# Inflation Divergence and Public Deficits In a Monetary Union♠

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## Abstract

We reconsider the link between domestic public debts and average and domestic inflation rates in a monetary union, using a modified version of a model by B-V (2002). It is thus possible to show that the causation between the inflation dynamics and the public finances might go from the former to the latter. We are thus able to tackle the issue of persistently divergent inflation rates within the euro area. We also demonstrate that the homogeneous fiscal rules defined in the Stability and Growth Pact are ill-suited and might even be counterproductive. This conclusion is all the more true as the EU is on the eve of enlargement towards the CEECs: our results show that imposing *homogeneous* fiscal rules to the CEECs may prove disruptive.

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## Introduction

The macroeconomic literature related to the determinants of the price level is quite deceptive as regards its conclusions in a monetary union context. Although the so-called Fiscal Theory of the Price Level (FTPL, hereafter) has helped to revive macroeconomic research on the determination of the price level, with a special emphasis on the interactions between monetary and fiscal policies[1], the conclusions drawn from this theory as regards monetary unions do not diverge at all from other theories. The main message is the following[2]: as one country might inflate the whole area through an 'active' fiscal policy (see Leeper, 1991), national fiscal policies must be limited in order to preserve the interests of the monetary union's members (Bergin, 2000), except if a mutual insurance mechanism is being organized (Woodford, 1996).

In this paper, we reconsider this statement, using a modified version of a model by Beetsma and Vermeylen (2002) which enlightens the relationship between public debt, real returns and inflation rates in a monetary union. Though not related explicitly to the FTPL, the paper by Beetsma and Vermeylen (hereafter B-V) introduces public debt as an important determinant for the inflation rate, somewhat in line, but not exactly, with Sargent and Wallace (1981). It is possible, using a modified version of their model, to characterize the inflation dynamics and inflation divergence (among the members of the monetary union) outside the public finances sphere, and thus to demonstrate that the homogeneous fiscal rules defined in the Stability and Growth Pact are ill-suited and might even be counterproductive. This conclusion is all the more true as the EU is on the eve of enlargement towards the CEECs: our

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1 Recent reviews and discussion of the FTPL can be found in Buiter (2002) and Creel and Sterdyniak (2001).

2 The same arguments can be found, for instance, in Gros and Thygesen (1992), though not in a FTPL framework.

theoretical results show that imposing *homogeneous* fiscal rules to the CEECs is unnecessary, even disruptive, within a monetary union, insofar as inflation divergence persists between the candidate countries and the EU countries.

The modifications we introduce in the model by B-V are twofold. Though they are not numerous, they lead to original conclusions in comparison with B-V's. We think the first modification enhances the plausibility of the general model, while the second one gives a new insight in the methodology adopted to cope with monetary uncertainty.

F, we depart from B-V's main assumption that inflation rates and real interest rates would be perfectly correlated within a monetary union. As shown in tables 1 and 2 below, the situation in the EU is far from revealing such a correlation. On the contrary, the dispersion across real interest rates and across inflation rates is sizeable. Evidence related to the covariance matrices of, respectively, the real long term interest rates and inflation rates also points to the low empirical plausibility of B-V's assumption (see the appendix).

Second, we introduce a specification in the government's loss function which makes it possible to discuss the ability of the government to finance public investment with public debt without incurring any cost. One favorable consequence of the above-mentioned assumption may be related to the monetary framework in the model. The latter is absolutely the same as in B-V – uncertainty is exclusively attached to the money creation mechanism –, but reasons for the inflation and public debt goals by the central bank are different from B-V's. The Barro-Gordon-type hypothesis is no longer legitimate: the central bank does not face a trade-off between actual inflation and inflation surprise but, rather, its own ability to distinguish a productive public capital expenditure from an unproductive one. In the present EU context, building upon the risk of an "inflation surprise" would not be very convincing: central banks do not perfectly control either the inflation rate or the monetary transmission channels. Central banks rather implement monetary policy in an uncertain framework, where uncertainty can be linked to these channels and/or to the policies which are being undertaken by other policymakers, be they foreign (extra-monetary union) central banks or governments. We favor the latter kind of uncertainty: the common central bank faces governments whose expenditures may be either productive or unproductive. Uncertainty regarding the precise nature of governments' expenditures is left to the central bank. In this context, the common central bank can eventually accept a higher current inflation rate insofar as it eases the financing process of a *productive* capital asset.

The rest of the paper is organized as follows. Section 2 presents the model, and focuses on its most important elements and deviations from the seminal model by B-V. Section 3 discusses the major conclusions that can be drawn from the model. The equilibrium condition between members of a monetary union is described. Its consequences for the future implementation of fiscal policies in the Euro area are dealt with in section 4, with a special emphasis on the macroeconomics of enlargement. Section 5 concludes.

**Table 1: Some key indicators in the euro area**

| | *1999* | *2000* | *2001* | *2002* |
|---|---|---|---|---|
| HICP | 1.1 | 2.1 | 2.4 | 2.2 |
| $\sigma^2_{HICP}$ | 0.8 | 1.0 | 1.1 | 1.2 |
| ΔHICP | -0.1 | 1.0 | 0.3 | -0.2 |
| $\sigma^2_{\Delta HICP}$ | 0.8 | 0.7 | 1.1 | 0.7 |
| $r_{CT}$ | 2.0 | 2.4 | 1.9 | 1.1 |
| $\sigma^2_{r_{CT}}$ | 2.1 | 1.4 | 1.1 | 1.2 |
| $r_{LT}$ | 3.6 | 3.4 | 2.6 | 2.6 |
| $\sigma^2_{r_{LT}}$ | 0.8 | 1.0 | 1.1 | 1.1 |

*Source*: EC forecasts, Spring 2003; computations by the authors.
HICP: Harmonized index of consumer prices; ΔHICP: HICP in first difference; $r_{CT}$: short term real interest rate; $r_{LT}$: long term real interest rate; $\sigma^2_X$ : standard deviation of variable X.

**Table 2: Inflation rates in the euro area**
**(annual percentage change)**

| | *2001* | *2002* | *2003** |
|---|---|---|---|
| Belgium | 2.4 | 1.6 | 1.4 |
| Germany | 2.1 | 1.3 | 1.3 |
| Greece | 3.7 | 3.9 | 3.8 |
| Spain | 2.8 | 3.6 | 3.2 |
| France | 1.8 | 1.9 | 1.9 |
| Ireland | 4.0 | 4.7 | 4.2 |
| Italy | 2.3 | 2.6 | 2.4 |
| Luxembourg | 2.4 | 2.1 | 2.1 |
| Netherlands | 5.1 | 3.9 | 2.7 |
| Austria | 2.3 | 1.7 | 1.8 |
| Portugal | 4.4 | 3.7 | 3.2 |
| Finland | 2.7 | 2.0 | 1.7 |
| **Euro area** | 2.4 | 2.2 | 2.1 |

*Source*: EC forecasts, Spring 2003; *: forecasts.

# 1. The model

The world is made up of N countries, where countries 1,..,$N^U$ form a monetary union[3]. Countries are constituted of two-period overlapping generations of a constant size (normalized to one).

## 1.1 The representative agents

The representative agent in each country *i* maximizes the expected lifetime quadratic utility (1) subject to the budget constraint (2):

$$U_t^i = C_{1,t}^i - \frac{1}{2}\gamma(C_{1,t}^i)^2 + \frac{1}{1+\rho}E_t\left[C_{2,t+1}^i - \frac{1}{2}\gamma(C_{2,t+1}^i)^2\right]; \qquad (1)$$

[3] N>1 and 1<$N^U$≤N.

$$C_{2,t+1}^{i} = (Y - T_{i,t} - C_{1,t}^{i})\left[\sum_{j=1}^{N} \omega_{j,t}^{i}(1 + r_{j,t+1}) + (1 - \sum_{j=1}^{N} \omega_{j,t}^{i})(1 + r^{*})\right], \quad (2)$$

where $C_{1,t}^{i}$ *and* $C_{2,t+1}^{i}$ are the representative agent's consumption in periods $t$ and $t+1$, respectively, $\rho$ is the agent's discount rate, $E_t$ is the expectations operator conditional on the available information, $\gamma$ a positive parameter, $Y$ the agent's endowment, $T_{i,t}$ the taxes paid by the representative agent, $\omega_{j,t}^{i}$ the share of this agent's savings in period $t$ invested in public debt of country $j$, $r_{j,t+1}$ is the real interest rate paid in period $t+1$ on public debt and $r^*$ the real, risk-free, interest rate on private savings.

### 1.2 The governments

Each government is able to spend an amount $G_{i,t}$ at period $t$ and finance it by raising taxes and/or issuing public debt $B_{i,t}$, following the dynamic budget constraint (3) expressed in real terms:

$$B_{i,t} = G_{i,t} + B_{i,t-1}(1 + r_{i,t}) - T_{i,t} . \quad (3)$$

Contrary to B-V (2002), the trade-off faced by governments will not be simply between the cost of raising taxes and the cost of deferring them but, rather, between the cost of raising taxes and the cost of deferring them *only insofar as* public expenditures are not productive. This means that the government might be able to *lower* its loss if it is able to finance *productive* expenditures *via* a public debt issuance. On the other hand, financing such an expenditure *via* taxation might be costly. Higher taxes in period $t$ might reduce the lifetime utility of the generation which has to pay the taxes in period $t$ since this generation might not gain from the productive expenditure whose benefits might be grasped only in a not-so-near future.

Public expenditures hence split in two main categories: some are productive ($G_{i,t}^{p}$) while others are not ($G_{i,t}^{np}$), with $G_{i,t} = G_{i,t}^{p} + G_{i,t}^{np}$. If public expenditures are productive, issuing public debt is beneficial to the governments (as it is presumably for the whole domestic economy), i.e. the government's loss is reduced, all else being equal.

Because the general model does not incorporate economic growth, the distinction between productive and unproductive expenditures has to rely on a specific mechanism. We have considered in the following that this distinction should be related to the "crowding-in vs. crowding-out effects" debate: productive expenditures have – quite obviously – a rate of return superior to that of unproductive expenditures, hence reduce the financial cost of public debt still in comparison with the financing of unproductive expenditures.

In order to reveal that productive expenditures impinge positively on welfare, we thus consider that they reduce the real *ex post* interest rate (a crowding-in effect) which indeed reduces the financial cost of public debt, while unproductive expenditures increase the real *ex post* interest rate (a crowding-out effect). The real financial cost of public debt is represented by $r_{i,t+1}$.

The government of country *i* minimizes therefore a loss function of the form:

$$L_{i,t}^{gov} = T_{i,t} + \frac{1}{1+\beta_i} E_t\left[ B_{i,t}(r_{i,t+1} - r^*) \right], \tag{4}$$

where $\beta_i$ is the rate at which government of country *i* discounts the real debt burden for the future generations.

Of course, both types of public expenditures – productive or unproductive – increase public debt, all else equal. However, the former type of expenditures may reduce the financial cost of public debt below a benchmark level (the real risk-free rate here), so that governments may be willing to finance productive expenditures through public debt rather than having to recourse to taxation. In the case where expenditures are unproductive, governments face the usual framework between higher present taxes and higher future taxes (higher present debt issuance). This latter case is consistent with the governments' loss function specification in B-V (2002).

### 1.3 The central bank

Consider, first, the situation of a country which is not a member of the monetary union. For convenience – though at least one central bank in the world, the European central bank (ECB), claims it can control a broad monetary aggregate (M3) –, we will assume that the central bank determines at period *t* the growth rate of the money supply $m_{i,t}$ from period *t* to *t+1*. As in B-V (2002), the inflation rate is closely related to the growth rate of the money supply, although this link is stochastic:

$$\pi_{i,t} = m_{i,t}(1+\varepsilon_{i,t}), \qquad (5)$$

where $\pi_{i,t}$ is the inflation rate in country *i* between periods *t* and *t+1*, and $\varepsilon_{i,t} \sim N(0,\sigma^2)$ and i.i.d. over time and across countries.

As we intend to compare the results of our model with some of the outcomes of the FTPL literature, we must be very cautious with the specification of the monetary bloc. For instance, eqn.(5) does not describe an automatic (quantity) relationship between money and inflation: first, as already mentioned, their link is stochastic (but the quantity theory also incorporates a stochastic process under the form of a stochastic velocity); second, the monetary aggregate is an instrument, not a goal in itself.

The goals of the central bank are indeed twofold. The first goal is to stabilize the inflation rate; but the second is to stabilize public debt as the latter might prove inflationary in the future insofar as public debt *does not* finance a productive public investment or expenditure. The central bank therefore minimizes a loss function of the form:

$$L_{i,t}^{cb} = \frac{1}{2} E_t(\pi_{i,t})^2 + \lambda_i E_t\left[B_{i,t}(1+r_{i,t+1})\right] \qquad \text{with } \lambda_i > 0. \qquad (6)$$

Thus, the central bank is not focusing exclusively on the stabilization of the inflation rate, which removes the comparability with the Quantity theory. Moreover, the central bank here is not confronted with a trade-off between actual inflation and unexpected inflation (the inflation surprise which is at the core of B-V's model, quite in line with the Barro and Gordon (1983) literature). In our setting, an increase in the inflation rate can ease the government's budget constraint in reducing real public debt; however, this monetary policy is inefficient (or costly) if this real public debt finances an unproductive public investment[4]. The central bank hence faces an uncertainty as regards the productive or unproductive pattern of public expenditures, a reason why the inflation rate is stochastic. The parameter $\lambda_i$ can be interpreted as the degree of indirect participation of the central bank in the implementation of public investment.

When countries 1,..,$N^U$ form a monetary union, they share a common central bank which controls the aggregate money supply $m_t^u$ whose relationship with the *average* inflation rate in the monetary union $\pi_t^u$ (and not the *common* inflation rate as stated in B-V, 2002) is similar to that found in eqn. (5). The common central bank's loss function is of the following form:

$$L_t^{cb,u} = \frac{1}{2} E_t(\pi_t^u)^2 + \lambda^u E_t\left[\frac{1}{N^u}\sum_{i=1}^{N^u} B_{i,t}(1+r_{i,t+1})\right], \qquad (7)$$

where the targets of the common central bank are *average* targets over the whole monetary union.

Under perfect foresight, the expected *nominal* interest rate is equal to the actual future *nominal* interest rate, hence:

$$r_{i,t+1} = r^e_{i,t+1} + \pi^e_{i,t} - \pi_{i,t} \; . \tag{5b}$$

As uncertainty in the model only stems from the inflation rate (eqn. 5), and using eqn. (5b), the variance of the domestic real debt return follows:

$$Var(r_{i,t+1}) = Var(\pi_{i,t}) = m^2_{i,t}\sigma^2 \; . \tag{8}$$

Unlike B-V (2002), we disregard the assumption that inflation rates and, thus, real debt returns would be perfectly correlated across countries in the monetary union. We rather consider that the correlation is nil:

$$\text{cov}_t(r_{i,t+1}; r_{j,t+1}) = \text{cov}_t(\pi_{i,t}; \pi_{j,t}) = 0 \quad \forall i \neq j \; . \tag{9}$$

As shown in table 1, the divergence across inflation rates and across real interest rates, as well as the dispersion across their time variations are quite important in the euro area. Covariance matrices regarding, first, the real long term interest rate and, second, the inflation rates[5] show that, at least since the adoption of the euro, covariances are close to zero, except for some occurrences when the Netherlands are involved. Hence, adopting assumption (9) seems realistic. It is also consistent with the common central bank targeting the average – and not common – inflation rate.

### 1.4 Equilibrium conditions

Equilibrium in the goods market requires that:

$$NY = C_{1,t} + C_{2,t} + I_t + G_t \tag{10}$$

with $C_{1,t} = \sum_{i=1}^{N} C^i_{1,t}$ ; $C_{2,t} = \sum_{i=1}^{N} C^i_{2,t}$ ; $I_t = \sum_{i=1}^{N} (Y - T_{i,t} - C^i_{1,t})(1 - \sum_{j=1}^{N} \omega^i_{j,t})$; and $G_t = \sum_{i=1}^{N} G_{i,t}$ .

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[4] The precise nature of the unproductive public expenditure stems from the fact that either the output is at its steady-state level (if the model is growth-oriented), or that a crowding-out effect has showed up. We still favor the second part of the alternative.

[5] Matrices have been left to the appendix.

Equilibrium in the market for each country's public debt requires:

$$B_{i,t} = \sum_{j=1}^{N} (Y - T_{j,t} - C_{1,t}^{j})\omega_{i,t}^{j} \qquad \text{for all } i. \tag{11}$$

The absence of perfect substitutability between public bonds of different countries can be attributed to the uncertainty of future real rates of return and to risk aversion by private agents. In a monetary union, the latter exhibit a preferred habitat behavior for domestic bonds, as they internalize the inflation rate and the subsequent domestic real interest rate[6].

# 2 The model solution

## 2.1 Solution for the representative agent

The first-order conditions of the young representative agent in country $i$ with respect to this agent's decisions to hold country $j$'s public debt and to invest with the risk-free saving technology, are:

$$1 - \gamma C_{1,t}^{i} = \frac{1}{1+\rho} E_t\left[(1 + r_{j,t+1})(1 - \gamma C_{2,t+1}^{i})\right] \quad \forall j, \tag{Foc1}$$

$$C_{1,t}^{i} = C_{2,t+1}^{i,e}. \tag{Foc2}$$

Substituting eqn.(2) in (Foc1) yields:

$$1 - \gamma C_{1,t}^{i} = \frac{1}{1+\rho}(1 + r_{j,t+1}^{e})(1 - \gamma C_{2,t+1}^{i,e}) - \frac{\gamma(Y - T_{i,t} - C_{1,t}^{i})}{1+\rho}\left[\omega_{j,t}^{i} Var_t(r_{j,t+1})\right].$$

Aggregating the latter expression across the representative agents of the different countries, taking into account the equilibrium conditions (11) and assuming that $r^* = \rho$, the

[6] The preferred habitat theory was first set forth in Modigliani and Sutch (1966) and was primarily dealing with the maturity structure of interest rates. This topic is beyond the scope of this paper.

"mean-variance"-expression for the demand for country *i*'s debt as a function of its expected real interest rate is:

$$r^e_{i,t+1} = r* + \mu_t \left[ B_{i,t} Var_t(r_{i,t+1}) \right] \tag{12}$$

with $\mu_t = \dfrac{\gamma}{N(1-\gamma \bar{C}_{1,t})}$; and $\bar{C}_{1,t} = \dfrac{C_{1,t}}{N}$.

The intuition here is as follows. The representative agents demand public debt until the real return equals the real return on private assets plus a risk premium proportional to public debt's holdings and the variability of the real interest rate. Thanks to diversification opportunities, the risk premium is the lower, the higher the number of the countries in the world.

Still on eqn.(12), it becomes clearly apparent that a growing debt might reduce the real rate of return but only insofar as the variance of this rate is sharply reduced. As the latter is related to the variance of the inflation rate, through eqn.(8), the ability to distinguish between "a crowding-in public expenditure" and a "crowding-out" one is indeed left to the central bank.

## 2.2 The governments' problem

In a Nash game situation, each government minimizes its loss function (4) subject to its budget constraint (3). Full information incorporated in eqn.(12) is considered as given, so that:

$$-\left(\frac{1}{1+\beta_i}\right)\left[E_t\left(r_{i,t+1} - r^*\right) - E_{t+1}\left(r_{i,t+2} - r^*\right)\left(1 + r_{i,t+1}\right)\right] = 0 .$$

Under assumptions $r^2_{i,t} \to 0$ and $r_{i,t}.r^* \to 0$, one obtains:

$$E_t r_{i,t+1} = E_t r_{i,t+2} . \tag{13}$$

*Proposition 1*: At equilibrium, under perfect foresight, the path of the real return on public debt is constant over time; thus, there exists an optimal level of public debt in each economy for which this rate of return can prevail.

*Proof*: (directly ensuing from eqn.(13)).

Applying eqn.(5b) forward, substituting into (12) also stated forward, and using eqn.(13), the general solution for the real return on public debt is:

$$Var_t(r_{i,t+1}) = \frac{E_t\pi^e_{i,t+1} - \pi^e_{i,t} - (E_t\pi_{i,t+1} - \pi_{i,t})}{\mu_t B_{i,t} - \mu_{t+1} E_t B_{i,t+1}}. \qquad (14)$$

The uncertainty on the debt's return depends on three distinct – though related – dynamics. First, the expectations' dynamics regarding the expected inflation path; second, the dynamics of future inflation; and the dynamics of public finances. The higher expected accelerating inflation or the lower actual accelerating inflation rate, the higher uncertainty all else equal. The higher the future fiscal surplus, the lower uncertainty on the debt's return.

### 2.3 A general result under EMU

For countries participating in a monetary union, the common central bank sets $m^u_t$ to minimize eqn.(7) subject to:

$$\pi_{u,t} = m_{u,t}(1+\varepsilon_{u,t}), \qquad (5c)$$

considering that domestic debts, expected real rates of return and expected inflation rates are given. This yields:

$$m^u_t = \pi^{e,u}_t = \frac{\lambda^u \bar{B}^u_t}{1+\sigma^2}, \qquad (15)$$

with $\bar{B}_t^u == \frac{1}{N^u}\sum_{i=1}^{N^u} B_{i,t}^u$ .

Substituting eqn.(15) into eqn.(8) gives:

$$Var_t(r_{u,t+1}) = \left(\frac{\lambda^u \bar{B}_t^u}{1+\sigma^2}\right)^2 \sigma^2 \equiv \hat{\sigma}^2 \quad \forall i \in [1, N^u]\,. \tag{16}$$

The variability of the average real return on public debt depends on the uncertainty regarding the link between money and average inflation, and on the average level of public debt in the monetary union.

If one were to stop the analysis here, one would therefore face a very typical situation within a monetary union: any country whose debt would grow, all else being equal in the other countries of the monetary union, would provoke higher uncertainty in the whole union.

Furthermore, one can rewrite average inflation in the monetary union as a function of the average public debt level, substituting eqn.(15) into eqn.(5c):

$$\pi_{u,t} = \frac{1}{N^u}\sum_{i=1}^{N^u} \pi_{i,t}^u = \frac{\lambda^u (1+\varepsilon_{u,t})}{(1+\sigma^2)} \bar{B}_t^u\,. \tag{17}$$

This latter expression entails that the average inflation rate in the monetary union also depends on the average level of public debt. One might thus be willing to conclude that a country implementing a *lax* fiscal policy would make its partner countries suffer from a higher average inflation rate which would trigger a restrictive monetary policy by the common central bank. This kind of argument is quite usual in the macroeconomic literature, as stated in the introduction, though it neglects a competitiveness effect: the country with a *lax* fiscal policy may undergo a higher inflation rate, hence a deteriorating trade balance, thus benefiting its partners. Despite this counter-argument, the literature embedded in the so-called FTPL also concludes that “beggar-thy-neighbor” fiscal policies should be limited so that the average inflation rate in a monetary union could be controlled for almost perfectly by the common central bank (Bergin, 2000; Woodford, 1996).

However, we intend not to stop the analysis at this point.

As uncertainty only stems from the monetary aggregate which is set by the common central bank of the monetary union, the variance of average inflation is the same as the variance of domestic inflation rates[7], so that:

$$Var_t(r_{u,t+1}) = Var_t(r_{i,t+1}) = (m_t^u)^2\sigma^2 . \tag{18}$$

Substituting eqns.(16) and (18) in eqn.(14) yields the average public debt level:

$$(\bar{B}_t^u)^2 = -\frac{(1+\sigma^2)^2}{\sigma^2(\lambda^u)^2}\left[\frac{E_t\pi_{i,t+1}^e - \pi_{i,t}^e - (E_t\pi_{i,t+1} - \pi_{i,t})}{E_t d_{gov_i,t+1}}\right] \quad \forall i \in [1, N^U] \tag{19}$$

with $d_{gov,t+1} = E_tG_{i,t+1} + B_{i,t}E_tr_{i,t+1} - E_tT_{i,t+1}$, the fiscal deficit inclusive of net interest payments.

The originality of eqn.(19) is that it holds for every country in the monetary union, so that there is actually a close relationship between domestic inflation dynamics, future domestic fiscal policies and the *average* public debt level.

Now, consider eqn.(19) under the form:

$$\frac{E_t\left[\pi_{i,t+1} - \pi_{i,t+1}^e\right]}{E_t d_{gov_i,t+1}} = \frac{E_t\left[\pi_{j,t+1} - \pi_{j,t+1}^e\right]}{E_t d_{gov_j,t+1}} \quad \forall i \neq j \; with \; (i,j) \in [1, N^u]^2 . \tag{20}$$

*Proposition 2*: The general solution of the model implies that monetary uncertainty in a monetary union might necessitate the implementation of heterogeneous domestic fiscal policies by the member states.

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[7] Note that it does not mean that inflation rates *per se* do not differ among countries forming a monetary union.

*Proof*: If, for any reason, both countries do expect the same future inflation rate, but the realized inflation rates differ, future fiscal policies *must* be different.

The intuition is as follows. At equilibrium, every domestic market for public debt (eqn.(11)) in the monetary union must be balanced and the optimal level of real public debt is given by eqn.(13) and is fixed. Since monetary policy is common to all member states, we have shown that the variance of the domestic inflation rates and real interest rates should converge, i.e. their divergence is being stabilized (eqn.(18)), so that, *in fine*, the divergence among domestic public debts is also being stabilized. This also means that the levels of public debts in the monetary union (*can*) *differ*. Moreover, if one country in the monetary union has a higher inflation rate than the one expected, in comparison with its other partners, this country has to implement a more active fiscal policy than its partners', in order for its real public debt not to diverge too much from its optimal initial level. Thus, *overall* public debt in the monetary union does not either diverge from its initial level. Equilibrium is satisfied on any market, be it domestic or union-wide.

Stated shortly: as inflation tends to reduce real public debt, a country can satisfy its present value budget constraint with a growing fiscal deficit. This mechanism can be somehow related to the "real-balance-Pigouvian effect" of the FTPL (Woodford, 2001): if one can demonstrate the existence of a given optimal level of public debt, economic behaviors as expressed in eqns.(14), (16) and (18) should always tend to make actual debt converge to this optimum. QED.

It should be noted that the mechanism at work differs from that developed in Sargent and Wallace (1981). They showed that an expansionary fiscal policy under perfect foresight provokes an increase in expected inflation, whatever the means adopted to finance the policy. Here, we consider the reverse causation and also, we study the case of a monetary union. In a monetary union, public debts may actually have feedback effects on the average inflation rate (the FTPL argument in eqn.(17)); but the domestic inflation rates may also have an impact on fiscal policies. This is this latter effect that we have revealed and emphasized so far.

## 3 Discussion

Proposition 2 incorporates an important result, notably in the context of the EMU as well as its forthcoming enlargement towards CEECs.

In light of these findings, the relevance of the Stability and Growth Pact (SGP) as it has been adopted in 1997 can be questioned and discussed. The Pact – i.e. the adoption of a homogeneous limit on public deficit among countries in the EU[8] and a homogenous mid-term target for the cyclically-adjusted deficit – automatically leads to somestandardization of the European economies as they should have the same actual and expected inflation rates, according to eqns. (19) and (20). This however seems quite at odds with the present situation in the EU. Though nominal convergence has been largely increased, in part due to the Maastricht treaty criteria which were meant as the prerequisites to the adoption of the Euro, there remain some discrepancies between European countries which still provoke persistent real divergence.

The real divergence should not only be linked to the usual 'GDP-per-capita' divergence – it has been following a converging path between EU countries well before the transition process towards adopting the Euro[9] –, but also to some important domestic economic structures. Different international specialization and different trade partners, with Germany and Austria relatively more open towards the CEECs and Russia than France, for instance; different situations as regards the labor market, with France and Germany still facing mass unemployment while the Netherlands have almost reached full (though decreasing)

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[8] The SGP applies to all EU members. Nevertheless, only Euro area members may incur fines if they do not fulfil the dispositions of the Pact.

employment (table 3); different situations as regards labor productivity, hence a different pace for supply-driven inflation (table 4); all these elements may continue to provoke some de-synchronization of European business cycles and different paths for domestic inflation rates. Though this de-synchronization has been reduced since the adoption of the Euro (see Bentoglio et al., 2001, and Fidrmuc and Korhonen, 2001), the occurrence of asymmetric shocks as well as different economic structures still remain a prominent issue in the Euro area (seminal work on this topic is due to Bayoumi and Eichengreen, 1993).

**Table 3: Unemployment rates in the Euro area (as a percentage of the labor force)**

| | *2001* | *2002* | *2003** |
|---|---|---|---|
| Belgium | 6.7 | 7.3 | 7.8 |
| Germany | 7.7 | 8.2 | 8.9 |
| Greece | 10.4 | 9.9 | 9.5 |
| Spain | 10.6 | 11.4 | 11.6 |
| France | 8.5 | 8.7 | 9.2 |
| Ireland | 3.9 | 4.4 | 5.6 |
| Italy | 9.4 | 9.0 | 9.1 |
| Luxembourg | 2.0 | 2.4 | 3.3 |
| Netherlands | 2.4 | 2.7 | 4.2 |
| Austria | 3.6 | 4.3 | 4.5 |
| Portugal | 4.1 | 5.1 | 6.5 |
| Finland | 9.1 | 9.1 | 9.4 |
| **Euro area** | 8.0 | 8.3 | 8.8 |

*Source*: EC forecasts, Spring 2003; *: forecasts.

EU-wide discrepancies will no doubt increase after the enlargement towards the CEECs. For instance, Babetski et al. (2003) reveal that for a majority of CEECs, there is clearly a divergent pattern of supply shocks towards the EU in comparison with Portugal and Spain before their accession to the EU, which consequently leads to different inflation paths.

[9] See Martin et al., 2001.

Fidrmuc and Korhonen (2001) find that the CEECs are a less homogeneous group than the EU countries, which should entail more variability in GDP growths and inflation rates, at least short to their accession. Fidrmuc and Korhonen however show that EU countries previously labelled "peripheral" have increased their correlation with the euro area shocks: their participation in the euro area seems to have helped them to catch up the same features as core countries (business cycles, demand and supply shocks). This lesson will no doubt also apply to the CEECs, but some time after they have joined the EU.

**Table 4: Labor productivity in the Euro area (percentage change on preceding year)**

| | *2001* | *2002* | *2003** |
|---|---|---|---|
| Belgium | -0.4 | 0.8 | 1.3 |
| Germany | 0.1 | 0.8 | 1.3 |
| Greece | 4.5 | 4.1 | 3.3 |
| Spain | 0.3 | 0.7 | 1.0 |
| France | -0.1 | 0.6 | 1.1 |
| Ireland | 2.6 | 4.6 | 2.9 |
| Italy | 0.1 | -0.7 | 0.6 |
| Luxembourg | -4.3 | -2.3 | 0.0 |
| Netherlands | -0.5 | 1.1 | 0.9 |
| Austria | 0.2 | 1.4 | 1.1 |
| Portugal | 0.3 | 0.3 | 0.8 |
| Finland | -0.6 | 1.4 | 2.4 |
| **Euro area** | 0.1 | 0.5 | 1.1 |

*Source*: EC forecasts, Spring 2003; *: forecasts.

A brief glance at tables 5 and 6 show how different major CEECs are in relation to EU countries. Though they only represent a mere 6 percent of the enlarged Union's income (Nuti, 2002), it is likely that the inflation rates should continue to diverge within this enlarged Union, at least in the short run. High rates of unemployment in the major CEECs (table 5) are expected to decrease with CEECs catching up further, so that demand-driven inflation should increase. The variability of the inflation rates, as a consequence of the large swings in labor productivity (table 6) might also prove very difficult to tackle within a fixed exchange rate system (ERM II) and/or with a common central bank (the ECB). This gives further weight to the adoption of domestic heterogeneous fiscal rules in Europe which would respect the differences in inflation rates within the enlarged EU.

**Table 5: Unemployment rates in some CEECs**
**(as a percentage of the labor force)**

| | *1999* | *2000* | *2001* | *2002* |
|---|---|---|---|---|
| Czech Rep. | 9.4 | 8.8 | 8.9 | 9.8 |
| Slovakia | 19.2 | 17.9 | 18.6 | 17.5 |
| Hungary | 9.6 | 8.7 | 8.0 | n.a. |
| Slovenia | 13.0 | 12.0 | 11.8 | n.a. |
| Poland | 13.1 | 15.1 | 17.5 | 18.1 |

*Source*: WIIW.

**Table 6: Labor productivity in some CEECs**
**(percentage change on preceding year)**

| | *1998* | *1999* | *2000* | *2001* |
|---|---|---|---|---|
| Czech Rep. | 3.7 | 1.7 | 9.5 | 5.5 |
| Slovakia | 9.1 | 0.2 | 12.1 | 5.9 |
| Hungary | 11.9 | 10.5 | 18.3 | 4.8 |
| Slovenia | 5.4 | 3.1 | 8.4 | 3.5 |
| Poland | 4.7 | 11.8 | 13.6 | 4.2 |

*Source*: WIIW, labor productivity in the industry sector (industry *public* sector for Poland).

Before new EU members enhance real convergence towards the previous EU countries, the European fiscal rules will thus be at stake. As discussed in Buiter and Grafe (2002) and Coricelli and Ercolani (2002), a reform of the SGP is needed in order for accession countries to comply with an economically sensible rule which will not lead them to slack public investment whereas there is a need for efficient infrastructures, notably in order to catch foreign direct investments. Our theoretical result also gives support to this view. As the government's loss does incorporate a measure of "productive expenditures", this leads the government to increase public investment: in the short run, this policy enhances aggregate demand and may fuel inflation. What proposition (2) shows is the consistency of this mechanism with the stability of the whole monetary union in the long run, insofar as domestic governments do not have to comply with an homogeneous fiscal rule. Indeed, as stated earlier, the causation between inflation and public deficits is from the former to the latter: inflation convergence allows a reduction in public deficits' divergence, not the contrary.

## Conclusion

The main thrust of the paper is in showing how the homogeneity of fiscal rules in the EU, under the form of the SGP, causes a standardization in economic structures among the EU countries. This standardization however is still questionable. On the empirical side, basic economic structures, such as labor productivity or unemployment rates, are shown to be quite different from one country to the other, despite the monetary union. It could hence explain the discrepancy among public deficits between the EU countries and invalidate the legitimacy of the SGP. Such discrepancies are expected to grow with the enlargement of the EU towards the CEECs whose inflation determinants, whether demand-related – unemployment rates should tend to decrease – or supply-driven (labor productivity), are generally higher and more volatile than in the EU. This is another argument for reforming the SGP.

Does a monetary union need macroeconomic standardization or convergence? Though this question is beyond the scope of the paper, some intuitions might be interesting to formulate. The drafters of the Maastricht treaty had given a prominent role to nominal convergence, at the expense of real convergence. This has at least partly resulted in the diverging patterns of growth, inflation dynamics and public deficits among EU members.

Hence, either European authorities, governments, the European Commission and the ECB, accept the present situation, and the Pact should be changed to take heterogeneous patterns into account, along proposition (2) in the paper. Or, real convergence is promoted but the transition will necessitate more flexibility in fiscal policies, because fiscal consolidation would be disruptive as European economies are about to be in a trough. Stated differently, automatic stabilizers should play fully whatever the current fiscal stance. Reductions in public debt levels, in order to facilitate inflation convergence, should only occur gradually. Thus, whatever the direction politicians will follow, current diverging fiscal policies are still the best practices for the EU.

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# Appendix

| Covariance Matrix for the Long term real interest rates in the Euro area | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | DK | D | EL | E | F | IRL | I | NL | A |
| B | | | | | | | | | | |
| DK | 0,0 | | | | | | | | | |
| D | 0,1 | 0,0 | | | | | | | | |
| EL | 0,1 | 0,1 | 0,3 | | | | | | | |
| E | 0,0 | 0,0 | 0,0 | 0,4 | | | | | | |
| F | 0,1 | 0,0 | 0,1 | 0,4 | 0,1 | | | | | |
| IRL | 0,2 | 0,0 | 0,1 | 0,6 | 0,3 | 0,2 | | | | |
| I | 0,0 | 0,0 | 0,0 | 0,3 | 0,1 | 0,1 | 0,1 | | | |
| NL | 0,2 | 0,1 | **0,6** | **1,0** | 0,1 | 0,4 | 0,1 | 0,2 | | |
| A | 0,2 | 0,0 | 0,2 | 0,4 | 0,1 | 0,2 | 0,2 | 0,1 | **0,5** | |
| P | 0,1 | 0,0 | 0,4 | **0,7** | 0,1 | 0,3 | 0,1 | 0,1 | **1,1** | 0,4 |
| Source: EC, Spring 2003 Forecasts; 1999-2002. | | | | | | | | | | |

| Covariance Matrix for the inflation rates in the Euro area | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | DK | D | EL | E | F | IRL | I | NL | A |
| B | | | | | | | | | | |
| DK | 0,1 | | | | | | | | | |
| D | 0,3 | 0,0 | | | | | | | | |
| EL | 0,2 | 0,0 | 0,3 | | | | | | | |
| E | 0,2 | 0,1 | 0,1 | 0,3 | | | | | | |
| F | 0,2 | 0,1 | 0,2 | 0,3 | 0,3 | | | | | |
| IRL | **0,5** | 0,2 | 0,3 | 0,4 | **0,6** | **0,5** | | | | |
| I | 0,2 | 0,1 | 0,1 | 0,2 | 0,2 | 0,2 | 0,4 | | | |
| NL | 0,2 | 0,0 | **0,5** | **0,8** | 0,1 | 0,4 | 0,3 | 0,2 | | |
| A | 0,4 | 0,1 | 0,4 | 0,4 | 0,2 | 0,3 | **0,6** | 0,2 | **0,6** | |
| P | 0,2 | 0,0 | 0,4 | **0,5** | 0,2 | 0,3 | 0,3 | 0,2 | **1,0** | **0,5** |
| Source: EC, Spring 2003 Forecasts, 1999-2002. | | | | | | | | | | |