authority is able to reduce the discrepancy between actual output and non tax-distorted output by choosing a higher inflation rate than that expected by the private sector. As a result, the discretionary monetary authority chooses a higher inflation rate. Committed fiscal authorities have an incentive to set high tax rates. This incentive arises due to the commitment of the central bank towards the private sector. The lower composite inflation under monetary commitment induces the fiscal authority to set higher tax rates. The higher taxes under commitment compensates for the lower seigniorage revenues resulting from lower inflation in the commitment case.

The discretionary fiscal authorities, on the other hand, have the freedom to make unexpected tax cuts to increase output. Thus, discretionary fiscal authorities choose lower tax rates than the committed authorities. The discretionary authorities choices of lower taxes are compensated by the higher seigniorage revenues obtained on choosing a higher inflation rate. The higher composite inflation rate is chosen by the central bank which acts in a discretionary manner. As a result, the discretionary fiscal authorities have an incentive to decide lower tax rates. The higher tax distortions under commitment reduce output compared to the discretionary regime.

Monetary policy time-inconsistency problems do not arise in the commitment case. Government expenditures could be better financed with higher taxes raised under fiscal commitment. Also, seigniorage revenues are lower under monetary commitment.

On comparing the two regimes, we notice that inflation is higher in the discretionary scenario while taxes are higher under the commitment scenario. When the difference between taxes in the commitment and discretionary regimes are greater than the difference between seigniorage revenues, then the tax effect is said to dominate the seigniorage effect. To check whether the tax effect dominates the seigniorage effect, or vice-versa, in this policy making framework we compare the government spending under monetary and fiscal discretion (MFD) and monetary and fiscal commitment (MFC), respectively. The formal comparison of the tax effect and the seigniorage effect has been illustrated in the appendix.

The tax effect dominates the seigniorage effect, which implies that government spending under commitment is higher than that under discretion. The domestic fiscal authority has the incentive to transfer the cost of increased taxation to the foreign firms, and therefore to the foreign country. Therefore, by increasing taxes the domestic fiscal authority gains higher tax revenues from the sales of foreign firms within its borders. The same reasoning holds for the foreign fiscal authority, which also sets higher tax rates. The incentive to resort to tax increases may be balanced against a lower output level. Taxes are higher under commitment (MFC) than under the discretionary (MFD) scenario. The discretionary fiscal authority has the flexibility to increase output by producing unexpected tax cuts, while the committed fiscal authority loses this ability. As a result taxes are set higher under the MFC environment. On the other hand, inflation is higher under discretion (MFD) than under commitment (MFC). However, as the target inflation is zero, the discretionary authority would also try to minimize the deviation from the target. Also, in the context of the EMU, the European System of Central Banks (ESCB) statutes regarding price stability objective and no monetary financing of public deficits would limit discretionary monetary policy making by the common central bank. These would limit the central bank from producing unexpected inflation. Under monetary commitment, inflation would be even lower as there is no flexibility of increasing
output via unexpected inflation. The difference between taxes under MFC and MFD would then be greater than the fraction of the difference between the inflation or seigniorage revenues between the MFD and MFC scenarios. Therefore, the tax effect dominates the seigniorage effect so that the government spending under commitment (MFC) is greater than under discretion (MFD).

Under discretion, the private sector expects the monetary authority to inflate due to the time-inconsistency problem. Also, the private sector of country 1 anticipates manipulation of taxes (e.g. tax rate cuts by domestic government, because the fiscal authorities are also acting in a discretionary manner in this set-up) in order to obtain higher inflation tax revenues from the common central bank. Therefore, the private sector expects higher implicit domestic inflation relative to foreign inflation in the future. As a result, the private sectors increase their current consumption at home relative to foreign output (i.e. $\beta > 0.5$). This process carries on due to the potential time-inconsistency problem. An increase in consumption expenditures translates to an increase in domestic aggregate demand which in turn raises the price level and the real output. The same reasoning holds for the foreign country. Under commitment, there is no time-inconsistency problem and hence no incentive to increase current consumption expenditures, which results in lower inflation and output compared with the discretionary case.

3.2. Asymmetric policy making scenarios

We next consider the asymmetric policy making framework. In the asymmetric setting, it is assumed that the monetary authority and the fiscal authorities act in opposite ways with respect to rules and discretion. The first case considers the situation in which the common monetary authority acts in a discretionary manner, while the fiscal authorities in the two countries precommit to its choice of tax rates in each country. In this scenario, the taxes are ex ante equal to the values expected by the respective private sectors, while the inflation rate differs from that expected by the private sectors. The fiscal authority of a country is again assumed not to coordinate with either the common monetary authority or the fiscal authority of the other country. Reduced-form solutions for output, government expenditure and composite inflation under monetary discretion and fiscal commitment (MDFC) are obtained as follows:

\[
(y - \bar{y})^{\text{MDFC}} = \frac{-abc\delta_2\delta_2^*}{(b + c)\delta_2\delta_2^* + abc[E\delta_1\delta_2^* + E\delta_1\delta_2 + \Omega\delta_2^*(\mu_1\delta_2B + \mu_2\delta_1AE)]} (\beta\bar{g} + (1 - \beta)\bar{g}^*) \tag{17a}
\]

\[
(\bar{g} - g)^{\text{MDFC}} = \frac{abc\delta_1\delta_2^*E}{(b + c)\delta_2\delta_2^* + abc[E\delta_1\delta_2^* + E\delta_1\delta_2 + \Omega\delta_2^*(\mu_1\delta_2B + \mu_2\delta_1AE)]} (\beta\bar{g} + (1 - \beta)\bar{g}^*) \tag{17b}
\]

\[
(\Pi^e)^{\text{MDFC}} = \frac{abc\delta_2^*(\mu_1\delta_2B + \mu_2\delta_1AE)}{(b + c)\delta_2\delta_2^* + abc[E\delta_1\delta_2^* + E\delta_1\delta_2 + \Omega\delta_2^*(\mu_1\delta_2B + \mu_2\delta_1AE)]} (\beta\bar{g} + (1 - \beta)\bar{g}^*) \tag{17c}
\]
The second asymmetric setting considers the situation in which the common monetary authority commits to the private sectors regarding its choice of an inflation rate, while the fiscal authorities in the two countries act in a discretionary manner with their respective private sectors regarding the choice of tax rates in each country. In the European Economic and Monetary Union, the asymmetric regime of monetary commitment and fiscal discretion (MCFD) seems to be a likely scenario. The European Central Bank, which would be built similar to the German Bundesbank might very well commit to a low inflation rate. Cukierman (1994) points out that commitment seems to be a more probable scenario with a common central bank whose board would be formed with members from different countries. In such a case, the costs of reneging on a promise would be higher than the case in which central banks issue their own currencies in their respective countries. It seems unlikely that all the separate governments in the Union would be able to commit to an announced tax rate with respect to their private sectors. The governments would like to have flexibility in their choice of tax rates, and hence a discretionary fiscal environment could be envisaged.

The time-consistent ex post solutions under monetary commitment and fiscal discretion (MCFD) for output, public expenditure deviation from target and the common inflation rate are given by:

\[
(y - \bar{y})^{MCFD} = \frac{-abc\delta_2\delta_2^*}{(b + c)\delta_2\delta_2^* + abc[D\delta_1\delta_2^* + D\delta_1^*\delta_2 + \Omega\delta_2^*\mu_2\delta_1 AD]} (\beta\bar{g} + (1 - \beta)\bar{g}^*) \quad (18a)
\]

\[
(\bar{g} - g)^{MCFD} = \frac{-abc\delta_1\delta_2^*D}{(b + c)\delta_2\delta_2^* + abc[D\delta_1\delta_2^* + D\delta_1^*\delta_2 + \Omega\delta_2^*\mu_2\delta_1 AD]} (\beta\bar{g} + (1 - \beta)\bar{g}^*) \quad (18b)
\]

\[
(\Pi_c)^{MDFC} = \frac{abc\mu_2\delta_1\delta_2^*AD}{(b + c)\delta_2\delta_2^* + abc[D\delta_1\delta_2^* + D\delta_1^*\delta_2 + \Omega\delta_2^*\mu_2\delta_1 AD]} (\beta\bar{g} + (1 - \beta)\bar{g}^*) \quad (18c)
\]

On comparing the reduced-form solutions for output, inflation, and government spending between the two asymmetric scenarios, the following observations can be made. Inflation is higher under monetary discretion (MDFC) as compared to monetary commitment (MCFD) scenario. However, taxes are higher under fiscal commitment (MDFC) than under fiscal discretion (MCFD) situation. As a result, the output comparisons between the two asymmetric regimes remain ambiguous. Government spending is seen to be higher under MDFC compared to MCFD.

The reduced-form solutions for output, government spending and inflation between the symmetric and asymmetric scenarios may be compared. First, we compare between the monetary and fiscal discretion (MFD) and the monetary commitment and fiscal discretion (MCFD) cases. Inflation is higher in the MFD case compared to the MCFD case. The
intuition behind this result could be traced to the fact that the discretionary monetary authority is able to reduce the discrepancy between output and nondistorted output by creating higher inflation than that expected by the private sectors. Under the MCFD case, the monetary authority has to commit to an announced inflation rate and does not have the power to raise output by creating unexpected inflation. As seigniorage revenues are higher under the MFD scenario, lower taxes need to be raised to finance government expenditure. Lower taxes under the MFD case relative to the MCFD case translates into higher output under the MFD in relation to MCFD. This is also seen from comparing the reduced form solutions for output under these two scenarios. Taxes are in general lower under fiscal discretion as fiscal authorities have the ability to raise output through unexpected tax cuts. The difference in taxes between the MFD and MCFD scenarios may be low. The discretionary monetary authority under MFD may need to inflate more to compensate for the lower taxes. On comparing the above two scenarios, the seigniorage effect is seen to dominate the tax effect. As a result, government spending under the symmetric MFD case is observed to be greater than the public expenditure under the asymmetric MCFD situation.

Comparing the symmetric scenario of monetary and fiscal commitment (MFC) with the asymmetric case of monetary commitment and fiscal discretion (MCFD), indicates that output in the MCFD case is greater than under the MFC case. Taxes would be lower under fiscal discretion (in MCFD) compared with fiscal commitment (in MFC), as discretionary fiscal authorities possess the ability to generate additional output by making unanticipated tax cuts. Inflation is higher in the MCFD case as compared with the MFC situation, so that lower taxes under the MCFD case are balanced by higher seigniorage revenues. The government spending under MFC is seen to be greater than that under MCFD. This result follows from the fact that the tax effect dominates the seigniorage effect, as discussed earlier in the comparison of the MFC and MFD scenarios.

The asymmetric scenario of monetary discretion and fiscal commitment (MDFC) is next compared with the symmetric regime. First, comparisons with reduced form solutions for the symmetric monetary and fiscal discretion (MFD) have been considered. Output is seen to be higher under MFD than under MDFC. This may be explained by the higher taxes under fiscal commitment embodied in the MDFC case, as discussed earlier. Inflation is observed to be higher under MFD, and therefore the higher seigniorage revenues could compensate for the lower tax revenues. Government spending is higher under MDFC than under MFD. This could again arise due to the dominance of the tax effect over the seigniorage effect.

Finally, the solutions for the MDFC and MFC situations have been compared. Under monetary discretion, reflected in the MDFC case, the monetary authority has an incentive to raise output by unexpected monetary injections. This would explain the higher inflation under MDFC. Thus, seigniorage revenues are higher in the MDFC case, and lower taxes need to be raised. Lower tax distortions under MDFC could be responsible for the higher output obtained in the MDFC scenario. The government spending under MDFC is observed to be higher than that under MFC. A summary of the comparisons of output, inflation and government spending among the different regimes is illustrated in Table 1.

The comparisons of the four cases may be summarized as follows:

\[(\Pi^C)^{MFC} > (\Pi^C)^{MDFC} > (\Pi^C)^{MCFD} > (\Pi^C)^{MFC}\]
We next study the implications of a scenario in which the common central bank and a fiscal authority are committed, whereas the other fiscal authority acts in a discretionary manner. The reduced-form solutions for output and government spending for country 1 under the situation in which its fiscal authority and the common central bank are committed vis-a-vis the private sector (MCF1C) are obtained as follows:

\[
\begin{align*}
(y - \bar{y})_{MCF1C} &= -\frac{abc\delta_1\delta_2^*}{(b + c)\delta_2\Delta^2 + abc[E\delta_1\delta_2^* + E\delta_1\delta_2 + \Omega\delta_2^*(\mu_2\delta_1AE)]} \\
&\quad (\beta\bar{g} + (1 - \beta)\bar{g}^*) \quad (19a) \\
(g - \bar{g})_{MCF1C} &= -\frac{abc\delta_1\delta_2^*E}{(b + c)\delta_2\Delta^2 + abc[E\delta_1\delta_2^* + E\delta_1\delta_2 + \Omega\delta_2^*(\mu_2\delta_1AE)]} \\
&\quad (\beta\bar{g} + (1 - \beta)\bar{g}^*) \quad (19b)
\end{align*}
\]

The reduced-form solutions for output and government spending for country 2 in which its fiscal authority is discretionary, whereas the monetary authority is committed vis-a-vis the private sector (MCF2D) are obtained as follows:

\[
\begin{align*}
(y - \bar{y})_{MCF2D} &= -\frac{abc\delta_2\delta_1^*}{(b + c)\delta_2\Delta^2 + abc[D^*\delta_1\delta_2^* + D^*\delta_1\delta_2 + (1 + \Omega)\delta_2\delta_1A*E^*]} \\
&\quad (\beta\bar{g} + (1 - \beta)\bar{g}^*) \quad (20a)
\end{align*}
\]
\[ (\bar{g} - g)^{\text{MCF2D}} = \frac{-abc \delta_1^* \delta_2 D^*}{(b + c) \delta_2^* \delta_2^* + abc[D \delta_1^* \delta_2^* + D^* \delta_1^* \delta_2^* + (1 - \Omega) \delta_2 \mu_2 \delta_1^* A^* D^*]} \]

where, 
\[ A^* = 2(2 - \psi)(1 - \Omega) \]

\[ B^* = \frac{2(2 - \psi) ab}{(1 - \phi)} \]

and, 
\[ D^* = ab \beta + \frac{abc}{(b + c) \theta} (1 - \beta)^2 [1 + ab \beta - ab(1 - \beta)] \]

In the above scenario, country 2 has a higher output level compared to country 1. The committed fiscal authority in country 1 sets higher tax rates compared to the discretionary fiscal authority in country 2. The discretionary fiscal authority has the freedom to increase output through unanticipated tax cuts. As a result, output is seen to be higher in country 2. Thus, with a given level of composite inflation, and higher taxes in country 1, government spending is seen to be higher in country 1.

The composite inflation under the setup of a committed monetary authority, with a committed fiscal authority in country 1 and a discretionary fiscal authority in country 2 (MCF1CF2D) is obtained as follows:

\[ (\Pi^C)^{\text{MCF1CF2D}} = \left\{ \frac{\phi abc \delta_2 \mu_2 \delta_1 AE}{(b + c) \delta_2^* \delta_2^* + abc[E \delta_1^* \delta_2^* + E^* \delta_1^* \delta_2^* + \Omega \delta_2 \mu_2 \delta_1^* AD]} \right\} \]

The composite inflation rate under the above setting is lower than that under MFD and MDFC, but higher than inflation under MCFD and MFC scenarios. The inflation is seen to be lower than under the scenarios of monetary discretion and higher than the other scenarios of monetary commitment. The fiscal authority in country 2 may have a further incentive to act in a discretionary manner in this set up compared to the case when both the fiscal authorities are discretionary (MCFD). The seigniorage revenues under this set up of a committed central bank in the presence of committed and discretionary fiscal authorities (MCF1CF2D) are higher than that under the MCFD scenario.

4. Fiscal coordination

We now assume that the fiscal authorities coordinate their fiscal policies in the presence of the common monetary authority. Thus, the model is solved under the assumption that
fiscal policies are coordinated as in Bryson, Jensen, and VanHoose (1993). The fiscal first-order conditions are represented by the following equations:

\[ \frac{\partial V^{FA}}{\partial \tau} + \frac{\partial V^{*FA}}{\partial \tau} = 0 \]  
\[ \frac{\partial V^{*FA}}{\partial \tau^*} + \frac{\partial V^{FA}}{\partial \tau^*} = 0 \]  

Under fiscal coordination, the governments choose their respective tax rates to minimize the loss function of both the fiscal authorities. This is different from insular fiscal policy in which the fiscal authorities chose the tax rates in their own countries’ to minimize their own loss function. The tax rate in the other country was considered as given, in the insular policy making framework. The common monetary authority again chooses the common inflation rate to minimize its loss function. The common inflation, \( \Pi_c \), is derived in terms of distortions of actual output (\( y \)) and government expenditure (\( g \)) from their desired values.

Government expenditure is obtained in terms of the target government spending and the deviation of output from the nondistorted value. The monetary first-order condition is then solved simultaneously with fiscal first-order conditions shown in Eqs. (21a) and (21b), to obtain the common inflation rate in terms of the output deviation from target. The deviation of government expenditure from its target value is also obtained in terms of deviation of output from its nondistorted value.

Under the setting of monetary and fiscal discretion, neither the monetary authority nor the fiscal authority commits to the inflation rate or the tax rate, respectively. The time-consistent ex post solutions under monetary and fiscal discretion for output, public expenditure deviation from target, and the common inflation rate in the presence of a common monetary authority and coordinating fiscal authorities are given by:

\[ y^{\text{MFD}} = \frac{-abc \delta_2^2 \delta_2^*}{(b + c) \delta_2 \delta_2^* + abc[\delta_1 \delta_2^* ab + \delta_2^* \Omega (\mu_1 \delta_2 B + \mu_2 \delta_1 Aab)]} (\beta \bar{g} + (1 - \beta) \bar{g}^*) \]  
\[ (\bar{g} - g)^{\text{MFD}} = \frac{a^2b^2c \delta_1 \delta_2^*}{(b + c) \delta_2 \delta_2^* + abc[\delta_1 \delta_2^* ab + \delta_2^* \Omega (\mu_1 \delta_2 B + \mu_2 \delta_1 Aab)]} (\beta \bar{g} + (1 - \beta) \bar{g}^*) \]  
\[ (\Pi_c)^{\text{MFD}} = \frac{abc \delta_2^5 (\mu_1 \delta_2 B + A \mu_2 \delta_1 ab)}{(b + c) \delta_2 \delta_2^* + abc[\delta_1 \delta_2^* ab + \delta_2^* \Omega (\mu_1 \delta_2 B + \mu_2 \delta_1 Aab)]} (\beta \bar{g} + (1 - \beta) \bar{g}^*) \]

We next consider the case of monetary and fiscal commitment with coordinating fiscal authorities. Again, the monetary authority does not coordinate with the fiscal authorities. Under this setup, the monetary authority commits to the private sectors regarding its announced inflation rate. The fiscal authorities also commit to their private sectors with regard to the tax rates. The following reduced form solutions are obtained under monetary and fiscal commitment:
where $F = abc/(b + c)$.

Comparing the reduced-form solutions between the regimes of discretion and commitment, we observe that output and composite inflation is greater under discretion (#MFD) than that under commitment (#MFC). The committed central bank cannot deviate from its announced inflation rate. The discretionary monetary authority, on the other hand, is able to increase the output towards the non tax-distorted level by choosing a higher inflation rate than that expected by the private sector. The reduced form solutions for the composite inflation rate is found to be higher under discretion (#MFD) than under commitment (#MFC). As the committed central bank sets lower inflation rate, the committed fiscal authorities have an incentive to set higher taxes under commitment. The higher taxes compensates for the lower seigniorage revenues under commitment. On the other hand, the discretionary fiscal authorities can make unexpected tax cuts to increase output, and therefore may choose lower taxes than the committed authorities. The discretionary authorities choice of lower taxes may be compensated by the higher seigniorage revenues obtained under monetary discretion. The higher tax distortions under commitment (#MFC) reduces output compared to the discretionary scenario (#MFD). The difference in the taxes between the discretionary and commitment regimes are greater than the difference between the seigniorage revenues. As a result, the tax effect dominates the seigniorage effect (as formulated in Appendix A), and government spending is obtained to be higher under commitment.

The asymmetric policy making framework with committed monetary authority and discretionary fiscal authorities has been considered next. Under this setting, the monetary authority precommits to its announced inflation rate. The fiscal authorities, on the other hand, act in a discretionary manner with respect to the private sectors in regard to its choice of tax rates. Also, the fiscal authorities are assumed to cooperate among themselves, although they do not cooperate with the common monetary authority. In the scenario of monetary commitment and fiscal discretion, the actual value of inflation is equal \textit{ex ante} to the value expected by the private sectors, but the taxes in each country are not \textit{ex ante} equal to the values expected by the respective private sectors. The reduced form solutions for output, government spending deviation from target and the common inflation rate are obtained as follows:
The superscript #MCFD refers to the scenario of monetary commitment and fiscal discretion under fiscal coordination.

Finally we consider the asymmetric situation of monetary discretion and fiscal commitment. The monetary authority would set the inflation rate in a discretionary manner, such that actual value of inflation set by the common central bank would differ from the value expected by the private sectors. However, the fiscal authorities would precommit to its announced tax rates with the private sectors and also coordinate between each other in choosing the tax rates for each country. The reduced form solutions under this environment are obtained as follows:

$$y^{#MCFD} = \frac{-abc \delta_2 \delta_2^*}{(b+c) \delta_2 \delta_2^* + abc[\delta_1 \delta_2^*ab + \delta_2^*\Omega \mu_2 \delta_1 Aab]} (\beta \bar{g} + (1 - \beta) \bar{g}^*)$$ (24a)

$$\bar{g} - g)^{#MCFD} = \frac{\delta_1 \delta_2^* a^2 b^2 c}{(b+c) \delta_2 \delta_2^* + abc[\delta_1 \delta_2^*ab + \delta_2^*\Omega \mu_2 \delta_1 Aab]} (\beta \bar{g} + (1 - \beta) \bar{g}^*)$$ (24b)

$$\Pi^{#MCFD} = \frac{a^2 b^2 c \mu_2 \delta_1 \delta_2^*}{(b+c) \delta_2 \delta_2^* + abc[\delta_1 \delta_2^*ab + \delta_2^*\Omega \mu_2 \delta_1 Aab]} (\beta \bar{g} + (1 - \beta) \bar{g}^*)$$ (24c)

The superscript #MDFC represents the situation of monetary discretion and fiscal commitment with coordinating fiscal authorities.

Comparing between the two asymmetric scenarios, inflation is obtained to be higher under the monetary discretion (#MDFC) scenario. The discretionary monetary authority has the ability to choose a higher inflation rate than that expected by the private sector in order to reduce the gap between actual and non-tax-distorted output. The committed monetary authority cannot deviate from its announced inflation rate. As the monetary authority is assumed to minimize the deviation of inflation from a zero inflation level, inflation is lower under monetary commitment (#MCFD). Taxes are higher under fiscal commitment #MDFC).
Under fiscal discretion, the fiscal authorities can make unanticipated tax cuts to raise output. The committed fiscal authorities lose this ability. As a result, taxes are lower under fiscal discretion (#MCFD) compared to fiscal commitment (#MDFC). Government spending financed from tax revenues and seigniorage is higher under #MDFC compared to #MCFD. Taxes and inflation are higher under #MDFC compared to #MCFD. Output comparisons between the two scenarios are ambiguous.

Comparing between the symmetric and asymmetric scenarios of rules and discretion, the following observations were made. A shift from monetary commitment and fiscal discretion (#MCFD) to monetary and fiscal discretion (#MFD) results in higher inflation, output and government expenditure. Inflation is higher under a discretionary monetary authority. Higher seigniorage revenues obtained under #MFD compensates for the lower taxes raised under #MFD. Output is higher under #MFD. The seigniorage effect dominates the tax effect in comparisons between symmetric and asymmetric scenarios of fiscal discretion. As a result, government spending is higher under #MFD.

A shift from #MCFD to #MFC, on the other hand, results in lower inflation, output, but higher government spending. Inflation is lower under monetary and fiscal commitment compared to that under monetary commitment and fiscal discretion. The lower taxes under fiscal discretion (#MCFD) may be compensated by higher seigniorage revenues. The tax effect dominates the seigniorage effect, and therefore government spending can be seen to higher under #MFC.

A shift from the other asymmetric scenario, #MDFC to the symmetric scenario of #MFD results in higher inflation and output, but lower government expenditure. Taxes are higher under fiscal commitment, and therefore output is lower under #MDFC. Inflation is higher under monetary and fiscal discretion, as lower taxes under fiscal discretion may compensated by higher seigniorage revenues. The tax effect dominates the seigniorage effect which results in higher government spending under #MDFC.

A shift from #MDFC to the other symmetric scenario of #MFC results in lower inflation, output, and government spending. The discretionary monetary authority has the ability to raise output by choosing a higher inflation than that expected by the private sector. Government spending is higher under monetary discretion and fiscal commitment as seigniorage revenues are higher under #MDFC.

Comparisons of reduced-form solutions for output, inflation, and government spending under the different scenarios of rules and discretion in the presence of fiscal authorities may be summarized as follows:

\[(\Pi^C)^{#MFD} > (\Pi^C)^{#MDFC} > (\Pi^C)^{#MCFD} > (\Pi^C)^{#MFC}\]

\[y^{#MFD} > y^{#MDFC} > y^{#MCFD} \]

\[y^{#MFD} > y^{#MDFC} > y^{#MFC}\]

\[\tau^{#MFD} < \tau^{#MDFC} < \tau^{#MCFD} < \tau^{#MFC}\]

\[g^{#MDFC} > g^{#MFC} > g^{#MFD} > g^{#MDF}\]
A comparison of the output, inflation, and government spending under the different scenarios of rules and discretion and in the presence of fiscal coordination is illustrated in Table 2.

In this section, the fiscal authorities have been assumed to coordinate with each other in the choice of tax rates for their respective countries. The coordination among the fiscal authorities results in lower taxes than under insular fiscal policy making as there is less incentive to pass on higher taxes to the sales of foreign firms. On comparing the relative size of output, inflation, and government spending between the different scenarios under fiscal coordination, the following results are obtained. Output is highest under monetary and fiscal discretion (#MFD), and lowest under monetary and fiscal commitment (#MFC). Inflation is lowest in the #MFC scenario and highest under #MFD. Government expenditure is highest under monetary discretion and fiscal commitment (#MDFC), and lowest under monetary commitment and fiscal discretion (#MCFD).

Comparing between the regimes with and without fiscal coordination, the relative sizes of output, inflation, and government spending are obtained as follows. The highest output is obtained under the scenario of monetary and fiscal discretion. Lower taxes under fiscal coordination results in higher output compared to output under insular fiscal authorities. As a result, output is highest under monetary and fiscal discretion with coordinating fiscal authorities (#MFD). Output is lowest under monetary and fiscal commitment. As taxes are higher under insular fiscal policies compared to the fiscal coordination regime, output is lowest under monetary and fiscal commitment without fiscal coordination (MFC).

Inflation is highest under the scenario of monetary and fiscal discretion. Lower taxes are raised under fiscal coordination. Higher inflation rate chosen under fiscal coordination provides higher seigniorage revenues which compensate for the lower taxes. As a result, inflation is highest under monetary and fiscal discretion with fiscal coordination (#MFD). Inflation is lowest under monetary and fiscal commitment. As tax revenues are higher under
insular fiscal policy making, lower seigniorage revenues need to be raised. Inflation is therefore lowest under monetary and fiscal commitment without fiscal coordination (MFC).

Government expenditure is financed through seigniorage revenues and taxes. Seigniorage revenues are higher under monetary discretion, while taxes are higher under fiscal commitment. Also, taxes are higher under the regime of insular fiscal policy compared to fiscal coordination. As a result, government expenditure is highest under monetary discretion and fiscal commitment without fiscal coordination (MDFC). On the other hand, seigniorage revenues are lower under monetary commitment, and taxes are lower under the fiscal discretion scenario. Further, taxes are lower under fiscal coordination. Government expenditure is thus found to be lowest under monetary commitment and fiscal discretion with coordinating fiscal authorities.

5. Conclusion

Previous literature on international policy coordination has considered monetary and fiscal coordination issues separately. Rogoff (1985) and Canzoneri and Henderson (1988) analyzed monetary policy coordination, but not fiscal policy coordination. Tabellini (1990) considered fiscal policy coordination, but did not address monetary policy coordination. Alesina and Tabellini (1987) consider a closed economy framework and find that when monetary and fiscal policies are not coordinated, a monetary regime with commitment does not necessarily improve welfare. VanHoose (1992) considers the effects on aggregate economic variables and welfare in the European Monetary System due to the use of monetary rules or discretion by the centralized policy making authorities. Bryson et al. (1993) evaluated the effects of international policy coordination in an environment in which both monetary and fiscal policy making are endogenous and are affected by time inconsistencies. They conducted their analysis in a two country framework with separate monetary and fiscal authorities in each country. In this paper, I have analyzed the effects of policy making in a two country framework with separate fiscal authorities and a common monetary authority. The reduced form solutions for output, inflation, and government spending have been compared under different scenarios of rules and discretion. The degree of market integration has effects on macroeconomic variables under the scenarios of rules and discretion. A higher degree of market integration results in higher output and inflation, but lower government spending under all the scenarios. The higher seigniorage revenues obtained result in lower taxes and higher output with increased market integration. The lower taxes outweigh the higher seigniorage revenues, and therefore government spending is seen to be lower. The effects of the coefficient beta, which provides a fraction of the home country output consumed by home workers, also affects the macroeconomic variables uniformly across the different scenarios of rules and discretion. A higher value of beta increases output, and government spending under all the scenarios. The effects of beta on the overall inflation rate remain ambiguous.

A movement from monetary and fiscal discretion to monetary and fiscal commitment results in lower inflation and higher public expenditure at the expense of lower output. The discretionary monetary authority is able to choose an inflation rate higher than that expected by the private sector. The committed monetary authority cannot deviate from its announced
inflation rate. The discretionary fiscal authority can make unanticipated tax cuts to increase output, while committed fiscal authorities cannot deviate from its announced tax rates. Taxes are higher under fiscal commitment, and as a result output is lower compared to the discretionary scenario. Seigniorage revenues are higher under monetary discretion. Government spending is financed partly from taxes and partly from the seigniorage revenues. The tax effect dominates the seigniorage effect, and so the government expenditure under commitment is higher than that under discretion.

A transition from monetary and fiscal discretion to an asymmetric scenario of monetary commitment and fiscal discretion results in lower inflation at the expense of lower output and public expenditure. Seigniorage revenues are higher under monetary discretion. Taxes are lower under monetary and fiscal discretion compared to monetary commitment and fiscal discretion. The seigniorage effect dominates the tax effect in the transition between the scenarios of fiscal discretion. As a result, government spending is higher under monetary and fiscal discretion.

A shift from monetary and fiscal discretion to monetary discretion and fiscal commitment is associated with lower inflation and higher government spending at the expense of lower output. Taxes are lower under fiscal discretion compared to fiscal commitment. The lower taxes under fiscal discretion are compensated by higher inflation under monetary commitment and fiscal discretion. The tax effect dominates the seigniorage effect, and therefore government spending is higher under monetary discretion and fiscal commitment.

Considering transitions from the other symmetric scenario of monetary and fiscal commitment to the two asymmetric scenarios yields the following results. A movement from monetary and fiscal commitment to monetary commitment and fiscal discretion results in higher output at the expense of higher inflation and lower government expenditure. Taxes are lower under fiscal discretion compared to fiscal commitment. The lower taxes under fiscal discretion are compensated by higher inflation under monetary commitment and fiscal discretion. The tax effect dominates the seigniorage effect. This results in higher government spending under monetary and fiscal commitment.

A shift from monetary and fiscal commitment to monetary discretion and fiscal commitment results in higher output and government expenditure at the expense of higher inflation. Seigniorage revenues are higher under a discretionary monetary authority. Taxes are higher under monetary and fiscal commitment to compensate for the lower seigniorage revenues. The seigniorage effect dominates the tax effect in the comparison between the two scenarios of fiscal commitment. As a result, government spending is higher under monetary discretion and fiscal commitment.

It may be noted that in spite of the commitment by the common central bank, the common inflation rate can be high if one country’s fiscal authority is discretionary while the other country’s fiscal authority acts in a committed manner. The common inflation rate under asymmetric fiscal policy making by the countries would be higher than the symmetric fiscal scenarios in which both countries’ fiscal authorities act in a similar fashion. This may be interesting in the context of the European Monetary Union in which the European Central Bank could commit to a low inflation. However, the common inflation may be high due to discretionary and committed policy making by the different fiscal authorities of the member countries.

Comparing the relative sizes of output, inflation and government expenditure under the
symmetric and asymmetric scenarios of rules and discretion, the following results are obtained. Output is highest under a regime of monetary and fiscal discretion (MFD) and lowest under monetary and fiscal commitment (MFC). Similarly, inflation is highest under MFD and lowest under MFC. Government expenditure is lowest under monetary commitment and fiscal discretion, (MCFD). The intuition behind the comparative effects of fiscal coordination and insular fiscal policies under commitment and discretion has been elaborated in the concluding portion of section IV. This situation may be interesting in the context of insular and possible coordinated fiscal policies by the member countries’ fiscal authorities under the European Monetary Union. The level of national output is higher under coordinating fiscal authorities compared to insular fiscal policy making. Taxes are lower under fiscal coordination, and this results in higher national output. As taxes are lower under coordinating fiscal authorities, seigniorage revenues and the level of inflation rate may be higher under fiscal coordination.

Notes

1. As in Alesina and Tabellini, 1987, the present analysis retains the simplifying assumption of no government debt and thus ignores the intertemporal portion of the government budget implied by public debt. The absence of the government debt can be interpreted as a situation in which the fiscal authorities wish to raise the desired amount of government expenditure in the form of taxes or seigniorage revenues. Also, see van Aarle et al. (1997) for the interaction between the ECB and fiscal authorities and the problem of debt stabilization under EMU.

2. The hypothesis of J. Bryson et al. (1993) regarding domestic taxation on the sales of foreign firms is maintained. The sales of the foreign producers in the domestic country are imposed a domestic sales tax at the point of sale. The domestic labor demand is derived by choosing the level of labor demand which maximizes profits for the domestic firms. A portion of the domestic firms’ sales is consumed at home and a remaining part is consumed in the foreign country. The revenues of the domestic firms are obtained by summing the revenues from sales in the home and foreign country, respectively. The net revenues from home country sales are obtained after considering domestic tax rates imposed on the sales. Similarly, the revenues from the sales in the foreign country are obtained on deducting foreign tax rates on the sales. The profits for the domestic firms are obtained by deducting the labor cost from the net revenues. The calculation for the labor demand is similar to the derivation of the labor demand functions as shown in Appendix A of Bryson et al. (1993), and may be obtained from the author upon request.

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Appendix

\[ g^{MFD} \geq g^{MFC} \]

\[ \Rightarrow \tau_t^{MFD} + \Omega(\Pi^C)^{MFD} \geq \tau_t^{MFC} + \Omega(\Pi^C)^{MFC} \]

\[ \tau_t^{MFC} > \tau_t^{MFD} , \& \]

\[ (\Pi^C)^{MFD} > (\Pi^C)^{MFC} \]

\[ (\tau_t^{MFC} - \tau_t^{MFD}) > \Omega[(\Pi^C)^{MFD} - (\Pi^C)^{MFC}] \]

If the final inequality is satisfied then the tax effect dominates the seigniorage effect, and the government spending under commitment is greater than under discretion. This follows from the government budget constraint. On the other hand, if the seigniorage effect dominates, then government spending under discretion is higher.

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