Monetary and budgetary-fiscal interactions in a Keynesian
heterogeneous monetary union

Angel Asensio*
CEPN, Université Paris 13-CNRS

Preliminary draft, October 2006

Abstract

The paper studies the effects of heterogeneity upon the monetary and fiscal-budgetary policy interactions in a Keynesian monetary union. As a result of interactions, some of our results contrast sharply with the ones in studies that consider separately monetary, fiscal and budgetary policies. Other non-conventional mechanisms are identified in connection with the supply-side effects of fiscal taxes variations. As concerns policy responses to inherited unemployment, the central bank profile proves notably to be crucial in determining the magnitude of the instrument moves that are required to achieve the objectives. Simulations suggest that heterogeneity is likely to introduce more sources of non conventional effects and to enforce adverse interactions, especially in contexts of high unemployment. However, provided authorities are able to control the distributive conflict and its inflationary consequences, it is beneficial for the union that monetary policy specializes in countering the common effects of shocks, because that pushes governments to concentrate in countering the idiosyncratic effects. Employment targets require then lower instruments responses, as a result of efficiency gains.

———————-

* Université Paris 13, U.F.R. Sciences Economiques, Av. J.-B. Clément, 93 430 Villetaneuse. Tel: 33 (0)1 49 40 33 30, asensio@seg.univ-paris13.fr

1   Introduction

Monetary and fiscal-budgetary policies interactions have been recently discussed within the Keynesian approach to macroeconomic governance (Asensio 2005a, 2006), including in the case for a symmetric monetary union (Asensio, 2005b). Within the eurozone, the convergence criteria ensure nominal homogeneity, but macroeconomic policies have to deal with countries which structures will remain strongly heterogeneous for a while. Keynesian literature has paid little attention to the question of whether and how heterogeneity does affect monetary and fiscal-budgetary interactions in a monetary union, although some important aspects have been tackled in Palley (2005a). We address the question by extending Asensio (2005b) as follows. First, we do not restrict the formal discussion round the symmetric two-country model, though it provides key analytical results, but we proceed with simulations based on differentiated parameters across countries, so that asymmetric effects of the common monetary policy and other consequences of heterogeneity are not neglected. The goal of these simulations is not to give any scenario, but to identify, with the help of the analytical results of the symmetric case, what are the predominant "mechanisms" at work in the presence of heterogeneity. Secondly, we study the type of monetary and fiscal-budgetary interactions that can occur when the rate of interest is endogenously determined according to different central bank "profiles". Thirdly, we explore further the idea that peaceful (and therefore non inflationary) income distribution is a better way to price stability and high employment, insofar as it allows for complementary rather than conflicting responses to the shocks and to the inherited unemployment.

Section 2 presents a two-country model where governments control taxes and public spending, while monetary authorities, it is assumed for the sake of analytical purpose only, control the long run rate of interest. Monetary policy pursues the collective objective of stabilizing the average price index, but it may concede some inflation, depending on the magnitude of the average unemployment and on the relative importance monetary authorities gives to unemployment and inflation. Governments in the other hand are supposed to aim at reducing unemployment without departing from their budget balance target. Since we are not looking for a specific situation, the question we shall discuss is relatively modest: we do not consider how pragmatic targets should be designed in such and such specific situation (targets will be considered as exogenously given)[1], but only what 'mechanisms' are at work. Of course, building models need to much aggregate functions stability compared with the unpredictable volatility of the real world, and the paper does not intend to give magic recipes based on simplistic models, such as anchoring the interest rate upon a presumed natural rate (as suggests the mainstream literature on the 'Taylor rule'). Our purpose is simply to help to understand those mechanisms that may be triggered by

---

[1] Whereas it is a central problem for the Keynesian approach to economic policy, policy targeting does not raise any difficulty within the mainstream, for a 'natural' trajectory is postulated. Policy targets then summarize to the 'natural rate of unemployment', the "natural rate of interest", and zero inflation.

monetary and fiscal-budgetary interactions when the central bank have some control over the rate of interest.

Section 3 studies monetary and fiscal-budgetary interactions according to the inherited unemployment rate and current shocks, first analytically for the symmetric case, and then by means of simulations for a heterogeneous union. Contrasting with the symmetric model, simulations show that monetary, budgetary and fiscal instruments respond to every type of shocks in a heterogeneous system. Thus the central bank no more concentrates on the symmetric components, for asymmetric components have common effects that fall within the central bank field of action. Conversely, governments respond to the common components of demand shocks for the central bank no more can offset them completely because of their idiosyncratic effects. As a result of interactions (between the monetary policy and fiscal-budgetary policies, and between fiscal-budgetary policies themselves), some of our results contrast sharply with the ones in studies that consider separately monetary, fiscal and budgetary policies. For example, Keynesian models of unemployment use to disregard non-demand shocks (that is, inflationary shocks and productivity shocks) for they do not hit outputs levels but prices at first. Yet, if the central bank reacts to that shocks in order to control the price index deviation, governments are likely to respond with fiscal and/or budgetary instruments. Conversely, if the reaction of the governments were not considered, one would expect the central bank to increase the rate of interest in relation with inflationary shocks. But a restrictive monetary response would not be a solution within our framework, since it would trigger an increase in public expenditures and tax rates, and therefore more inflationary pressures and more restrictive monetary policy... Actually, the central bank reaches its objective when it decreases the rate of interest in response to inflationary shocks, because public expenditures and taxes (which have both demand and supply sides effects) are then reduced in order to compensate for the expansionary effect of interest rate on employment. Other non-conventional mechanisms follow form taking into account the supply-side effects of fiscal taxes variations. For example, as concerns the asymmetric effects of demand shocks, it is usually expected that public expenditures and taxes rise in countries where aggregate demand decreases. However, insofar as the stimulating effect of a decrease in fiscal taxes is reinforced by the price competitiveness channel (lower taxes, lower costs); decreasing public expenditures along with a tax rate reduction may have expansionary effects.

On the other hand, interactions between policy instruments are likely to produce inefficiency. It turns out that it is especially in front of "inherited unemployment" by contrast with the part of unemployment that is caused by current shocks (that is, in contexts that are discarded in mainstream economics), that the central bank and governments responses reveal mutually conflicting. Given governments objectives, the sign and magnitude of monetary, budgetary and fiscal instruments responses to inherited unemployment depend on monetary policy profile, and is as much sensitive as governments consider it more difficult to move towards full employment. Consequently, inasmuch as the magnitude of the instrument moves that are required to achieve the objectives matters (and

3

it should matter, for the weaker the required responses are, the more ambitious the targets can be), the central bank profile is of crucial interest, though it may work in different ways.

Simulations suggest furthermore that heterogeneity is likely to introduce more sources of non conventional effects and to enforce adverse interactions, especially in contexts of high unemployment.

Section 4 suggests that such adverse interactions could be avoided, and policies efficiency could be improved as regard price stability and employment, provided authorities were able to control the distributive conflict and its inflationary consequences. In that case, monetary policy could specialize in countering the common effects of shocks (including inherited unemployment). Such a specialization of monetary policy pushes governments to specialize in countering the idiosyncratic effects of shocks (including asymmetric inherited unemployment), and distracts by the way every authority of others objectives, which eliminates adverse interactions. As a result of these efficiency gains, employment targets require lower instruments responses.

2   The formal framework

In mainstream economics, when aggregate demand and prices decrease but wages do not because of some rigidity, the need for transaction-money falls, and the rate of interest decreases, raising the demand and the price of goods and moving the real wages towards their full employment level[2]. Monetary policy may help to restore the natural rate of interest, in the way suggested by the 'Taylor rule', and to restore by the way the natural rate of unemployment. Things go differently in Keynesian contexts, because the magnitude of the decrease in interest rate (either the so-called 'Keynes effect', or the one resulting of monetary policy) and of any positive real balance effect (people do not want to hold idle cash balances and therefore increase the demand for goods) depends on speculative decisions concerning the demand for money, with the result that income and employment depends on the degree of confidence of the moment and its impact on the demand for money. At equilibrium, there are no competitive mechanisms which could move the economy towards any predetermined "long run" solution.

Equilibrium with under-employment means on the one hand that the self-regulatory labour market process failed, either the wages decrease have not been able to stimulate the effective demand or have amplified the depression (but in this case wages should continue to fall[3]), or, as it will be assumed in the paper, workers have been able to stop the decrease in wages, and, on the other hand, that the central bank can not adjust the rate of interest to the natural rate

---

[2]Theoretically, it is possible that flexible nominal wages reach this solution without any variation in the rate of interest (but it is not certain; see the *General Theory*, Ch. 19): through positive effects on the marginal efficiency of capital and effective demand, wage flexibility may produce inflation, reduce real wage and rise production. If on the other hand nominal wages are sticky, the role of interest rate becomes crucial.

[3]See Tobin (1975) and Palley (2005b) about this kind of instability.

because the demand for money is not independent of the monetary policy, so that the rate of interest is not really under control, though it is influenced by monetary authorities.

The modelling of macroeconomic policies within such a Keynesian approach to equilibrium (Asensio, 2005a, 2006) has been recently extended to the case of a monetary union (Asensio, 2005b). We develop the model so as to take heterogeneity or 'structural asymmetries' into account. Then, we suggest a way to study monetary and fiscal-budgetary interactions.

2.1 A Keynesian two-country model of monetary union

Starting with the usual four-macro-market structure of the closed economy, we move towards a two-country monetary union by assuming perfectly integrated market for bonds and unique money. Consequently, the system comprises six markets (the two labour markets -immobile factor-, the two markets for goods - imperfect substitutes -, the market for bonds, and the market for money), which supposes five relative prices (two real wages in terms of goods, the international relative price of goods, the rate of interest and the real price of money in terms of goods, which inverse is the nominal price of goods. Because of Walras's law, the equilibrium condition for the market of bonds will remain implicit.

Variables are expressed in terms of relative variations from their initial value, excepting the rate of interest and the tax rate, which are expressed as variations. We focus on the short run behaviour of the system, in the sense that productive physical stock of capital is assumed to be constant during the period considered. In contrast with Asensio (2005b) parameters (generally in small Greek letters) may differ across countries. Price and quantity determination are discussed below with respect to the market considered.

2.1.1 Markets for goods

Apart from taxes and public expenditures changes $\left(\widehat{t}_i,\, g_i\right)$, the demand for goods varies in both countries with the rate of interest $\left(\widehat{i}\right)$, the international relative output price $(p_j - p_i)$, and an exogenous component (a_i), so as the market clearing conditions have the form[4]:

$$y_i = -\gamma_i \widehat{t}_i - \sigma_i \widehat{i} + \kappa\,(p_j - p_i) + \lambda_i\,(\varphi_i g_i + a_i),\quad i = 1, 2, j = 1, 2, i \neq j \quad (1)$$

At equilibrium, firms supply the amount of goods that is demanded, and their demand for labour is adjusted in accordance with the technology (see below the market for labour). Given that level of employment, the marginal productivity equalization to the real cost of labour induces a negative relation between employment and real wage variations:

$$n_i = -\rho_i\,(w_i - p_i) + d_i,\quad i = 1, 2$$

---

[4] See the appendix n° 1.

n_i is the relative variation in employment level of country i

w_i is the relative variation in nominal wage in country i

d_i measures exogenous influences

It is possible to introduce a fiscal cost effect by supposing that it works through the price of the variable input in the short run: replacing the nominal cost of labour (W) by $W(1 + \xi t)$, where $0 \le \xi < 1$ measures the (weakened) impact of the tax rate t on the labour cost, profit maximisation requires $\partial Y / \partial N = W (1 + \xi t) / P$. The relative variation in the demand for labour (n) then takes the form of a function of the fiscally-corrected labour cost, which relative variation can be approximated by $(p - w - \xi \widehat{t})$ for small values of $\widehat{t}$ (variation in t):

$$n_i = \rho_i(p_i - w_i - \xi \widehat{t_i}) + d_i$$

In case of nominal wage rigidity (see below the market for labour), the equation above actually gives the price index variation that makes firms able to remain on their demand for labour curve when they adjust the supply of good (and the demand for labour) to the effective demand. If demand increases, it is through inflation that the real wage variation is made equal to the marginal productivity decline, prompting firms to raise their production in order to respond to the increasing demand. We can rewrite that equation in accordance with the Keynesian approach to inflation in contexts of unemployment:

$$p_i = w_i + n_i - y_i - \overset{\circ}{\alpha}_i + \xi_i \widehat{t_i} \tag{2}$$

where $-\overset{\circ}{\alpha}_i + \xi_i \widehat{t_i}$ is the rate of variation of the mark-up on unit labour cost[5].

2.1.2 Labour markets

The demand for labour in each country depends on the quantity of goods to be delivered, according to the available technology:

$$y_i = \alpha_i n_i + c_i \Rightarrow$$

$$n_i = \frac{y_i - c_i}{\alpha_i}, \quad i = 1, 2 \tag{3}$$

y_i is the relative variation in output in country i, c_i represents other exogenous technological factors. We assume $\alpha_i < 1$ (diminishing marginal product of labour).

---

[5] It is not essential to make imperfect competition assumptions in order to obtain a mark-up relation. For example, starting from the production function $Y = CN^\alpha$, $\alpha < 1$, competitive pricing requires the marginal productivity to be equal to the real cost of labour: $\partial Y / \partial N = W (1 + \xi t) / P \implies P = W (1 + \xi t) / (C\alpha N^{\alpha - 1}) = (WN (1 + \xi t) / Y) / \alpha$; hence, by differentiation of the associated logarithmic expression (for small values of $\widehat{t}$), we have $p = w + n - y - \overset{\circ}{\alpha} + \xi \widehat{t}$, where $\overset{\circ}{\alpha}$ is the rate of variation in α (exogenous). Notice that an increasing mark-up on unit labour cost expresses in this case a declining wages-output ratio $(\overset{\circ}{\alpha} < 0)$ and/or increasing fiscal taxes $(\widehat{t} = dt > 0)$.

At equilibrium, workers offers the amount of labour firms demand, but in accordance with our presentation of self-regulating forces failures, the nominal wages is anchored in an exogenous (but possibly variable) threshold $(\overline{w}_i)$. The current wage may deviate from this threshold when certain events occur, such as a rise in unemployment rate or exogenous disturbances:

$$w_i = \overline{w}_i - \theta_i \left(n_{fi} - n_i\right), \quad i = 1, 2 \tag{4}$$

where n_{fi} is the rate of change of the labour force in country i.

2.1.3   Market for money

Following the post-Keynesian approach to endogenous money, we will suppose that banks deliver the quantity of money that is demanded at the current rate of interest, which is influenced by the central bank decisions (see the section 2.2 below). Since it is through the rate of interest that the central bank may influence outputs and prices, explicit modelling of the demand for money, and therefore of the equilibrium quantity of money, is not necessary. Despite the formal resemblance with the recent mainstream approach to endogenous money, the functioning of the market differs sharply: because of the speculative demand instability, the transmission of short-term interest rates variations, through which the central bank may influence the long-term interest rates, is made uncertain (in the Keynesian sense). For example, lower short-term rates (increases in high-powered money) aiming to extend credit do not produce the same decline in long-term rates depending on whether the liquidity preference changes or not. When it rises, banks may be able to sell more credit without having to reduce their interest rates, for non-bank loans rates in this case tend to rise in order to compensate the increasing liquidity preference. Moreover, speculative behaviours also may block the transmission process when the current rates are considered as very low (liquidity trap). Thus automatic monetary rules à la Taylor turn out to be excessively optimistic in a Keynesian context.

2.1.4   Interdependencies

Shocks transmit across countries through international trade and financial transactions. For example, a rise in autonomous demand of country i increases activity and prices at equilibrium, and therefore increases the external demand to country j because of the price competitiveness effect. In addition, as far as it has a negative impact on country's i current account, the shock involves a proportionate net capital inflow at equilibrium.

In the same way, economic policies carry positive or negative externalities, depending on the type of the spillover and depending on the macroeconomic context abroad.

Insofar as they transmit across countries, shocks (and policy responses) have common effects, even if they hit directly one only of the two countries. Shocks that do not transmit proportionally have both common and idiosyncratic effects. It is of importance to distinguish between the shock itself, which may have

common and idiosyncratic components, and the effects of the shock, which may also have common and idiosyncratic components. Indeed, the common part of any shock may have asymmetric effects in a heterogeneous union, whereas it would only have common effects in a symmetric union. On the other hand, the idiosyncratic part of any shock may have a common effect.

2.2 Modelling macroeconomic policies

We assume that authorities in each country make the same evaluation of the past average value of all coefficients of the two-country model, but they know that coefficients may shift unpredictably in the future, without any anchorage. Hence, their policy will be decided without reference to any trend or natural position.

Authorities have the same ideal objectives, namely full employment and zero inflation, but they manage instruments gradually and with transparency, because their efficiency would suffer if people changed their expectations and decisions (some coefficients would shift).

2.2.1 Budgetary and fiscal policies

Then, according to the context, governments set pragmatic targets which tend towards (but may differ from) the ideal.

$$
\begin{aligned}
n_i &= \mu_i q_i \\
0 &< \mu_i \leq 1
\end{aligned}
\tag{5}
$$

q_i represents the relative increase in the labour force that is initially required for full employment in country i; it is an approximate measure of the 'inherited' rate of unemployment of the current period (since n_i is the variation in employment for the current period, $q_i - n_i$ measures approximately the rate of unemployment at the end of the period).

μ_i is a coefficient that the government chooses in function of the confidence he has in the success of operations. It is important to bear in mind that this equation, like most equations of Keynesian models, does not pretend to the stability that is usually assumed. Indeed μ_i is subject to various changing factors. Some of them concern the effective demand expected sensitivity to the policy instruments; others depend on financial constraints which may limit the government room for manoeuvre, others may add political considerations (e.g. public opinion)... In this perspective, economic-policy designing hinges as much on the selection of the objective (value of μ_i) as on the adjustment of instruments (value of g_i or $\widehat{t}_i$ which solves equation (5), given equations (1), (2), (3) and (4))[6].

---

[6]Notice that both are likely to be connected, for the weaker the required instrument responses are, the more ambitious targets can be.

Yet, since budget balances depend on short run employment objectives, governments may have to limit the increase in public expenditures, unless they are able to adjust taxes. Consequently, employment and budget balance objectives, as well as the concerned instruments, turn out to be interdependent, and therefore must be simultaneously chosen within a country. Hence, let us suppose that fiscal taxes are set so that the budget-balances are equal to some exogenous values which depend on governments financial policies[7]:

$$b_i = z_i \tag{6}$$

where $b_i = \varphi\left(y_i - g_i\right) + \widehat{t_i}$ (see the appendix n°2), and z_i represents factors which may interfere in the short run, like deliberate structural deficit due to long run public investments or debt management considerations. z_i is a part of the global policy, and has to be choose jointly with μ_i (for example, it may be high when μ_i is high). Once again, the problem as much concerns the objective selection (value of z_i) as the instruments adjustment (value of $\widehat{t_i}$ or g_i which solves equation (6)).

It is then possible to determine the pairs $(g_i, \widehat{t_i})$ which solve conditions (5) and (6), given equations (1), (2), (3) and (4).

2.2.2 Monetary policy

Because of the sensitivity of effective demand and employment to the interest rate, the move of fiscal and budgetary instruments required by conditions (5) and (6) depends on monetary policy decisions. Of course, interest rates also matter for the choice of objectives (μ_i, z_i). For example, if the governments think that the central bank will accommodate, they can adopt more ambitious plans in terms of employment, or limit the cost of a given increase in employment in terms of deficit, taxes and/or expenditures adjustment. Thus, the central bank can take different ways in order to make it more or less difficult for governments to reach their objectives[8].

It may be that the central bank has no control over the long run rate of interest, at least as concerns decreases. In that case, the long run interest rate must be considered as exogenous, and equations 5 and 6 deliver the fiscal-budgetary instruments adjustment that is required to reach the pragmatic objectives of governments. When the central bank have some control over the long term interest rates, as will be supposed in the rest of the paper, it is confronted with a dual mission (although one or the other may be considered as superior): as unique and legitimate guardian, it must preserve the confidence in money, which is a decreasing function of the average inflation of the union; as a potentially powerful lever for aggregate demand, it should assist governments in case of

---

[7] It is obvious that political implications of the couple public spending / fiscal taxes are likely to influence the choice of μ_i and z_i.

[8] As Asensio (2005) stated, the central bank participation to economic recovery does not require necessarily lower interest rates, for it can help in a decisive way by avoiding interest rates increases when budgetary-fiscal policies stimulate the activity.

unemployment. The following equation is flexible enough to capture various monetary-policy profiles:

$$\frac{1}{2}(p_1 + p_2) = \beta\frac{1}{2}(q_1 - n_1 + q_2 - n_2) = \beta\frac{1}{2}((q_1 + q_2) - (n_1 + n_2)), \ \beta \geq 0 \ (7)$$

If $\beta = 0$, the inflation target is simply zero. Such a configuration corresponds to a case where monetary authorities believe that competitive forces always work efficiently (therefore $q_1 = q_2 = 0$), and that the best that monetary policy can do is to preserve the purchasing power of money[9]. This is almost the ECB posture (if one disregards its definition of price stability, which admits in fact an inflation target "below, but close to, 2%"), since it only allows inflation deviations over "very short spans of time", so as to be able to smooth the impact of supply shocks like cost-push shocks[10,11]. If $\beta > 0$ the central bank concedes as more inflation as unemployment is high (zero inflation at full employment). Hence, β commands in a way the relative importance of employment compared to price stability, but monetary policy is also affected in a crucial way depending on whether $\frac{1}{2}(q_1 + q_2)$ is positive or equal to zero, for a rise in average employment ($\frac{1}{2}(n_1 + n_2)$) triggers a deflationary monetary policy if it is interpreted as a deviation from the natural level of employment (that is if q_1 and q_2 are considered as equal to zero), whereas on the contrary prices are allowed to rise insofar as the rise in employment is less than $\frac{1}{2}(q_1 + q_2)$ when $\frac{1}{2}(q_1 + q_2)$ is considered as positive.

3 Monetary and budgetary-fiscal policies interactions

Whereas mainstream economics aims to formulate stabilization policy rules that would be as neutral as possible vis-à-vis the presumed natural trajectory of the economy, Keynesian economics has to deal with the more difficult problem of designing a policy in the absence of any predetermined trajectory. Though authorities may influence the economic system, the future outcome is always uncertain for people expectations and behaviour may shift unexpectedly. Hence

---

[9] This belief does not fit well in the Keynesian contexts, for authorities are supposed to know that coefficients may unpredictably shift, and if the future of the economy can not be known, efficiency can not be ensured. Hence, it is not very sensible to act in Keynesian contexts as if efficiency was ensured, though it is in the 'new classical' approach of ergodic regimes.

[10] See the European central bank web page on medium-term orientation of monetary policy. See also Arestis and Chortareas (2006) for a recent appraisal of the monetary policy in the euro area.

[11] Since in mainstream macroeconomics the aggregate demand natural level is the full employment level, cost-push shocks are admitted to reduce the full capacity supply (and demand) for goods and services. In Keynesian economics on the other hand, cost-pushed inflation may reduce the full capacity supply of goods without reducing the effective demand and employment levels. Hence, supply shocks do not impact the level of activity insofar as they do not reduce the full capacity below the current level of effective demand.

authorities have to hypothesize their influence upon the system, which depend on the context of the moment, and then design pragmatically realizable targets. Since we are not looking for a specific situation, the question we shall discuss here is relatively modest: we do not consider how pragmatic targets should be designed in such and such specific situation (we shall consider that the targets are given exogenously); we shall simply suggest, first analytically in a simple symmetric model, and then, by simulating a heterogeneous monetary union, some general principles concerning the way authorities should adjust their instrument in order to reach any set of objective in accordance with equations 5, 6 and 7.

3.1 Analytical results for the symmetric case

Let first consider two countries identical in all respects (all parameters are identical). For the sake of simplicity, we suppose moreover that $z_1 = z_2 = 0$ (that is, budget balances are at the desired levels and fiscal authorities do not want to change them), and we redefine the shocks so as to separate the common (lower case letter) and idiosyncratic (upper case letter) components: $x_1 \equiv x_S + x_A$ and $x_2 \equiv x_S - x_A$, $x = c, \overline{w}, \overset{\circ}{\alpha}, a$.

It is straightforward to show (see the appendix n°3) that in the symmetric case, provided authorities have enough control over their respective instruments, the objectives expressed in equations 5, 6 and 7 suppose that the central bank reacts to the common component of shocks $(a_S, c_S, \overline{w}_S, \overset{\circ}{\alpha}_S)$ and to the average inherited unemployment[12] $(\frac{1}{2}(q_1 + q_2) = q_S)$, and governments react to both the common and idiosyncratic part of unemployment and shocks, excepted the common component of demand shocks.

That result is rather intuitive as concerns the central bank reactions, for they target average variables, but one could be amazed of the reactions of the governments to the common component of both inherited unemployment and non-demand shocks. Actually, the central bank controls inflation through the influence it has on aggregate demand. Hence, it offsets the impact of the common part of demand shocks on the average price index by adjusting the rate of interest in such a way that it offsets the common effect on aggregate demand (see equation 1)[13], but, since the common components of non-demand shocks produce prices deviations that are not due to a variation of the aggregate demand, aggregate demand deviations can not be avoided, if not fortuitously, which calls for government reactions.

---

[12] $\frac{1}{2}(q_1 + q_2)$ and $\frac{1}{2}(q_1 - q_2)$ can be interpreted respectively as the common part and the asymmetric part of inherited unemployment: if by definition $q_1 = q_S + q_A$ and $q_2 = q_S - q_A$, where q_S is the common (symmetric) component and q_A is the asymmetric one, then $\frac{1}{2}(q_1 + q_2) = q_S$, and $\frac{1}{2}(q_1 - q_2) = q_A$.

[13] Indeed, for $\widehat{t}_i = g_i = 0$, $i = 1, 2$ if $\widehat{i} = \dfrac{\lambda}{\sigma} a$, then $\frac{1}{2}(y_1 + y_2) = 0$. Insofar as the monetary reaction offsets the effects of that component on outputs, the reactions of the governments turn to be unnecessary.

Keynesian models of monetary and fiscal-budgetary policies use to disregard non-demand shocks (that is inflationary shocks $(\overline{w}, \overset{\circ}{\alpha})$ and productivity shocks (c)) since they do not hit the outputs levels but prices at first. Yet, if the central bank reacts to the common part of that shocks in order to control the price index deviation, governments are likely to respond with fiscal and/or budgetary instruments. Since monetary policy does not respond to asymmetric shocks in our symmetric monetary union, such an interaction concerns the common part of inflationary shocks only $(\overline{w}_S, \overset{\circ}{\alpha}_S)$. If the reactions of the governments were not considered, one would expect the central bank to increase the rate of interest in relation with inflationary shocks. But a restrictive monetary response would not be a solution within our framework, since it would trigger an increase in public expenditures and tax rates, and therefore more inflationary pressures and more restrictive monetary policy... Conversely, as appendix n°3 lets see, the central bank actually reaches its objective when it decreases the rate of interest in response to the common part of inflationary shocks, because public expenditures and taxes are then reduced in order to compensate for the expansionary effect of interest rate on employment:

for $q_S = q_A = c_S = c_A = a_S = a_A = \overset{\circ}{\alpha}_A = \overline{w}_A = 0$,

$$\widehat{i} = -\frac{\lambda - \gamma}{\sigma \xi}(\overline{w}_S - \overset{\circ}{\alpha}_S)$$

$$g_1 = g_2 = -\frac{1}{\varphi \xi}(\overline{w}_S - \overset{\circ}{\alpha}_S); \ \widehat{t}_1 = \widehat{t}_2 = -\frac{1}{\xi}(\overline{w}_S - \overset{\circ}{\alpha}_S)$$

Remark

Since the public expenditures and interest rate effects on the average price index counter each other, it is finally the tax reduction effect that permits the central bank to reach its objective, which reveals some complementarity between monetary and fiscal authorities. Indeed, in the absence of such a supply side effect, there would be no equilibrium solution for the set of objectives described in equations 5, 6 and 7 when $\overset{\circ}{\alpha}_S \neq 0$ or $\overline{w}_S \neq 0$ (see the results above with $\xi \to 0$).

The governments also respond to the asymmetric components of non-demand shocks, although the central bank does not:

for $q_S = q_A = c_S = c_A = a_S = a_A = \overset{\circ}{\alpha}_S = \overline{w}_S = 0$,

$$\widehat{i} = 0$$

$$g_1 = -g_2 = \frac{2\kappa}{\varphi(\lambda - \gamma - 2\xi\kappa)}(\overline{w}_A - \overset{\circ}{\alpha}_A); \ \widehat{t}_1 = -\widehat{t}_2 = \frac{2\kappa}{\lambda - \gamma - 2\xi\kappa}(\overline{w}_A - \overset{\circ}{\alpha}_A)$$

The reason is that, in an open system, price indexes divergence implies a loss of international price competitiveness, which weaken the aggregate demand of the country and stimulate the one of the partner. Hence, the shocked economy decreases the tax rate and public expenditures (the partner does the opposite) so as to compensate for the price indexes divergence $(\lambda - \gamma < 2\xi\kappa)$, unless the negative impact of this response on domestic demand is higher compared with the positive impact on external demand, which would imply increases in tax rate and public expenditures $(\lambda - \gamma > 2\xi\kappa)$.

12

Although productivity shocks do not directly hit aggregate demand, budgetary and fiscal instruments respond even when the central bank does not (asymmetric shocks c_A). Indeed, governments do not precisely target output levels, but employment levels, with the result that expansionary policy is required when productivity shocks save employment, for a given demand level. Since the symmetric component of employment-saving shocks raises unemployment while it has disinflationary effects, this kind of shock calls for complementary monetary and fiscal-budgetary responses. Hence, the central bank reduces the rate of interest, unless the disinflationary impact of the increase in average productivity is counterbalanced by the inflationary impact of the governments responses ($\lambda - \gamma > \xi (1 - \varphi\lambda)$):

for $q_S = q_A = c_A = a_S = a_A = \overset{\circ}{\alpha}_A = \overline{w}_A = \overset{\circ}{\alpha}_S = \overline{w}_S = 0$,

$$\widehat{i} = \frac{\lambda - \gamma - \xi (1 - \varphi\lambda)}{\sigma\xi} c_S;$$

$$g_1 = g_2 = \frac{\varphi\xi + 1}{\varphi\xi} c_S; \ \widehat{t}_1 = \widehat{t}_2 = \frac{1}{\xi} c_S$$

Remark

The higher ξ is, the more the central bank is prompted to reduce the rate of interest, so as to avoid strong fiscal-budgetary expansionary responses.

Asymmetric productivity shocks cause price indexes divergence that would be reinforced in case of expansionary fiscal-budgetary responses. Actually, responses are not expansionary unless domestic demand impacts are too big compared with the price competitiveness advantage (that is $\lambda - \gamma > 2\xi\kappa$):

for $q_S = q_A = c_S = a_S = a_A = \overset{\circ}{\alpha}_A = \overline{w}_A = \overset{\circ}{\alpha}_S = \overline{w}_S = 0$,

$$\widehat{i} = 0$$

$$g_1 = \frac{1 - 2\kappa - \varphi\gamma - 2\varphi\xi\kappa}{\varphi(\lambda - \gamma - 2\xi\kappa)} c_A; \ \widehat{t}_1 = \frac{1 - 2\kappa - \lambda\varphi}{\lambda - \gamma - 2\xi\kappa} c_A \text{ (the numerators of these}$$

expressions are negative for realistic values of the parameters)

$$g_2 = -\frac{1 - 2\kappa - \varphi\gamma - 2\varphi\xi\kappa}{\varphi(\lambda - \gamma - 2\xi\kappa)} c_A; \ \widehat{t}_2 = -\frac{1 - 2\kappa - \lambda\varphi}{\lambda - \gamma - 2\xi\kappa} c_A$$

For similar reasons, asymmetric demand shocks may also trigger non conventional budgetary and fiscal responses in our framework:

for $q_S = q_A = c_S = a_S = \overset{\circ}{\alpha}_A = \overline{w}_A = \overset{\circ}{\alpha}_S = \overline{w}_S = 0$,

$$\widehat{i} = 0$$

$$g_1 = -\frac{\lambda}{\varphi(\lambda - \gamma - 2\xi\kappa)} a_A; \ \widehat{t}_1 = -\frac{\lambda}{\lambda - \gamma - 2\xi\kappa} a_A$$

$$g_2 = \frac{\lambda}{\varphi(\lambda - \gamma - 2\xi\kappa)} a_A; \ \widehat{t}_2 = \frac{\lambda}{\lambda - \gamma - 2\xi\kappa} a_A$$

Indeed, the stimulating effect of decreasing fiscal taxes are reinforced, as concerns the asymmetric component, by the price competitiveness channel; if the competitive effect is strong enough, decreasing the public expenditures and tax rate would eventually have expansionary effects upon the shocked economy.

Table n°1: instruments responses*

	$\widehat{i}$	g_1	g_2	$\widehat{t_1}$	$\widehat{t_2}$
q_S	+/−	+/−	+/−	+/−	+/−
q_A	+/−	+/−	+/−	+/−	+/−
a_S	+	0	0	0	0
a_A	0	+/−	+/−	+/−	+/−
c_s	+/−	+	+	+	+
c_A	0	+/−	+/−	+/−	+/−
$\overline{w}_S, -\overset{\circ}{\alpha}_S$	−	−	−	−	−
$\overline{w}_A, -\overset{\circ}{\alpha}_A$	0	+/−	+/−	+/−	+/−

* A " + " indicates that the instrument respond
with the same sign as the shock

As concerns the common component of inherited unemployment, the results reported in appendix n°3 reveal that the monetary policy profile (value of β) influences the budgetary-fiscal instrument deviations that are required in order to reach the targets, and, that conversely, governments objectives, as measured by μ, influence the interest rate deviation that is required in order to reach the objective of equation 7 (β and μ appear only within the terms of $\widehat{i}$, g_i and $\widehat{t_i}$ that are in factor of q_S.[14] These interactions are likely to produce inefficiency, especially when contradictory objectives lead to moves in instruments which tend to offset each other. For example an increase in the interest rate that aims to depress aggregate demand in order to reduce inflationary pressures, while expansionary fiscal-budgetary policy aims to stimulate aggregate demand even at the cost of inflationary pressures. In such a case, instruments hinder each other and make it more difficult to reach the objectives (bigger instrument moves are required).

It can be shown that the central bank increases the interest rate in response to the common part of inherited unemployment if

$$\beta > \mu \frac{(1 - \lambda\varphi)\,\alpha\xi + (1 + \theta - \alpha)\,(\lambda - \gamma)}{(1 - \mu)\,(\lambda - \gamma)} = \mu \frac{(1 + \theta - \alpha)}{(1 - \mu)} + \mu \frac{(1 - \lambda\varphi)\,\alpha\xi}{(1 - \mu)\,(\lambda - \gamma)}$$

The intuitive reason is that, if β is sufficiently high, the public expenditures inflationary pressures, reinforced by the increased tax rates, become strong enough to justify higher interest rate[15].

---

[14] Governments responses to the other types of shocks do not interfere in a conflicting way with the monetary response (either the central bank does not respond while governments do (shocks without common effects -including the ones of fiscal and budgetary responses- such as $a_A, c_A, \overline{w}_A, \overset{\circ}{\alpha}_A$ in a symmetric system), or the interest rate adjustment which is required in order to offset the common effects of shocks effectively offsets these common effects (a_S) and limit the governments responses to the asymmetric effects to which the central bank does not aim to respond, or, when the interest rate adjustment does not offset the common effects ($c_S, \overline{w}_S, \overset{\circ}{\alpha}_S$), there is some complementarity between central bank and governments responses. For all these shocks, β and μ do not influence the response of authorities.

[15] It can be shown from appendix n°3 that high values of β lead to positive responses of g_i and $\widehat{t_i}$ to the common part of inherited unemployment, whereas lower enough values imply

Monetary policy would not contribute in that case to fight unemployment (though it would be as less restrictive as unemployment is higher; cf. supra). Such a policy, that might be justified when inflationary pressures result from the distributive conflict ($\overline{w}_i, \overset{\circ}{\alpha}_i, \widehat{t}_i$ in equation 2), would be illegitimate when inflation comes from aggregate demand and employment expansion, for inflation in that case ensures the decrease in real cost of labour that prompt firms to hire workers and respond to the market expansion[16].

3.2 Instruments interactions in an heterogeneous monetary union

Symmetric models help to identify the channels through which shocks and policy responses transmit across countries, but they simplify them in two directions. Firstly, the common parts of shocks have different effects when countries react differently from each other, whereas they have symmetric effects in a symmetric system. Secondly, the asymmetric parts of shocks do not transmit identically in every country, with the result that they do not offset each other at the average level; hence, they may have common effects in asymmetric systems, whereas they do not in symmetric ones. Heterogeneity therefore raises difficulties that can hardly be solved analytically, but can be explored by simulating numerically the model for a reasonably selected set of country specific parameters (see appendix n°5). "Reasonable parameters" does not mean that they apply to such and such country, but only that their value is not implausible according to the relying theory. Of course, numerous sets of parameters would fit this definition, and therefore simulations are always more or less arbitrary. But, although most results can not be generalized, simulations usefully provide some general lessons.

Table n°2 presents the responses of monetary and budgetary-fiscal instruments to the different types of shocks and to the variables which represents the inherited unemployment (remember that authorities achieve their objective with these responses).

---

negative responses (if $\mu\dfrac{1+\theta-\alpha}{1-\mu} > \beta > \mu\dfrac{1+\theta-\alpha\left(1+\varphi\xi\right)}{1-\mu}$, g_i is negative and $\widehat{t}_i$ is positive). Hence, the more the central bank aim to limit inflation, the more governments contain the inflationary consequences of their response by choosing appropriately the adjustment of $\widehat{t}_i$.

[16] From equation 2, with $\overset{\circ}{\alpha}_i = \widehat{t}_i = 0$, we have $p_i - w_i = n_i - y_i$ or equivalently, $w_i - p_i = y_i - n_i$, which means that at equilibrium, real wages and labour productivity vary proportionally (if taxes and mark up are unchanged). Since a rise in aggregate demand and output decreases the productivity of labour (provided $c_i = 0$, see equation 3), it decreases the real wage.

Table n°2: instruments responses (coefficient value*)

	$\hat{i}$	g_1	g_2	$\hat{t}_1$	$\hat{t}_2$
q_S	0.04298	1.1636	1.2294	0.3944	0.4572
q_A	0.005234	−0.6767	0.80222	−0.2681	0.35545
a_S	0.55789	−0.21730	0.22816	−0.078227	0.091265
a_A	0.0079531	1.847	−1.9394	0.66493	−0.77575
c_s	0.10297	4.8552	5.2854	1.3879	1.7141
c_A	−0.020522	5.3188	−5.5347	1.5548	−1.8139
$\overline{w}_S, -\overset{\circ}{\alpha}_S$	−0.17731	−3.8389	−4.3025	−1.382	−1.7210
$\overline{w}_A, -\overset{\circ}{\alpha}_A$	0.015645	−4.5632	4.7914	−1.6428	1.9166

* If $q_S = 0.1$ (a 10% increase in average employment is initially required to full employment at the union level), the interest rate variation is 0.1 x 0.04298 = 0.004298. A decrease of 1% in the asymmetric part of demand shocks of country 2 (that is $a_A = 0.01$) leads to an increase of public expenditures equal to $g_2 = -0.01$ x −1.9394 = 0.019394 and an increase in the tax rate equal to $\hat{t}_2 = -0.01$ x −0.77575 = 0.0077575 in country 2...[17] It is easy to deduce instruments responses to q_1 and q_2 by noting that $q_1 = q_S + q_A$ and $q_2 = q_S - q_A$.

Contrasting with the symmetric model (see Table n°1), simulations show that monetary, budgetary and fiscal instruments respond to every types of shocks in a heterogeneous system. Thus the central bank no more concentrates on the symmetric components, for asymmetric components have common effects that fall within the central bank field of action. Conversely, governments respond now to the common component of demand shocks for the central bank no more can offset them completely because of their idiosyncratic effects.

Some simulation results are easy to understand with the help of the analytical results that have been drawn in the symmetric case $(q_S, q_A, a_A, \overline{w}_S, \overset{\circ}{\alpha}_A, \overline{w}_A, \overset{\circ}{\alpha}_A)$, while the others seem more substantially affected by heterogeneity. For example, with the selected set of parameters, the common component of negative demand shocks $(a_S < 0)$ requires a decrease in public spending and fiscal tax rate in country 2, whereas an increase of these variables is required in country 1. The reason is that, given the differentiated impact of the shock across countries, the effect of the decrease in interest rate (which is also differentiated) is bigger than the depressive impact of the shock in country 2, but not in country 1. It is out of our purpose to give explanations for every shock, all the more so as different results could have been generated with other sets of parameters, but it is useful to note that heterogeneity introduces more sources of non conventional mechanisms.

Simulations provide furthermore complementary lessons as concerns instruments interactions. In the graphs below, the coefficients values of instruments

---

[17]Remember that $\hat{t}$ is the variation of the tax rate; hence the tax rate rises from x to $x + \hat{t}$, whereas g is the relative variation of the public expenditures, which rise from x to $x(1 + g)$.

responses to common inherited unemployment have been reported on the vertical axis for values of β belonging to the interval $[0;\frac{3}{4}]$ (right axe), and values of $\mu_1 = \mu_2$ belonging to the interval $[0;1]$ (left axe).

Instruments responses to q_S

$\widehat{\imath}$

g_1 | $\widehat{t_1}$

g_2 | $\widehat{t_2}$
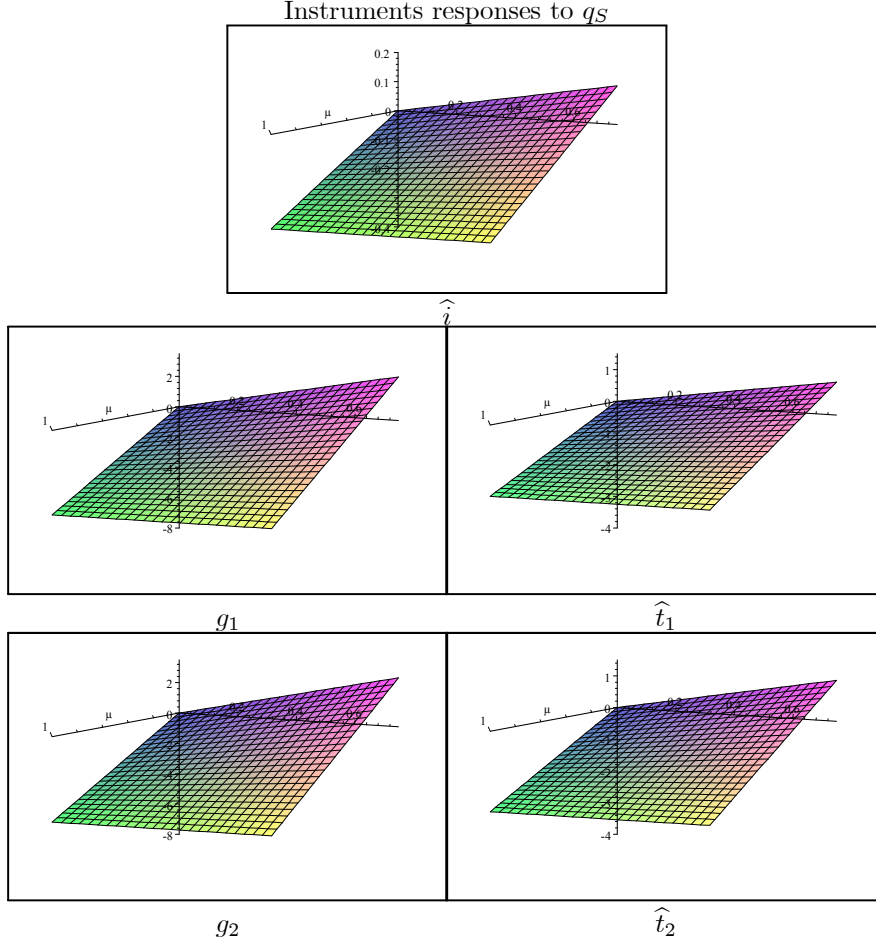
Simulations show that, given governments objectives (especially when they are relatively modest, which should normally concern situations of high unemployment), the sign and magnitude of instruments responses to the average inherited unemployment (including interest rate) depend on the monetary policy profile, as measured by β. Hence, insofar as the magnitude of budgetary-fiscal responses matters (the weaker the required responses are, the more ambitious targets can be), the institutional profile or degree of conservatism of the central bank is of crucial importance. However, the influence of β tends to zero as μ tends to one. That result, which is apparent in appendix n°3 for a sym-

17

metric system[18], extends actually to the heterogeneous system, whatever the values of μ_1 and μ_2 are. Indeed, simulating the model without constraining the values of μ_i to be equal, lead to solutions for $g_i, \widehat{t}_i$, and $\widehat{i}$ that have the form: $((A\beta + B)\,\mu_2 + (-A\beta + C)\,\mu_1)\,q_A + ((A - \frac{1}{2}\beta)\,\mu_2 + (B - \frac{1}{2}\beta)\,\mu_1 + \beta)\,q_S + ...,$ which clearly shows that the result holds generally, including the asymmetric component provided $\mu_1 \neq \mu_2$.[19]

4 Complementary responses and efficient macro-policies: the role of income distribution

We have argued that interactions between the central bank and governments objectives are likely to provoke some inefficiency, especially in contexts of high unemployment. Therefore, as far as the asymmetric components of inherited unemployment are concerned, besides the symmetric ones, heterogeneity is likely to enforce this kind of inefficiency. Could these adverse interactions be avoided so as to improve policies efficiency without renouncing to price stability and high employment? The present section suggests that the answer depends on the ability authorities to control the distributive conflict and its inflationary consequences.

Aggregate demand impulses, and the induced inflation, are necessary conditions for economic recovery when nominal wages are given (see the footnote n°16 and section 2 about the market for goods)[20]; in such a context, even mainstream economics would not recommend anti-inflationary measures, since relative prices adjustment (like real wage) is quite different from pure inflation. The case for pure inflation may arise at full employment if authorities try to stimulate aggregate demand and prices so as to obtain "extra output". That is the credo in new consensus macroeconomics, which uses to take full employment as the presumed "natural" position of economic systems. Keynesians have however for a long time insisted on the income distribution connection to inflation. Tensions about the distribution of income are a dangerous cause of inflation because it may prompt the central bank to raise interest rates before full employment is reached[21].

Thus, provided distributive tensions are under control (which involves the State regalian missions, and is normally outside of the province of monetary

---

[18] In the numerators of the coefficients of response of $\widehat{i}$, g_i and $\widehat{t}_i$ to q_S, the term which are multiplied by β go to zero as μ goes to 1.

[19] If $\mu_1 = \mu_2$, governements policy responds in opposite directions so as no average effects will be left on employment. The average price index however may vary inasmuch as tax rates variations have differentiated effects on prices (equation 2), with the result that the central bank raises or reduces the rate of interest so as to maintain the average price index unchanged, since the average level of unemployment is unchanged (equation 7). Hence, the value of β does not influences in that case the required variation of the rate of interest.

[20] Contrary to the new Keynesian economics, which postulates ergodicity, it does not mean that, in our non-ergodic Keynesian framework, wages rigidity causes unemployment at equilibrium (cf. Asensio, 2005a, 2006).

[21] See Palley (1997, 2001) and Asensio (2005a).

authorities), the central bank should not care about (demand led) inflation until full employment is reached at the union level (i.e. $\frac{1}{2}(q_1 + q_2) = \frac{1}{2}(n_1 + n_2)$). That would discard opportunely the source of inefficiency we have identified, and would make monetary and budgetary-fiscal instruments moves complementary.

A simple way of modelling it is to suppose that, as far as it controls the rate of interest, monetary policy fights the common part of inherited unemployment, plus the common effects of shocks, which implies that governments concentrate their policy against asymmetric effects of shocks and asymmetric inherited unemployment. If for example public expenditures are devoted to the employment targets (while taxes are adjusted so as to control the budget balance), the rate of interest must be adjusted so as public expenditures are not active at the collective level:

$$\frac{1}{2}(g_1 + g_2) = 0 \tag{7'}$$

Solving for equations 5, 6 and 7', given equations 1 to 4, shows that, in a symmetric system, the rate of interest is reduced as long as inherited unemployment remains positive at the union level ($\frac{1}{2}(q_1 + q_2) = q_S > 0$) (see appendix n°4). Moreover, the more ambitious fiscal-budgetary policies are (higher μ_i), the more the central bank decreases the rate of interest. Then public expenditures respond indeed to the sole asymmetric components $a_A, \overline{w}_A, \overset{\circ}{\alpha}_A, c_A$ and q_A (while taxes are activated besides in response to the symmetric component c_S and q_S, since the response of the rate of interest to the average inherited unemployment and to the common part of productivity shocks results in increasing outputs and taxes collection, with the result that fiscal taxes have to be adjusted in order to verify equation 6^{22}). A similar division of labour is at work in a heterogeneous union, but the central bank specializes in fighting the common consequences of common and asymmetric shocks, while governments specializes in fighting the idiosyncratic effects of common and asymmetric shocks.

The following graphs illustrate how instruments responses to inherited unemployment differ when the central bank objective is given by equation (7) instead of equation (7') for values of β belonging to the interval $[0; \frac{3}{4}]$ (rigth axe), values of μ_2 belonging to the interval $[0;1]$ (left axe), and for various values of μ_1.[23]

---

[22] The opposite case (the central bank adjusts the interest rate so that $\frac{1}{2}(\widehat{t}_1 + \widehat{t}_2) = 0$) gives similar results as concerns monetary policy, but taxes then respond to the sole asymmetric components, while public spending respond also to c_S and $\frac{1}{2}(q_1 + q_2) = 0$.

[23] Insofar as we are looking for the collective advantages attached to the described monetary policy, we consider the average response of the governements (that is $\frac{1}{2}(g_1 + g_2)$ and $\frac{1}{2}(\widehat{t}_1 + \widehat{t}_2)$) instead of national responses.
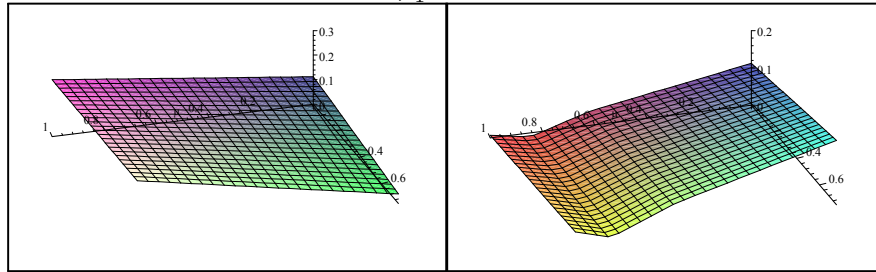
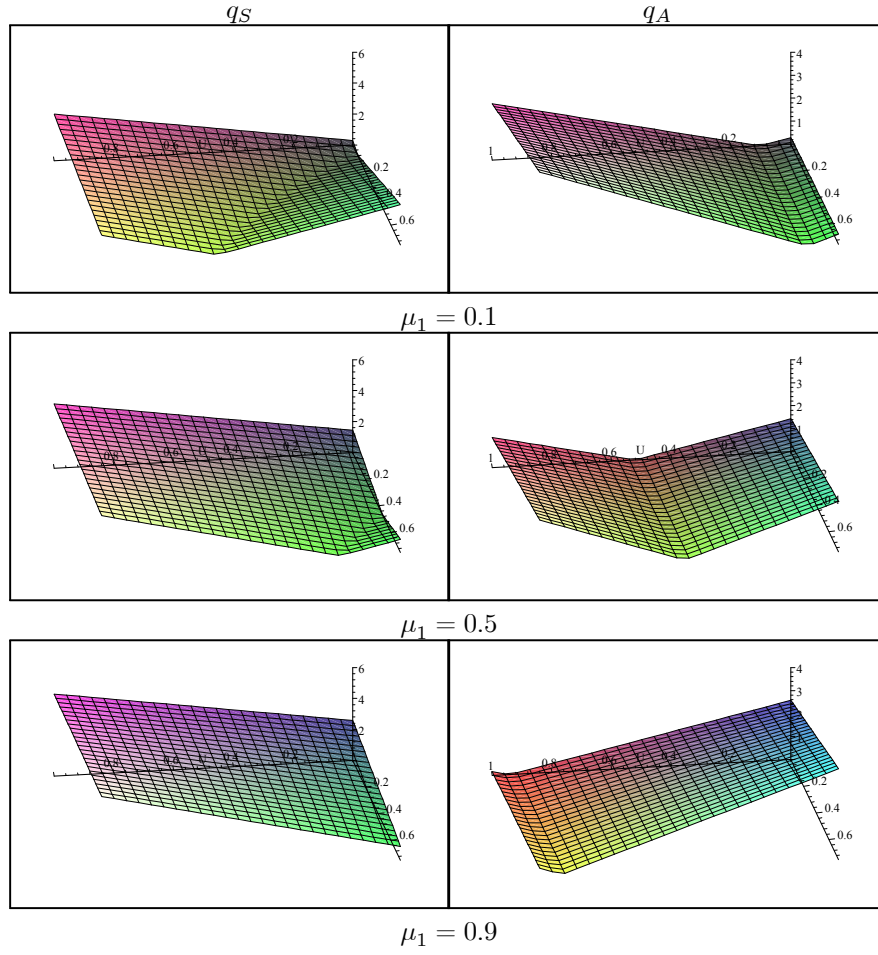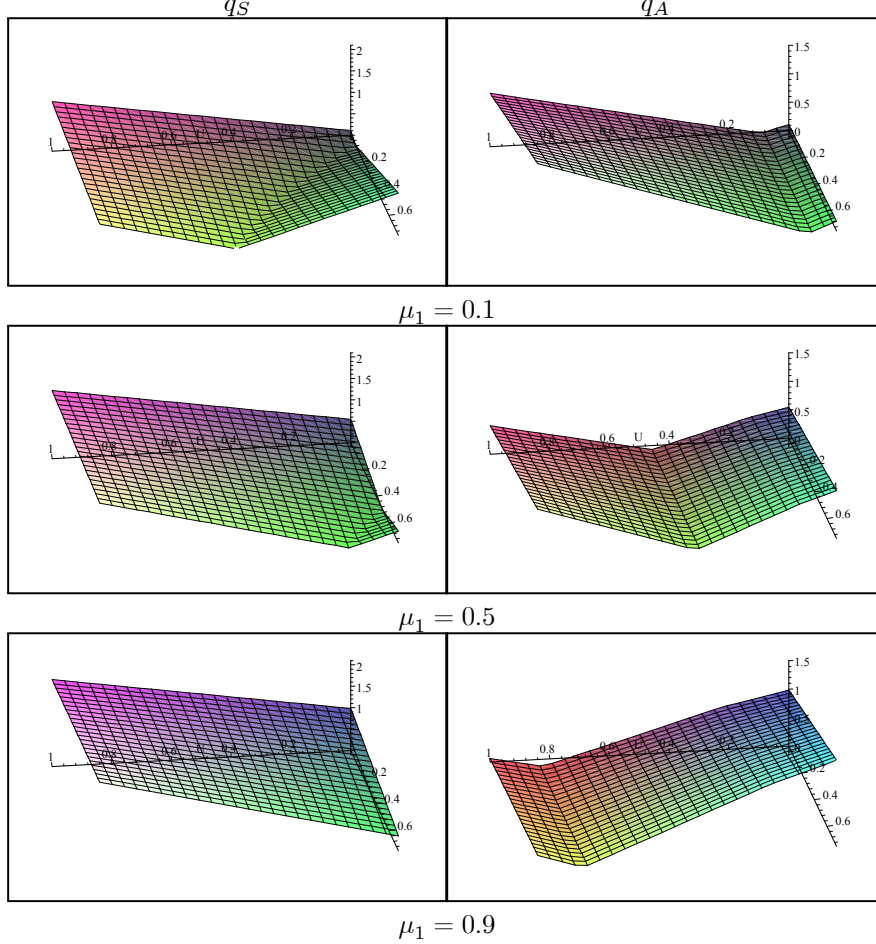Difference* in the interest rate response to

q_S q_A

$\mu_1 = 0.1$

$\mu_1 = 0.5$

$\mu_1 = 0.9$
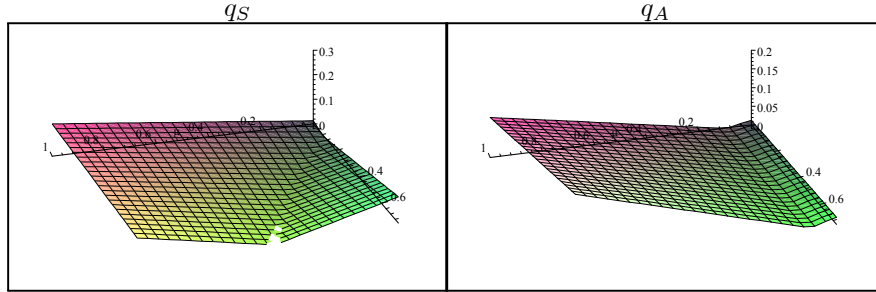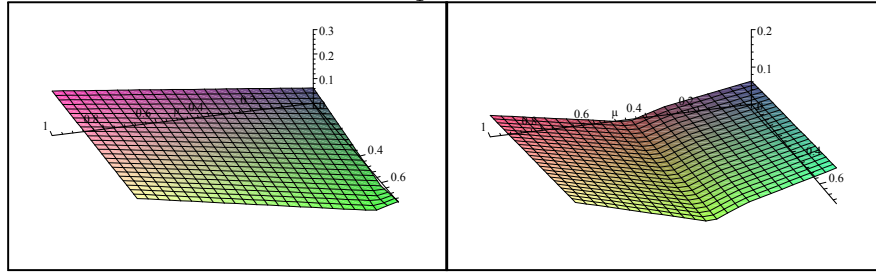
Difference* in the average public expenditures response to

q_S $\qquad\qquad\qquad\qquad$ q_A

$\mu_1 = 0.1$

$\mu_1 = 0.5$

$\mu_1 = 0.9$

Difference* in the average fiscal tax rate response to

q_S q_A

$\mu_1 = 0.1$

$\mu_1 = 0.5$

$\mu_1 = 0.9$

* Difference between the absolute values of the coefficient generated with equation
(7) and equation (7')

    These simulations suggest that, when monetary policy counters the common
effects of shocks (including the common part of inherited unemployment), em-
ployment targets trigger weaker responses to inherited unemployment (except
for specific combinations of β, μ_1 and μ_2). Indeed, since such a specialization
of monetary policy pushes governments to specialize in countering the idio-
syncratic effects of shocks (including asymmetric inherited unemployment), it
distracts every authority of others objectives, and eliminates by the way ad-
verse interactions between monetary and budgetary-fiscal policies, and between
budgetary-fiscal policies themselves. As a result of these efficiency gains, em-
ployment targets require lower instruments responses. It is of interest to con-
sider that division of labour from the collective point of view: by countering

the common effects, the central bank does something governments could not do without triggering adverse interactions[24], while by countering the asymmetric effects, governments do something the central bank can not.

On the other hand, as long as the central bank does not take care about inflation, the rate of interest does not respond to the common effects of inflationary shocks $(\overline{w}, \overset{\circ}{\alpha})$, with the result that, when the distributive conflict results in strong inflationary pressures, the central bank is faced with a dilemma: to sacrifice the complementarity vis-à-vis the governments policies in order to fight inflation, or to sacrifice the stability of prices in order to help governments to fight unemployment[25].

5 Conclusion

Our results reveal important effects of heterogeneity upon the monetary and fiscal-budgetary policy interactions in a Keynesian monetary union. Based on a two-country model, we have drawn first a set of analytical results for the symmetric case which helped then to bring up the predominant "mechanisms" at work in the simulations of the heterogeneous system. Contrasting with the symmetric model, simulations show that monetary, budgetary and fiscal instruments respond to every type of shocks in a heterogeneous system. Thus the central bank no more concentrates on the symmetric components, for asymmetric components have common effects that fall within the central bank field of action. Conversely, governments respond to the common components of demand shocks for the central bank no more can offset them completely because of their idiosyncratic effects.

As a result of interactions (between the monetary policy and fiscal-budgetary policies, and between fiscal-budgetary policies themselves), some of our results contrast sharply with the ones of studies that consider separately monetary, fiscal and budgetary policies, which put forward the idea that, within interdependent economies, macroeconomic policies may hardly be understood separately form each other. Other non-conventional mechanisms have been identified in connection with the supply-side effects of fiscal taxes variations (but as budget balances have been supposed to be at the desired levels, so as fiscal authorities do not want to change them, further research would be useful in order to study aspects of interactions that would result from public finance adjustment programs). On the other hand, interactions between policy instruments are likely to produce inefficiency, especially in front of "inherited unemployment" (by contrast with the part of unemployment that is caused by current shocks), that is, in contexts that are discarded in mainstream economics. The central bank

---

[24] Hence, the monetary policy induced by equation (7') can be viewed as a coordination device, especially as regards inherited unemployment responses.

[25] Remember however that high inflation may weaken both the confidence in money and the effectiveness of monetary policy, which makes it more difficult for the central bank to control the rate of interest. This is a supplementary reason for searching out a peaceful distribution of output within the countries.

profile proves notably to be of crucial interest in determining the magnitude of the instrument moves that are required to achieve the objectives, though it may work in different ways. Simulations suggest furthermore that heterogeneity is likely to introduce more sources of non conventional effects and to enforce adverse interactions, especially in contexts of high unemployment.

The last part of the paper explores how such adverse interactions could be avoided, and how policies efficiency could be improved as regard price stability and employment. We found that, provided authorities are able to control the distributive conflict and its inflationary consequences, monetary policy could specialize in countering the common effects of shocks (including inherited unemployment), while governments would concentrate in countering the idiosyncratic effects. Such a division of labour proves highly desirable from a collective point of view: by countering the common effects, the central bank does something governments could not do without triggering adverse interactions, while governments do something the central bank could not[26]. That suggests an application of the subsidiarity principle to the macroeconomic governance of the eurozone.

6 Appendix n°1

Let start from the national aggregate-demand functions $Y_{di} = \upsilon_i (Y_i - t_i Y_i) - \beta_i (i - p^a_{+1i}) + \left(\dfrac{P_j}{P_i}\right)^\zeta + G_i + A_i$, $i = 1, 2$, $j = 1, 2$, $i \neq j$, where Y_i represents the output volume in country i, t_i the tax rate (taxes/output), υ the propensity to consume $(0 < \upsilon < 1)$, G_i the governments expenditures, A_i an autonomous component, P_i the price level of goods, p^a_{+1i}, the expected variation of P_i till the next period, $i - p^a_{+1i}$ the real rate of interest.

Through differentiation (assuming $d\upsilon = d\beta = 0$ and $dp^a_{+1i} = 0$), and dividing by Y_o, we get:

$$
\begin{aligned}
\frac{dY_i}{Y_{i0}} &= \upsilon_i \frac{dY_i}{Y_{i0}} - \upsilon_i t_{i0} \frac{dY_i}{Y_{i0}} - \upsilon_i dt_i - \frac{\beta_i}{Y_{i0}} di + \\
&\quad \frac{\zeta}{Y_{i0}} \left(\frac{P_{j0}}{P_{i0}}\right)^\zeta \frac{dP_{j0}}{P_{j0}} - \frac{\zeta}{Y_{i0}} \left(\frac{P_{j0}}{P_{i0}}\right)^\zeta \frac{dP_{i0}}{P_{i0}} + \frac{dG_i}{Y_{i0}} + \frac{dA_i}{Y_{i0}}
\end{aligned}
$$

Since $t_{i0} = \dfrac{T_{i0}}{Y_{i0}}$, the equality $\dfrac{dG}{Y_{i0}} = t_{i0} \dfrac{dG}{G_{i0}}$ holds when the budget is balanced $(T_{i0} = G_{i0})$. Writing relative deviation rates with small letters $(x_i = \dfrac{dX_i}{X_{i0}}$, except $a_i = \dfrac{dA_i}{Y_{i0}})$, we have:

$$
y_{di} = \upsilon_i (1 - t_{i0}) y_i - \upsilon_i dt_i - \frac{\beta_i}{Y_{i0}} di + \frac{\zeta}{Y_{i0}} \left(\frac{P_{i0}}{P_{j0}}\right)^\zeta (p_j - p_i) + t_{i0} g_i + a_i
$$

---

[26] Palley (2005a) however argues that the central bank could differentiate interest rates across member countries, by setting an adequate system of asset-based reserve requirements.

Equilibrium requires:

$$y_i = y_{di}$$

hence

$$y_i = -\gamma_i \widehat{t}_i - \sigma_i \widehat{i} + \kappa_i (p_j - p_i) + \lambda_i (\varphi_i g_i + a_i), i = 1, 2, j = 1, 2, i \neq j$$

where $\widehat{i} = di$, $\widehat{t}_i = dt_i$, $\varphi_i = t_{i0}$, $\gamma_i = \dfrac{v_i}{1 - v_i (1 - \varphi_i)}$, $\lambda = \dfrac{1}{1 - v_i (1 - \varphi_i)}$,

$$\sigma_i = \frac{1}{1 - v_i (1 - \varphi_i)} \frac{\beta_i}{Y_{i0}}, \quad \kappa_i = \frac{1}{1 - v_i (1 - \varphi_i)} \frac{\zeta}{Y_{i0}} \left(\frac{P_{i0}}{P_{j0}} \right)^{\zeta}$$

7 Appendix n°2

The budget balance (B) is defined as:

$B = tPY - PG$

Differentiating around a solution indexed by 0 yields:

$dB = t_o P_o dY + P_o Y_o dt + t_o Y_o dP - P_o dG - G_o dP$

and dividing by the initial value of output:

$dB/(P_o Y_o) = t_o dY/Y_o + dt + t_o dP/P_o - dG/Y_o - (G_o/Y_o)(dP/P_o)$

Hence, around a situation of balanced budget where $t_o = G_o/Y_o$ (remember $g = dG/G_o$):

$b = t_o (y - g) + dt$

and, with the same notation as in appendix n°1:

$b = \varphi (y - g) + \widehat{t}$

8 Appendix n°3

Solving for equations 5,6 and 7, given equation 1 to 4, yields:

$$\widehat{i} = \frac{1}{2} \frac{\beta (1 - \mu)(\lambda - \gamma) - \mu ((1 - \lambda \varphi) \alpha \xi + (1 + \theta - \alpha)(\lambda - \gamma))}{\sigma \xi} (q_1 + q_2) +$$
$$\frac{\lambda}{\sigma} a_S - \frac{\lambda - \gamma}{\sigma \xi} \left(\overline{w}_S - \overset{\circ}{\alpha}_S \right) + \frac{-\gamma + \lambda + \varphi \xi \lambda - \xi}{\sigma \xi} c_S$$

$$g_1 = \frac{2\kappa}{\varphi (\lambda - \gamma - 2\xi\kappa)} \left(\overline{w}_A - \overset{\circ}{\alpha}_A \right) - \frac{1}{\varphi \xi} \left(\overline{w}_S - \overset{\circ}{\alpha}_S \right) -$$
$$\frac{2\kappa + \varphi\gamma + 2\varphi\xi\kappa - 1}{\varphi (\lambda - \gamma - 2\xi\kappa)} c_A + \frac{\varphi\xi + 1}{\varphi\xi} c_S - \frac{\lambda}{\varphi (\lambda - \gamma - 2\xi\kappa)} a_A -$$
$$\frac{1}{2} \frac{\mu (1 + \theta - \alpha (1 + \varphi\xi)) - \beta (1 - \mu)}{\xi\varphi} (q_1 + q_2) +$$
$$\frac{1}{2} \mu \frac{(1 - \alpha + \theta - \varphi\alpha\xi) 2\kappa + (1 - \varphi\gamma) \alpha}{\varphi (\lambda - \gamma - 2\xi\kappa)} (q_1 - q_2)$$

$$\widehat{t}_1 = -\frac{1}{\xi}\left(\overline{w}_S - \overset{\circ}{\alpha}_S\right) + \frac{2\kappa}{\lambda - \gamma - 2\xi\kappa}\left(\overline{w}_A - \overset{\circ}{\alpha}_A\right) - \frac{2\kappa + \lambda\varphi - 1}{\lambda - \gamma - 2\xi\kappa}c_A +$$

$$\frac{1}{\xi}c_S - \frac{\lambda}{\lambda - \gamma - 2\xi\kappa}a_A - \frac{1}{2}\frac{\mu\left(1 + \theta - \alpha\right) - \beta\left(1 - \mu\right)}{\xi}\left(q_1 + q_2\right) +$$

$$\frac{1}{2}\mu\frac{\left(1 - \alpha + \theta\right)2\kappa + \left(1 - \varphi\lambda\right)\alpha}{\lambda - \gamma - 2\xi\kappa}\left(q_1 - q_2\right)$$

g_2 and $\widehat{t}_2$ may be deduced by changing the sign of the expressions in front of $\overline{w}_A, \overset{\circ}{\alpha}_A, c_A, a_A$ and $\left(q_1 - q_2\right)$.

Instruments responses to the average inherited unemployment ($\frac{1}{2}\left(q_1 + q_2\right) > 0$) according to the value of β

	$\beta < A$	$\beta = A$	$A < \beta < B$	$\beta = B$	$B < \beta < C$	$\beta = C$	$\beta > C$
g_i	< 0	$= 0$	> 0	> 0	> 0	> 0	> 0
$\widehat{t}_i$	< 0	< 0	< 0	$= 0$	> 0	> 0	> 0
$\widehat{i}$	< 0	< 0	< 0	< 0	< 0	$= 0$	> 0

$$A = \mu\frac{\left(1 + \theta - \alpha\right)}{\left(1 - \mu\right)}, B = \mu\frac{1 + \theta - \alpha - \alpha\varphi\xi}{1 - \mu},$$

$$C = \mu\frac{\left(1 + \theta - \alpha\right)}{\left(1 - \mu\right)} + \mu\frac{\left(1 - \lambda\varphi\right)\alpha\xi}{\left(1 - \mu\right)\left(\lambda - \gamma\right)}, A \leq B \leq C$$

9   Appendix n°4

Solving for equations 5,6 and 7', given equation 1 to 4, yields:

$$\widehat{i} = \frac{1}{2}\frac{\alpha\mu\left(\gamma\varphi - 1\right)}{\sigma}\left(q_1 + q_2\right) + \frac{1}{2}\frac{2\lambda a_S + 2\left(\gamma\varphi - 1\right)c_S}{\sigma}$$

$$g_1 = \frac{1}{2}\frac{2\kappa\left(1 + \theta\right) - \left(\gamma\varphi + 2\kappa + 2\kappa\xi\varphi - 1\right)\alpha}{\left(\lambda - \gamma - 2\xi\kappa\right)\varphi}\mu\left(q_1 - q_2\right) -$$

$$\frac{1}{2}\frac{2\left(\gamma\varphi + 2\kappa + 2\kappa\xi\varphi - 1\right)c_A + 2\lambda a_A - 4\kappa\left(\overline{w}_A - \overset{\circ}{\alpha}_A\right)}{\left(\lambda - \gamma - 2\xi\kappa\right)\varphi}$$

$$\widehat{t}_1 = \frac{1 - \varphi\lambda - 2\kappa}{\lambda - \gamma - 2\xi\kappa}c_A - \varphi c_S - \frac{\lambda}{\lambda - \gamma - 2\xi\kappa}a_A +$$

$$2\frac{\kappa}{\lambda - \gamma - 2\xi\kappa}\left(\overline{w}_A - \overset{\circ}{\alpha}_A\right) - \varphi\alpha\mu\frac{1}{2}\left(q_1 + q_2\right) +$$

$$\frac{1}{2}\mu\frac{2\kappa\left(1 - \alpha + \theta\right) + \alpha\left(1 - \varphi\lambda\right)}{\lambda - \gamma - 2\xi\kappa}\left(q_1 - q_2\right)$$

g_2 and $\widehat{t}_2$ may be deduced by changing the sign of the expressions in front of $\overline{w}_A, \overset{\circ}{\alpha}_A, c_A, a_A$ and $(q_1 - q_2)$.

10   Appendix n°5

Parameters values

$\theta_1 = 1.3; \theta_2 = 1.2$

$\xi_1 = 0.7; \xi_2 = 0.6$

$\kappa = 2.4$

$\sigma_1 = 4; \sigma_2 = 3$

$\varphi_1 = 0.36; \varphi_2 = 0.4$

$\alpha_1 = 0.68; \alpha_2 = 0.72$

$\gamma_1 = 1.6; \gamma_2 = 1.5$

$\lambda_1 = 2.0; \lambda_2 = 1.9$

$\mu_1 = 0.1; \mu_2 = 0.12$

$\beta = 0.5$

11   References

Arestis P. and G. Chortareas, 2006, Monetary policy in the euro area, *Journal of Post Keynesian economics*, 28 (3), 371-394.

Asensio A., 2005a, Monetary and budgetary-fiscal policy interactions in a Keynesian context: revisiting macroeconomic governance, paper presented at the *9th Conference of the Research Network* 'Alternative Macroeconomic Policies', Berlin, October 28-29, forthcoming in P. Arestis, E. Hein and E. Le Heron (eds), *Aspects of modern monetary and macroeconomic policy*, Palgrave, March 2007.

Asensio A., 2005b, The macroeconomic governance of the European Monetary Union: why does it fail and what should it be?, CEMF conference (université de Bourgogne) '*The Political Economy of Governance*', 2-3 December 2005, Dijon.

Asensio A., 2006, New-Consensus Macroeconomic Governance in a Keynesian world, and the Keynesian alternative, *Brazilian Journal of Political Economy*, 26(4), October.

Keynes J.M., 1936, *The general theory of employment, interest and money*, London, Macmillan.

Palley, T.I. 1997, The institutionalization of deflationary policy bias, in Hagerman, H. and A. Cohen, eds. *Advances in monetary theory*. Boston: Kluwer Academic Publisher.

Palley, T.I. 2001, The role of Institutions and policies in creating high European unemployment: the evidence, *working paper n° 336*, Annandale-on-Hudson, N.Y.: The Levy Institute.

Palley, T.I. 2005a, Monetary policy in currency unions: lessons for the European central bank, paper presented at the *9th Conference of the Research Network* 'Alternative Macroeconomic Policies', Berlin, October 28-29.

Palley T.I., 2005b (November), Keynesian Models of Recession and Depression, unpublished manuscript, available at: www.thomaspalley.com.

Tobin J., 1975, Keynesian Models of Recession and Depression, *American Economic Review*, 65, 195 202.