The Lost Paradise : Imperfect Market Integration and the Ranking of OCA criteria

Jean-Christophe Poutineau*
CREM – UMR CNRS 6211
Université de Rennes 1
France

This version : May 11, 03
For submission to Money Macro and Finance Research Group
36th ANNUAL CONFERENCE
September 6-8 2004

This paper develops a compact new open macroeconomics model of a Monetary Union to evaluate, on the one hand, the consequences of the imperfect integration of the goods and labour markets, when countries are hit by asymmetric shocks and, on the other hand, the macroeconomic and welfare gains associated with a further integration of either market. First we outline the stabilising nature of short run fixed wages since macroeconomic adjustment is characterised by a lower volatility of the main aggregates. A greater integration of either market smoothes macroeconomic adjustment, but does not necessarily lead to big gains in terms of inflation differential reduction when wages are fixed in the short run. Second, when wages are fixed, a greater integration of the goods market increases welfare dispersion while an increase in labour market integration reduces per capita welfare dispersion in the union. Thus the Mundellian OCA criterion clearly dominates Mc Kinnon's. Nevertheless, the optimality of the Mundellian criterion rests on the fact that wages are fixed in the short run since wage flexibility, on the one hand, makes welfare dispersion unaffected by the relative integration of either market when the monetary union is affected by asymmetric demand shocks, and, on the other hand, the integration of the goods market is a key factor for reducing welfare dispersion in the union following an asymmetric productivity shock.

Keywords : market integration, OCA criterion, new open economy macroeconomics
JEL classification : E58, F33, F41

---

* Faculté des sciences économiques, 7 place Hoche, 35065 Rennes cedex. Phone : (+33) 02 23 23 33 52 ; Fax : (+33) 02 99 38 80 84 ; email : jean-christophe.poutineau@univ-rennes1.fr

1 – Introduction

The creation of a single currency area requires some homogeneity in the economic structure of the participating countries, since they can no longer rely on exchange rate management to smooth the macroeconomic consequences of asymmetric national or regional shocks. The analytical pillars for building monetary unions that were set in the early sixties by the theory of Optimal Currency Areas (OCA) define homogeneity in terms of either labour or goods market integration. As a by product of that time Keynesian economics these analyses assumed short run rigid real wages and prices – thus requiring an adjustment in terms of quantity of goods and labour – but also a very low international mobility of financial assets. These seminal contributions have deeply influenced the way we think about the desirability of a common currency, since, despite the increased European financial integration, they are still regularly invoked as key criteria to ease the macroeconomic adjustment in the European Monetary Union (Trichet, 2003).

Mundell (1961) firstly insisted on labour market integration. In a two country world - with wage and price rigidities, as well as a low international capital mobility - a switch in demand in favour of a country goods induces an excess demand for both goods and labour in this nation, while the other country experiences both a reduction in activity and an increase in unemployment. In this situation labour mobility dampens the costs of asymmetric shocks in a monetary union, since the unemployed workers of the second country would find a job in the first one, thus also solving the goods market problem of country 1. According to Mc Kinnon (1963), the integration of the goods market would avoid the expenditure switching outlined by Mundell : when two countries trade intensively with each other the distinction between domestic and foreign goods looses much of its significance, and most goods fetch the same price once converted in the same currency; in this case, nominal exchange rate fails to affect their real exchange rate, thus giving up the exchange rate as an adjustment variable entails no serious loss of policy independence. In this situation the integration of the goods market constitutes the key element for building a currency union.

In practice, the European union has been built on the premises of goods market integration. As outlined by Blanchard (2004), this is clearly a consequence of the Delors report which offered a timetable to eliminate physical barriers. Although most of the institutional agenda set out in 1985 was achieved at the start of 1993, the effective integration of the goods market is still under debate. Among others, Chen (2004) finds that European economies display significant goods market border features since Germany appears to trade about 2,5 more with itself, Great Britain 3.2, France and Italy more than 7 times. Head and Mayer (2000) show that, even if the degree of goods market segmentation has shrunk over the last decade, two European regions trade in average 14 times more when they belong to the same country. Furthermore, the smaller European economies display a lower degree of market integration. Thus, the abolition of border controls on intra-EU trade, as well as the harmonisation or mutual recognition of standards and other regulations, that were intended to increase intra-EU competition and hence intra-EU trade did not lead to a full integrated goods market.

The increase of labour market integration is a much more critical question. First, the statistical measurement of this phenomenon makes problem in Europe, since there is no clear homogeneous definition of migration in the European countries (Wildasin, 2000). Second, factors impeding labour mobility are related to national market regulations as well as factors depending on language or cultural barriers. The integration of this market may be much longer than the reduction of barriers to trade. At a first glance, the European labour market is clearly less integrated than the American one, as outlined by the greater dispersion of regional unemployment rates in Europe. The interregional migration of labour between regions in the EU is much lower than it is in the United states (Gros, 2003), and it is difficult to determine which part of labour migration can be considered as an adjustment mechanism to asymmetrical shocks. As reported by Blanchard and Katz (1992), labour migration is a key equilibrating factor in the United states since they find that a on percent shock to employment in a given state is followed by a 0.3 percent increase in unemployment , a 0.05 % decrease in labour force participation, migration - as a residual - accounting for 0.65 %. Furthermore, the Results reported by Decressin and Fatas (1995), show that in Europe, most of an asymmetrical shock is absorbed by changes in the participation rate while, in the US, it is immediately reflected in migration.

Since the coherence of the Euro area regarding these two OCA criteria is an open question, the analysis of the European monetary union as an imperfectly integrated economic area gains some interest today. The current European situation raises a series of interesting analytical questions : What are the consequences of an imperfect integration of both goods and labour market with respect to the reference case of a perfectly integrated economic area, in terms of macroeconomic volatility and in terms of welfare ? Since Goods market Integration is clearly much higher than labour market integration, are the marginal gains associated to a further labour market integration sizeable ? More generally, with regards to welfare is there a clear hierarchy between the two original criteria of Mundell and Mc Kinnon ?

To answer these questions, this paper develops a compact new open macroeconomics model of a monetary union. The objective is to evaluate, on the one hand, the macroeconomic consequences of the imperfect integration of the goods and labour markets, when countries are hit by asymmetric shocks and, on the other hand, the welfare gains associated with a further integration of either market. The paper is organised as follows : paragraph 2 outlines a two country world that forms the basis of the analysis; paragraph 3 analyses the macroeconomic adjustment in the monetary union in the case of flexible wages depending on the relative integration of either markets; paragraph 4 evaluates the macroeconomic costs associated to an imperfect integration of the markets when wages are fixed in the short run; paragraph 5 concentrates on welfare issues to rank OCA criteria; paragraph 6 concludes .

2. A Two Country World

The model describes a two country world that forms a Monetary Union. Each nation $n = \{1,2\}$ represents half of the Union. It is populated by N consumers and by a single firm that produces a national final good. There are three types of exchanges between the two economies : final goods, labour force and a one period composite bond. The imperfect integration of the goods and the labour market are treated in a simple symmetrical way through their consequences, by imposing home bias on final consumption and on labour input use in national production functions. Segmentation and full integration of either markets will be considered as limiting cases for the relevant bias parameter.

2.1 Households

In each economy $n = \{1,2\}$ The number N of consumers is normalised to one. The immortal representative Household i of country n has preferences over a consumption aggregate $C_s^n(i)$ and supplies monopolistically its own type of labour in quantity $L_s^n(i)$, so that it maximises a welfare index Ω_t^n subject to a budget constraint, i.e.,

$$\begin{cases} Max\,\Omega_t^n = \sum_{s=t}^{\infty}\left(\frac{1}{1+\delta}\right)^{s-t} E_t\left(U_t^n \ln C_s^n(i) - Z_0 L_s^n(i)\right), \\ s.t. \\ P_t^n R_t B_t^n(i) + W_t^n(i) L_t^n(i) = P_t^n C_t^n(i) + P_t^n B_{t+1}^n(i), \end{cases} \tag{2.1}$$

where, for $s \in [t, \infty)$, P_s^n is the consumer price index in country *n*, $B_s^n(i)$ ($B_{s+1}^n(i)$) are the holdings of the composite one period real bond by the i^{th} agent of country n at the end of period s ($s+1$) that pays a gross real rate of interest of R_s between periods $(s-1)$ and s and $W_s^n(i)$ is the nominal wage corresponding to type i labour in the n^{th} country. Finally, $U_s^n = U_0 e^{u_s^n}$, U_0 and Z_0 are exogenous utility parameters, and u_s^n is a white noise shock to preferences regarding aggregate consumption.

The solution to this problem satisfies two first order conditions which insure both the internal and external equilibria of the n^{th} economy in period t. Therefore, we are provided with a consumption based bond Euler equation and a wage setting equation for each differentiated type of labour, i.e., respectively,

$$\begin{cases} U_t^n C_t^n(i)^{-1} = \frac{R_{t+1}}{1+\delta} E_t\left(U_{t+1}^n C_{t+1}^n(i)^{-1}\right), \\ \frac{W_t^n(i)}{P_t^n} = \frac{\phi}{\phi-1} Z_0 C_t^n(i), \end{cases} \tag{2.2}$$

where ϕ is a parameter reflecting the elasticity of substitution of between the different types of labour in the production process of each firm. The aggregate consumption level of the representative household of the n^{th} economy, $C_s^n(i)$ is defined for $s \in [t, \infty)$ according to the index,

$$C_s^n(i) = \frac{C_{1s}^n(i)^{\gamma_n} C_{2s}^n(i)^{(1-\gamma_n)}}{\gamma_n^{\gamma_n}(1-\gamma_n)^{(1-\gamma_n)}}, \tag{2.3}$$

where $C^n_{1s}(i)$ ($C^n_{2s}(i)$) denotes its consumption of country 1 (country 2) goods. The consumer price index in the n^{th} country is thus defined as,

$$P^n_s = P^{\gamma_n}_{1s} P^{(1-\gamma_n)}_{2s}, \tag{2.4}$$

where, P_{1s} (P_{2s}) denotes the price of the good produced in country 1 (country 2). In this framework, the imperfect integration of the goods market is simply modelled as a home bias in favour of national goods in the consumption bundle of the representative household. To make the model tractable, we impose that $\gamma_1 + \gamma_2 = 1$ at the international level. In this case, a bias in favour of national good in country 1 simply requires that $\gamma_1 = \gamma > 0.5$, while, as a mirror image, the relative weight devoted to the consumption of country 2 good in country 2 consumption is equal to $(1-\gamma_2) = \gamma_1 = \gamma > 0.5$. In this perspective, full integration and full segmentation of the goods market are thus limiting cases, requiring respectively symmetry in consumption practises (i.e., $\gamma_1 = \gamma_2 = 0.5$) or total specialisation in tastes (i.e. $\gamma_1 = \gamma_2 = 1$). Eventually, for $n = \{1,2\}$, the choice between the two types of goods for $s \in [t, \infty)$ is defined according to,

$$\begin{cases} C^n_{1s}(i) = \gamma_n \left(\dfrac{P_{1s}}{P^n_s} \right)^{-1} C^n_s(i), \\ C^n_{2s}(i) = (1-\gamma_n) \left(\dfrac{P_{2s}}{P^n_s} \right)^{-1} C^n_s(i), \end{cases} \tag{2.5}$$

with, $\gamma_1 = \gamma$ and $\gamma_2 = (1-\gamma)$

2.2 Firms

There is a single firm in each country n that combines labour inputs to produce a national good that is traded internationally on a competitive goods market, according to the following technology,

$$Y_{ns} = A_t^n L_{ns}, \tag{2.6}$$

with $A_s^n = A_0 e^{a_s^n}$ for $s \in [t, \infty)$, where A_0 is an exogenous parameter and a_s^n is a white noise productivity shock, and with,

$$L_{ns} = \left[\rho_n^{\frac{1}{\phi}} \int_0^1 L_{ns}^1(i)^{\frac{\phi-1}{\phi}} di + (1-\rho_n)^{\frac{1}{\phi}} \int_0^1 L_{ns}^2(i)^{\frac{\phi-1}{\phi}} di \right]^{\frac{\phi}{\phi-1}} , \tag{2.7}$$

where, $L_{ns}^1(i)$ ($L_{ns}^2(i)$), features country n demand for type i labour supplied in country 1 (country 2). Symmetrically to γ_n on the goods market, the parameter ρ_n in (2.7) features the degree of labour segmentation in the Monetary Union. Treating the composite labour L_t^n according to the consumption index $C_t^n(i)$, ρ_n is such that $\rho_1 + \rho_2 = 1$, thus implying $\rho_1 = \rho$ and $\rho_2 = 1 - \rho$. As a consequence, full segmentation (integration) of the labour market requires $\rho = 1$ ($\rho = 0.5$).

The efficiency condition on either national input is defined according to,

$$\begin{cases} L_{ns}^1(i) = \rho_n \left(\dfrac{W_s^1(i)}{W_s^n} \right)^{-\phi} \left(A_s^n \right)^{-1} Y_{ns}, \\ L_{ns}^2(i) = (1-\rho_n) \left(\dfrac{W_s^2(i)}{W_s^n} \right)^{-\phi} \left(A_s^n \right)^{-1} Y_{ns}, \end{cases} \tag{2.8}$$

while the no entry condition on the goods market requires that the selling price of the good produced in the n^{th} country is,

$$P_{ns} = \left(A_s^n \right)^{-1} W_s^n, \tag{2.9}$$

with,

$$W_t^n = \left[\rho_n \int_0^1 W_s^1(i)^{1-\phi} di + (1-\rho_n) \int_0^1 W_s^2(i)^{1-\phi} di \right]^{\frac{1}{1-\phi}}. \tag{2.10}$$

2.3 General Equilibrium Conditions

The general equilibrium of the model is defined according to two sets of equations. The Intratemporal condition is given by the goods and labour market clearing conditions, which are defined for $s \in [t, \infty)$, $i \in [1, N]$ and $n = \{1,2\}$ according to,

$$\begin{cases} Y_{ns} = C^1_{ns}(i) + C^2_{ns}(i), \\ L^n_s(i) = L^1_{ns}(i) + L^2_{ns}(i), \end{cases} \tag{2.11}$$

while the financial market equilibrates current account deficits, a country accumulating claims on the other member to finance a goods transaction deficit/surplus. Thus, the inter-temporal equilibrium of the model thus requires that,

$$\begin{cases} P^1_s(B^1_{s+1} - B^1_s) = P_{1s}C^2_{1s} - P_{2s}C^1_{2s} + P^1_s(R_s - 1)B^1_s \\ \\ P^2_s(B^2_{s+1} - B^2_s) = P_{2s}C^1_{2s} - P_{1s}C^2_{1s} + P^2_s(R_s - 1)B^2_s \\ \\ B^1_{s+1} + B^2_{s+1} = 0 \end{cases} \tag{2.12}$$

In the paper we solve the model (2.1)-(2.12) in log-deviation to evaluate the effect of a greater integration of either Goods or Labour market in terms of macroeconomic volatility and in terms of welfare.

2.4 The Model in Log-deviation

The symmetric steady state is characterised by $C^n_t = C_0$ for $n=\{1,2\}$ for all $t \leq 0$. From the Euler consumption equation $R_1 - 1 = \delta$, from the balance of payment relation, $B^n_0 = 0$, which in turn implies that $C_0 = Y_0$. On the other hand, combining the F.O.C. on labour supply, and the no entry, we get $Y_0 = C_0 = \phi(\phi - 1)^{-1} A_0 Z_0^{-1}$; Accordingly, the steady state level of employment is $L_0 = \phi(\phi - 1)^{-1} Z_0^{-1}$. Finally, normalising $P_{n0} = P^n_0 = 1$ we get $W^n_O(i) = W^n_O = A_0$.

Applying the standard rules of log linearisation in the neighbourhood of this steady steady-state we can write the model according to equations (2.13)-(2.38). Pair expressions are related to the Domestic economy and impair relations to the Foreign country. Equations (2.13)-(2.24) describe the demand side of the model ((2.13) and (2.14) the log linear expression of the Euler Relation, (2.15) and (2.16) the decomposition of the national consumption index given the mirror image assumption, (2.17)-(2.20) the individual demand functions related to the domestic and the foreign goods, (2.21) and (2.22) the national price levels, (2.23) and (2.24) the current account). Equations (2.25) and (2.38) describe the supply side of the model ((2.25) and (2.27) labour supply, (2.28)-(2.29) labour demand addressed to domestic and foreign country labour force, (2.31) and (2.32) the production function, (2.33) and (2.34) the no entry condition, (2.35) and (2.36) the labour force employed in the economy and (2.37) and (2.38) the per capita wage in the economy).

$$E_t(c_{t+1}^1) = c_t^1 + \frac{\delta}{1+\delta} r_{t+1} - u_t^1, \qquad (2.13)$$

$$E_t(c_{t+1}^2) = c_t^2 + \frac{\delta}{1+\delta} r_{t+1} - u_t^2, \qquad (2.14)$$

$$c_t^1 = \gamma c_{1t}^1 + (1-\gamma) c_{2t}^1, \qquad (2.15)$$

$$c_t^2 = (1-\gamma) c_{1t}^2 + \gamma c_{2t}^2, \qquad (2.16)$$

$$c_{1t}^1 = c_t^1 - \left(p_{1t} - p_t^1\right), \qquad (2.17)$$

$$c_{1t}^2 = c_t^2 - \left(p_{1t} - p_t^2\right), \qquad (2.18)$$

$$c_{2t}^1 = c_t^1 - \left(p_{2t} - p_t^1\right), \qquad (2.19)$$

$$c_{2t}^2 = c_t^2 - \left(p_{2t} - p_t^2\right), \qquad (2.20)$$

$$p_t^1 = \gamma p_{1t} + (1-\gamma) p_{2t}, \qquad (2.21)$$

$$p_t^2 = (1-\gamma) p_{1t} + \gamma p_{2t}, \qquad (2.22)$$

$$b_{t+1}^1 - b_t^1 = \left(p_{1t} - p_{2t}\right) - \left(c_{2t}^1 - c_{1t}^2\right) + \delta b_{t+1}^1, \qquad (2.23)$$

$$b_{t+1}^2 - b_t^2 = -\left(p_{1t} - p_{2t}\right) + \left(c_{1t}^2 - c_{2t}^1\right) + \delta b_{t+1}^2, \qquad (2.24)$$

$$w_t^1(i) = p_t^1 + c_t^1, \qquad (2.25)$$

$$w_t^2(i) = p_t^2 + c_t^2, \qquad (2.26)$$

$$l_{1t}^1(i) = -\phi\left(w_t^1(i) - w_t^1\right) - a_t^1 + y_{1t}, \qquad (2.27)$$

$$l_{2t}^1(i) = -\phi\left(w_t^1(i) - w_t^{21}\right) - a_t^2 + y_{2t}, \qquad (2.28)$$

$$l_{1t}^2(i) = -\phi\left(w_t^2(i) - w_t^1\right) - a_t^1 + y_{1t}, \qquad (2.29)$$

$$l_{2t}^2(i) = -\phi\left(w_t^2(i) - w_t^2\right) - a_t^2 + y_{2t}, \qquad (2.30)$$

$$y_{1t} = a_t^1 + l_{1t}, \qquad (2.31)$$

$$y_{2t} = a_t^2 + l_{2t}, \qquad (2.32)$$

$$p_{1t} = w_t^1 - a_t^1, \qquad (2.33)$$

$$p_{1t} = w_t^1 - a_t^1, \qquad (2.34)$$

$$l_{1t} = \rho l_{1t}^1(i) + (1-\rho) l_{1t}^2(i), \qquad (2.35)$$

$$l_{2t} = (1-\rho) l_{2t}^1(i) + \rho l_{2t}^2(i), \qquad (2.36)$$

$$w_t^1 = \rho w_t^1(i) + (1-\rho) w_t^2(i), \qquad (2.37)$$

$$w_t^2 = (1-\rho) w_t^1(i) + \rho w_t^2(i). \qquad (2.38)$$

3. Market Integration and Macroeconomic Volatility with Flexible Wages

This paragraph evaluates the impact of goods and labour market integration on the relative adjustment of national aggregates in the Monetary Union for the constrained optimal equilibrium. We first develop a simple solution procedure to compute the reduced form of the model, then we evaluate the sensitivity of aggregate volatility to the integration of markets following demand and productivity shocks.

3.1 The IE-EE solution procedure

We adapt the "GG-MM" method introduced by Obstfeld and Rogoff (1995) and extended to alternative new open macroeconomics settings by Hau (2000) and Warnock (2003) to equations (2.13) – (2.38), so that the model can be summarised according to two main schedules. First, the EE relation describes the external equilibrium of the countries participating to the Monetary Union as the intertemporal equilibrium of their current account. Subtracting (2.24) from (2.23), taking into account the financial market equilibrium and the fact that the deviation of the difference in the rate of per capita consumption follows a random walk, (i.e. that the deterministic component of the deviation of per capita consumption rates are permanent[1], so that $b_{s+1}^1 = b_s^1$ for $s > t$), combining the expression thus obtained with equations (2.13)-(2.22) we obtain the EE schedule as the first relation in (3.1). Second, the IE schedule defines the relative internal equilibrium of the participating countries as the determination of relative output. Since wages are flexible, output is supplied determined and the internal equilibrium of the participating countries takes into account the equilibrium of the labour market. Combining (2.25) – (2.26) with (2.33) – (2.26) and rearranging by taking into account (2.21) – (2.22), the IE schedule is defined according to the second relation in (3.1),

$$\begin{cases} \left(c_t^1 - c_t^2\right) = -\dfrac{\delta(2\gamma-1)\left(1-(2\gamma-1)(2\rho-1)\right)}{1+\delta\left(1-(2\gamma-1)(2\rho-1)\right)}\left(p_{1t}-p_{2t}\right) + \dfrac{1}{1+\delta\left(1-(2\gamma-1)(2\rho-1)\right)}\left(u_t^1-u_t^2\right), \\ \left(p_{1t}-p_{2t}\right) = \dfrac{(2\rho-1)}{1-(2\gamma-1)(2\rho-1)}\left(c_t^1-c_t^2\right) - \dfrac{1}{1-(2\gamma-1)(2\rho-1)}\left(a_t^1-a_t^2\right). \end{cases}$$

---

[1] this simplifies the model dynamics by assuming that the new steady state that is reached at the end of $s = t$ is maintained for $s \in [t, \infty)$ as outlined by Obsfeld and Rogoff (1995).

(3.1)

As shown in (3.1), The External Equilibrium of the countries in the monetary union requires a negative relation between consumption growth differential $\left(c_t^1 - c_t^2\right)$ and domestic terms of trade $\left(p_{1t} - p_{2t}\right)$. This must be understood as follows : an increase in the relative price of the country 1 good decreases its demand in both economies with respect to that of country 2 good. Consumption home bias $(\gamma > 0.5)$ implies a relatively higher reduction of domestic consumption, thus explaining the negative link between the two aggregates. It shall be noted that, an increase in the integration of the goods market (i.e., a decrease of γ) dampens this effect since it increases final consumption bundles homogeneity. The relative internal equilibrium of the economies requires a positive relation between $\left(p_{1t} - p_{2t}\right)$ and $\left(c_t^1 - c_t^2\right)$ for a given difference in output growth. This must be understood as follows : an increase in consumption growth rate differential implies a net increase in the domestic wage which depresses labour demand and activity. To maintain output growth differential, this requires a net increase of the relative price of the domestic final good so as to keep real wages unchanged. Labour market integration (i.e., a decrease of ρ) reduces the sensitivity of terms of trade increase to consumption growth differential since the domestic firm can substitute foreign labour for domestic labour, thus putting less weight on the goods selling price.

The solution of (3.1) can be combine with,

$$\begin{cases} b_{t+1}^1 = -(c_t^1 - c_t^2) - (2\gamma - 1)(p_{1t} - p_{2t}), \\ p_t^1 - p_t^2 = (2\gamma - 1)(p_{1t} - p_{2t}), \\ y_{1t} - y_{2t} = -(p_{1t} - p_{2t}), \\ l_{1t} - l_{2t} = -(p_{1t} - p_{2t}) - \left(a_t^1 - a_t^2\right), \\ l_{1t}^2 - l_{2t}^1 = -(1-\rho)(p_{1t} - p_{2t}) - (1-\rho)\left(a_t^1 - a_t^2\right), \end{cases} \tag{3.2}$$

to define the reduced form of the aggregates according to,

$$b_{t+1}^1 = -\frac{1}{\Phi}\left(u_t^1 - u_t^2\right) + \frac{(2\gamma - 1)}{\Phi}\left(a_t^1 - a_t^2\right), \tag{3.3}$$

$$\left(p_{1t} - p_{2t}\right) = \frac{(2\rho - 1)}{\Phi}\left(u_t^1 - u_t^2\right) - \frac{\left[1 + \delta\left(1 - (2\rho - 1)(2\gamma - 1)\right)\right]}{\Phi}\left(a_t^1 - a_t^2\right), \tag{3.4}$$

$$\left(c_t^1 - c_t^2\right) = \frac{1}{1+\delta}\left(u_t^1 - u_t^2\right) + \frac{\delta(2\gamma - 1)}{1+\delta}\left(a_t^1 - a_t^2\right), \tag{3.5}$$

$$\left(p_t^1 - p_t^2\right) = \frac{(2\gamma-1)(2\rho-1)}{\Phi}\left(u_t^1 - u_t^2\right) - \frac{(2\gamma-1)[1+\delta(1-(2\rho-1)(2\gamma-1))]}{\Phi}\left(a_t^1 - a_t^2\right), \tag{3.6}$$

$$\left(y_{1t} - y_{2t}\right) = \frac{(2\gamma-1)(2\rho-1)}{\Phi}\left(u_t^1 - u_t^2\right) - \frac{2(2\gamma-1)\{1+\delta[1-(2\rho-1)(2\gamma-1)]\}}{\Phi}\left(a_t^1 - a_t^2\right), \tag{3.7}$$

$$\begin{aligned}\left(l_{1t} - l_{2t}\right) = &-\frac{2(2\rho-1)(2\gamma-1)}{\Phi}\left(u_t^1 - u_t^2\right) \\ &+ \frac{2(2\gamma-1)-(1-(2\rho-1)(2\gamma-1))(1-\delta)(4\gamma-3)}{\Phi}\left(a_t^1 - a_t^2\right),\end{aligned} \tag{3.8}$$

$$\begin{aligned}\left(l_{1t} - l_{2t}\right) = &-(1-\rho)\frac{2(2\rho-1)(2\gamma-1)}{\Phi}\left(u_t^1 - u_t^2\right) \\ &+ (1-\rho)\frac{2(2\gamma-1)-(1-(2\rho-1)(2\gamma-1))(1-\delta)(4\gamma-3)}{\Phi}\left(a_t^1 - a_t^2\right),\end{aligned} \tag{3.9}$$

with $\Phi = (1+\delta)(1-(2\rho-1)(2\gamma-1))$.

Equations (3.3)-(3.9) are simulated in figures 2 and 3 to characterise the constrained optimal macroeconomic adjustment of the monetary union when it is affected by asymmetric demand or supply shocks.

3.2 Shocks and Macroeconomic Adjustment

The EE-IE solution procedure offers a very simple tool to document the general equilibrium consequences of shocks. The EE-IE system defined by (3.1) is presented in Figure 1 in the consumption growth differential / terms of trade increase space. At point A, (EE1-IE1 are such that $\left(u_t^1 - u_t^2\right) = \left(a_t^1 - a_t^2\right) = 0$) the Monetary Union lies on the initial symmetric steady state defined in 2.4. An asymmetric positive home demand shock ($\left(u_t^1 - u_t^2\right) > 0$) moves the EE schedule rightwards to EE2, so that the new short run equilibrium B is characterised by an increase of both relative aggregate home consumption and the terms of trade. Figure 2 documents the impact of this shock on the main aggregates. We more particularly concentrate on values of $\gamma \in [0.95, 0.8]$ which implies a relative preference towards national goods representing from nineteen to four times the consumption of the imported good. Curves are drawn for a given value of ρ (the thickest curve represents the autarkic labour market situation, $\rho = 1$, the dotted curve stands for the perfect mobility situation, $\rho = 0.5$, the intermediate curve for a very low value of labour force mobility $\rho = 0.98$).

INSERT HERE FIGURES 1 AND 2

Assuming an autarkic labour market a positive aggregate demand in the home country increases nominal wages, thus reducing labour demand and activity with respect to the foreign country an increase in the home final good relative price to balance the labour market. Goods market developments can be analysed as follows : Part of the increase in consumption is met through a deficit of the current account – in the intertemporal approach tradition. Finally, given home bias in consumption, the domestic price index is relatively more affected by the terms of trade increase, thus inducing a clear inflation differential between the member countries of the union. An increase in goods market integration smoothes the macroeconomic adjustment in the monetary union since, for a stable relative aggregate consumption growth differential, it dampens the relative deviation of participating countries aggregates. An increase in labour mobility also dampens aggregate fluctuations : the possibility of labour substitution induces a net labour force inflow in the domestic economy; this, in turn, limits both national relative wage inflation and output reduction with respect to the other economy. In the extreme case of perfect labour integration, there is no term of trade adjustment in the union : indeed, perfect substitution between domestic and foreign labour make relative wages adjustment redundant in the union thus putting no weight on individual price adjustment to adjust the labour market in terms of real wages. Consequently, there is no longer any deviation in employment (and in labour force inflow) nor in activity, and inflation differential vanishes.

INSERT HERE FIGURE 3

An asymmetric positive home supply shock (i.e., $\left(a_t^1 - a_t^2\right) > 0$)moves the IE schedule rightwards to IE2, so that the new short run equilibrium C is characterised by an increase in the relative aggregate home consumption and a reduction in the terms of trade. Now, a positive domestic productivity shock reduces the relative price of the domestic goods and leads to both an increase in activity and in labour demand in the domestic economy. When labour force is mobile, this generates labour inflow. Due to terms of trade reduction, the goods market adjustment is characterised by a relative decrease in the domestic consumption price index and a small increase in domestic consumption, as long as it exhibits a clear home bias. The reduction of the terms of trade increases the relative demand for the domestic good in the foreign economy thus inducing a positive home current account surplus. As noted previously goods market and labour market integration dampen aggregate relative volatility. In the extreme case where labour is perfectly mobile, half of the domestic employment increase is met by labour inflow.

The features characterising the adjustment of the monetary union in a flexible wage setting will serve below as a benchmark for assessing the consequences of short run wage rigidity on the intertemporal general equilibrium.

4 Market Integration and Macroeconomic Volatility with Short Run Fixed Wages

This paragraph evaluates how short run wage rigidity affects macroeconomic adjustment in the monetary union. The consequences of wage rigidity are firstly assessed on the definition of the internal equilibrium of the Monetary Union participants; then we simulate the consequences of an asymmetric demand shock on the main aggregates.

4.1 The IE-EE solution procedure with short run fixed wages

Short run wage rigidity affects the IE schedule. Given monopolistic competition in the labour market and fixed wages, the economy now operates under its optimal constrained production possibility frontier and output is demand determined. The relative internal equilibrium of the Monetary Union participants does no longer take into account labour market equilibrium, since employment depends on the goods market equilibrium. Combining individual goods schedules with the relative equilibrium conditions and taking into account the fact that the link between consumption and output deviations are home biased , we now write the EE-IE system according to,

$$\begin{cases} \left(c_t^1 - c_t^2\right) = -\dfrac{\delta(2\gamma-1)(1-(2\gamma-1)(2\rho-1))}{1+\delta(1-(2\gamma-1)(2\rho-1))}\left(p_{1t} - p_{2t}\right) + \dfrac{1}{1+\delta(1-(2\gamma-1)(2\rho-1))}\left(u_t^1 - u_t^2\right), \\ \left(p_{1t} - p_{2t}\right) = -\dfrac{1}{2(2\gamma-1)}\left(c_t^1 - c_t^2\right). \end{cases}$$

(4.1)

The relative internal equilibrium of countries now requires a negative link between the domestic terms of trade increase and consumption growth differential. Indeed, output differences are determined by consumption differences which in turns are negatively affected by the relative price of individual goods. An increase in the integration of the goods market dampens the impact of terms of trade on consumption bundles, as they become more homogenous. Thus, as shown in Figure 1, the IE3 schedule is negatively slopped and becomes flatter as goods market integration increases. Since terms of trade variation now reflect goods market adjustment, they are no longer determined by the labour market adjustment as it was the case for the optimal constrained equilibrium.

Combining the solution of (4.1) with (3.2), we can write the reduced form of the model with short run fixed wages according to,

$$b_{t+1}^1 = -\frac{1}{2+\delta(1-(2\rho-1)(2\gamma-1))}(u_t^1 - u_t^2), \tag{4.2}$$

$$\left(c_t^1 - c_t^2\right) = \frac{2}{2+\delta(1-(2\rho-1)(2\gamma-1))}\left(u_t^1 - u_t^2\right), \tag{4.3}$$

$$\left(p_{1t} - p_{2t}\right) = -\frac{1}{(2\gamma-1)(2+\delta(1-(2\rho-1)(2\gamma-1)))}\left(u_t^1 - u_t^2\right), \tag{4.4}$$

$$\left(y_{1t} - y_{2t}\right) = \frac{2}{(2\gamma-1)(2+\delta(1-(2\rho-1)(2\gamma-1)))}\left(u_t^1 - u_t^2\right), \tag{4.5}$$

$$\left(p_t^1 - p_t^2\right) = -\frac{1}{2+\delta(1-(2\rho-1)(2\gamma-1))}\left(u_t^1 - u_t^2\right), \tag{4.6}$$

$$\left(l_{1t} - l_{2t}\right) = \frac{2}{(2\gamma-1)(2+\delta(1-(2\rho-1)(2\gamma-1)))}\left(u_t^1 - u_t^2\right) - \left(a_t^1 - a_t^2\right), \tag{4.7}$$

$$\left(l_{1t}^2 - l_{2t}^1\right) = \frac{2(1-\rho)}{(2\gamma-1)(2+\delta(1-(2\rho-1)(2\gamma-1)))}\left(u_t^1 - u_t^2\right) - (1-\rho)\left(a_t^1 - a_t^2\right), \tag{4.8}$$

4.2 The Consequences of a Demand shock

The consequences of an asymmetric one percent home demand shock are presented in figure 1. EE moves rightwards to EE2 along IE3. The new short run equilibrium D is characterised by a relative domestic consumption growth and a reduction in the terms of trade. The adjustment of (4.2)-(4.8) is simulated in figure 4. Since the economy operates under its production possibility frontier, a positive demand shock now increases relative domestic activity, reduces involuntary unemployment and increases consumption (thus imports, as part of it falls on foreign goods). The integration of the goods market increases demand for the home goods, which leads to a further decrease of the relative domestic good price thus an increase of its relative demand, which finally transfers into an increase of the output growth differential. As consumption bundles become more homogeneous, the inflation differential diminishes. An increase in labour mobility has little effect on output differential and on terms of trade adjustment; it mainly affects inflation differential and labour inflow, since, as in the optimal constrained equilibrium situation half of the relative employment increase is filled by labour force inflow.

INSERT HERE FIGURES 4 AND 5

Finally, figure 5 compares the actual and the optimal constrained short run adjustments for a very limited degree of labour force mobility ($\rho = 0.98$). Although consumption growth differential appear comparable, the current account deficit is limited in the fixed wage case, since the reduction of the relative price of the domestic good increases exports towards the foreign country. One shall also outline the different adjustment path of the various variables and the fact that flexible wages in the short run introduce more volatility in the short run in the monetary union. The following section evaluates the consequences of these dissimilarities in terms of per capita welfare for the participating countries.

5. Asymmetric Shocks and Welfare Dispersion in a Monetary Union

This last section investigates the welfare consequences of an imperfect integration of the labour and goods market when the monetary union is affected by asymmetric shocks. We first define the log deviation of per capita national welfare, then we assess the effect of short run wage rigidity with respect to the benchmark optimal constrained equilibrium

5.1 Asymmetric Shocks and Welfare Transfers

Independently of the nationality of the representative agent, the expression of the welfare function (2.1) in the symmetric steady state is $\Omega_0^n = \dfrac{U_0(1+\delta(1+\ln C_0)) - Z_0(1+\delta)}{\delta}$, so that the deviation of country n welfare in period t with respect to Ω_0^n is defined according to,

$$\omega_t^n = \Omega_t^n - \Omega_0^n = \left(U_0 \ln C_0\right)u_t^n + U_0\left(c_t^n + \frac{1}{\delta}E_t(c_{t+1}^n)\right) - Z_0\left(l_t^n + \frac{1}{\delta}E_t(l_{t+1}^n)\right). \tag{5.1}$$

Applying Aoki's method, we can define national per capita welfare deviation as a combination of both the average union per capita welfare increase and of the per capita welfare transfer according to,

$$\begin{cases} \omega_t^1 = \omega_t^e + \frac{1}{2}(\omega_t^1 - \omega_t^2), \\ \omega_t^1 = \omega_t^e - \frac{1}{2}(\omega_t^1 - \omega_t^2), \end{cases} \tag{5.2}$$

where $\omega_t^e = \frac{1}{2}(\omega_t^1 + \omega_t^2)$. Furthermore, defining $u_t^e = \frac{1}{2}(u_t^1 + u_t^2)$ and $a_t^e = \frac{1}{2}(a_t^1 + a_t^2)$ as the average union demand and supply shock, we get, independently of wage flexibility and market integration,

$$\omega_t^e = \left(U_0 \ln C_0\right)u_t^e + U_0 a_t^e. \tag{5.3}$$

As a consequence, the impact of market integration on welfare in the monetary union can simply be evaluated on the basis of the welfare transfer between the participating countries.

For the optimal constrained equilibrium of the monetary union, combining (5.1) with (3.2), we can write for $\gamma \in \left]1\,,0.5\right[$,

$$\left(\omega_t^1-\omega_t^2\right)=\chi_1^{flex}\left(u_t^1-u_t^2\right)+\chi_2^{flex}\left(c_t^1-c_t^2\right)+\chi_3^{flex}\left(p_{1t}-p_{2t}\right), \tag{5.4}$$

with,

$$\begin{cases}\chi_1^{flex}=-\dfrac{U_0(1-\delta\ln C_0)(1-(2\rho-1)(2\gamma-1))+2\phi Z_0}{\delta(1-(2\rho-1)(2\gamma-1))},\\ \chi_2^{flex}=\dfrac{(1+\delta)U_0(1-(2\rho-1)(2\gamma-1))+2\phi Z_0(2-(2\rho-1)(2\gamma-1))}{\delta(1-(2\rho-1)(2\gamma-1))},\\ \chi_3^{flex}=2\phi Z_0(2\gamma-1)\end{cases} \tag{5.5}$$

and, $\left(c_t^1-c_t^2\right)$ and $\left(p_{1t}-p_{2t}\right)$ respectively given by (3.5) and (3.6).

Under short run fixed wages, since employment depends on relative final goods demand, the welfare transfer is defined for $\gamma \in \left]1\,,0.5\right[$ according to,

$$\left(\omega_t^1-\omega_t^2\right)=\chi_1^{fix}\left(u_t^1-u_t^2\right)+\chi_2^{fix}\left(c_t^1-c_t^2\right), \tag{5.6}$$

with,

$$\begin{cases}\chi_1^{fix}=-\dfrac{U_0(1-\delta\ln C_0)(1-(2\rho-1)(2\gamma-1))+2\phi Z_0}{\delta(1-(2\rho-1)(2\gamma-1))},\\ \chi_2^{fix}=\dfrac{[U_0(1+\delta\ln C_0)(2\gamma-1)-Z_0(2\rho-1)](1-(2\rho-1)(2\gamma-1))+2\phi Z_0(2\gamma-1)}{\delta(2\gamma-1)(1-(2\rho-1)(2\gamma-1))}\end{cases} \tag{5.7}$$

and, $\left(c_t^1-c_t^2\right)$ given by (4.3).

5.2 Wage rigidity and the ranking of OCA criteria

Since the per capita union level consequences of shocks are identical independently of market integration or wage rigidity, welfare issues relating to the impact of asymmetric shocks must be assessed on the basis of national per capita welfare dispersion with respect to the union level per capita average. In what follows we evaluate this phenomenon according to the following function,

$$\Psi_t = \sqrt[4]{(\omega_t^1 - \omega_t^e)^2 (\omega_t^2 - \omega_t^e)^2} \ , \qquad (5.8)$$

which after some simple manipulation using (5.2) simplifies to,

$$\Psi_t = \frac{1}{2}\left|\omega_t^1 - \omega_t^2\right| \qquad (5.9)$$

This expression is simulated for $\gamma \in \left]1\,,0.5\right[$ and $\rho \in \left[1\,,0.5\right]$ in tables 1, 2 and 3.

INSERT HERE TABLES 1 AND 2

Table 1 reports welfare dispersion between union members following an asymmetric one percent demand shock, depending upon both the integration of the goods market (measured in columns) and the integration of the labour market (lines). Ceteris paribus, a greater integration of the goods market increases welfare dispersion while an increase in labour market integration reduces per capita welfare dispersion in the union. Thus the Mundellian OCA criterion clearly dominates Mc Kinnon criterion in terms of welfare. Indeed, assuming no labour mobility, an asymmetric demand shock affects both welfare levels, since with fixed wages this decreases the relative price of the domestic good which in turn improves both welfare in the union. Nevertheless, the productive weight of this supplementary goods are all carried by the domestic economy, which ceteris paribus decreases home welfare. Thus, as goods market integration increases, so does welfare dispersion in the monetary union. The reduction of welfare dispersion comes from a greater integration of the labour market, as this induces a better sharing of the labour effort needed to produce the supplementary goods in the short run fixed situation.

As outlined by table 2, the optimality of the Mundellian criterion depends on the fact that wages are fixed in the short run. Indeed, the flexibility of the wages has two main consequences in this setting : first, welfare dispersion is unaffected by the relative integration of either market; second the optimal constrained welfare dispersion is higher for relatively low integration level of either market (the welfare dispersion of the short run fixed wage situation is greater only for very low of the labour market integration and a high integration of the goods market). This feature can be linked to the highest volatility of aggregates noted in the flexible case.

INSERT HERE TABLE 3

Nevertheless, flexible wages do not insure the neutrality of market integration in a monetary union since, as reported in Table 3, the integration of the goods market appears as a key factor for reducing welfare dispersion in the union following an asymmetric productivity shock. In this situation, indeed, an asymmetric supply shock reduces the relative price of the domestic good which affects the relative demand of this good in the two countries. A greater integration of the goods market thus allows a better sharing of the relevant welfare gains.

6. Conclusion

The aim of this paper was to document in a new open economy macroeconomics framework the consequences of imperfect goods and labour market integration in a monetary union, when it is affected by asymmetric shocks. First, comparing different degrees of wage rigidity, we found, for a comparable consumption growth differential, that the current account deficit was limited in the fixed wage case, since the reduction of the domestic terms of trade increases exports towards the foreign country. More generally, we outline the destabilising nature of flexible wages on macroeconomic adjustment since the macroeconomic adjustment was characterised by a greater volatility of the main aggregates. Finally, a greater integration of either market tends to smooth the macroeconomic adjustment in the Monetary Union, although the inflation differential gain may be small in the fixed wage situation.

Second, when wages are fixed in the short run, a greater integration of the goods market increases welfare dispersion while an increase in labour market integration reduces per capita welfare dispersion in the union. Thus the Mundellian OCA criterion clearly dominates Mc Kinnon criterion. The reduction of welfare dispersion comes from a greater integration of the labour market, as this induces a clear sharing of the labour effort needed to produce the supplementary goods in the short run fixed situation. The optimality of the Mundellian criterion depends on the fact that wages are fixed in the short run. On the one hand, we found that wage flexibility makes welfare dispersion unaffected by the relative integration of either market when the monetary union is affected by asymmetric demand shocks. Nevertheless, on the other hand, the integration of the goods market appears as a key factor for reducing welfare dispersion in the union following an asymmetric productivity shock.

7. References

Blanchard O.J. (2004): The economic future of Europe, Journal of Economic perspectives, forthcoming

Blanchard O.J. and L. Katz (1992): « Regional Evolutions », Brookings Papers on Economic Activity, pp 1-75

Chen N. (2004) : « Intra-national versus Inter-national Trade in the European Union : Why do National Borders matter ? », Journal of International Economics, forthcoming

Decressin J. and A fatas (1994) : « Regional Labour Market Dynamics in Europe », CEPR Discussion Paper n°1085

Gros Daniel (2003) : « An Application of the Optimum Currency Area Approach – Regional versus International Labour Mobility in the E(M)U », Submissions on EMU from leading academics, HM Treasury 2003

Hau H. (2000) : « Exchange Rate Determination under Factor Price Rigidities », Journal of International Economics, Vol. 50 (2000), No. 2, 421-447.

Head K. and Mayer T. (2000) : « Non Europe : The Magnitude and Causes of Market Fragmentation in Europe », Weltwirschaftliches Archiv, 136(2), pp 285-314.

Mc Kinnon R. (1964) : « Optimum Currency Areas », American Economic Review 53, pp 717-724.

Mundell R. (1961) : « A Theory of Optimum Currency Areas », American Economic Review 51, pp 657-665.

Obstfeld Maurice and Rogoff Kenneth (1995) : « Exchange Rate Dynamics Redux », Journal of Political Economy, 100, pp 624-660

Trichet Jean-Claude (2003), « Zones Monétaires Optimales et mise en œuvre des politiques économiques », Bulletin mensuel de la Banque de France, Bulletin de la Banque de France n° 120, décembre, pp 29-38.

Wildasin D.(2000): « Factor mobility and fiscal policy in the EU: policy issues and analytical approaches », Economic Policy, Volume 15, Issue 31, Page 337-378.

Warnock F. (2003) « Exchange rate dynamics and the welfare effects of monetary policy in a two-country model with home-product bias », Journal of International Money and Finance, Volume 22, Issue 3, June 2003, Pages 343-363

Figure 1

The EE-IE System

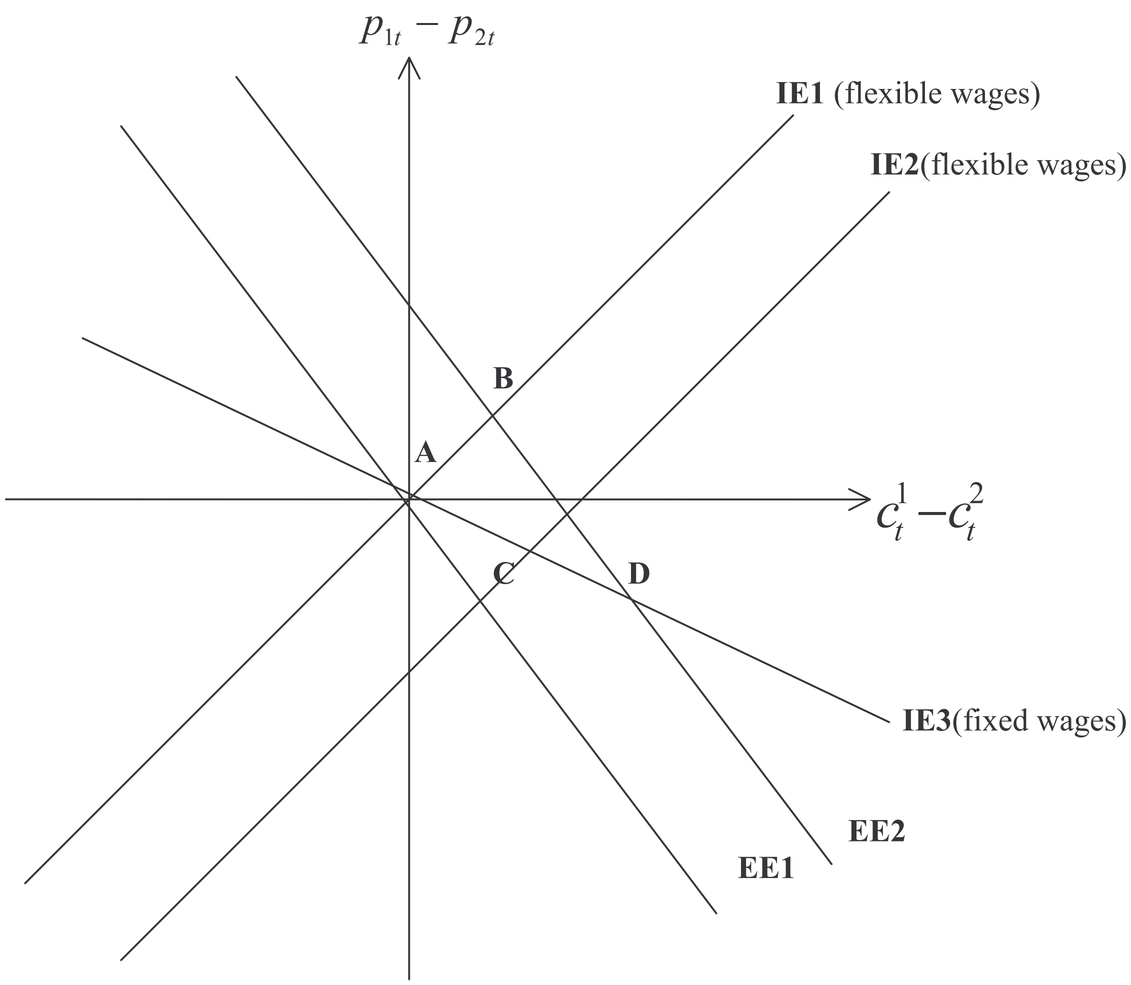

Figure 2 :
flexible wages ; demand shock

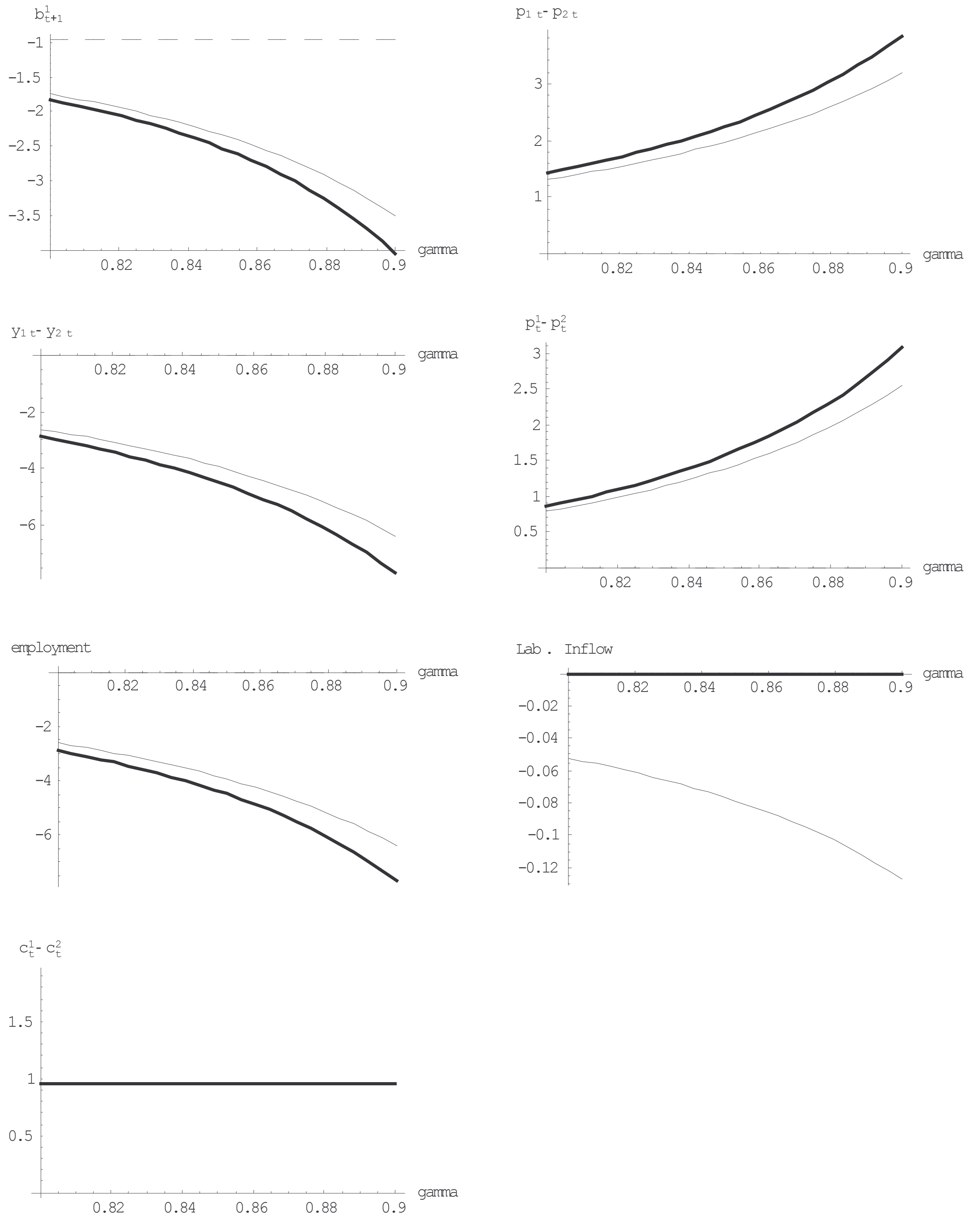

Figure 3 :
flexible wages ; supply shock

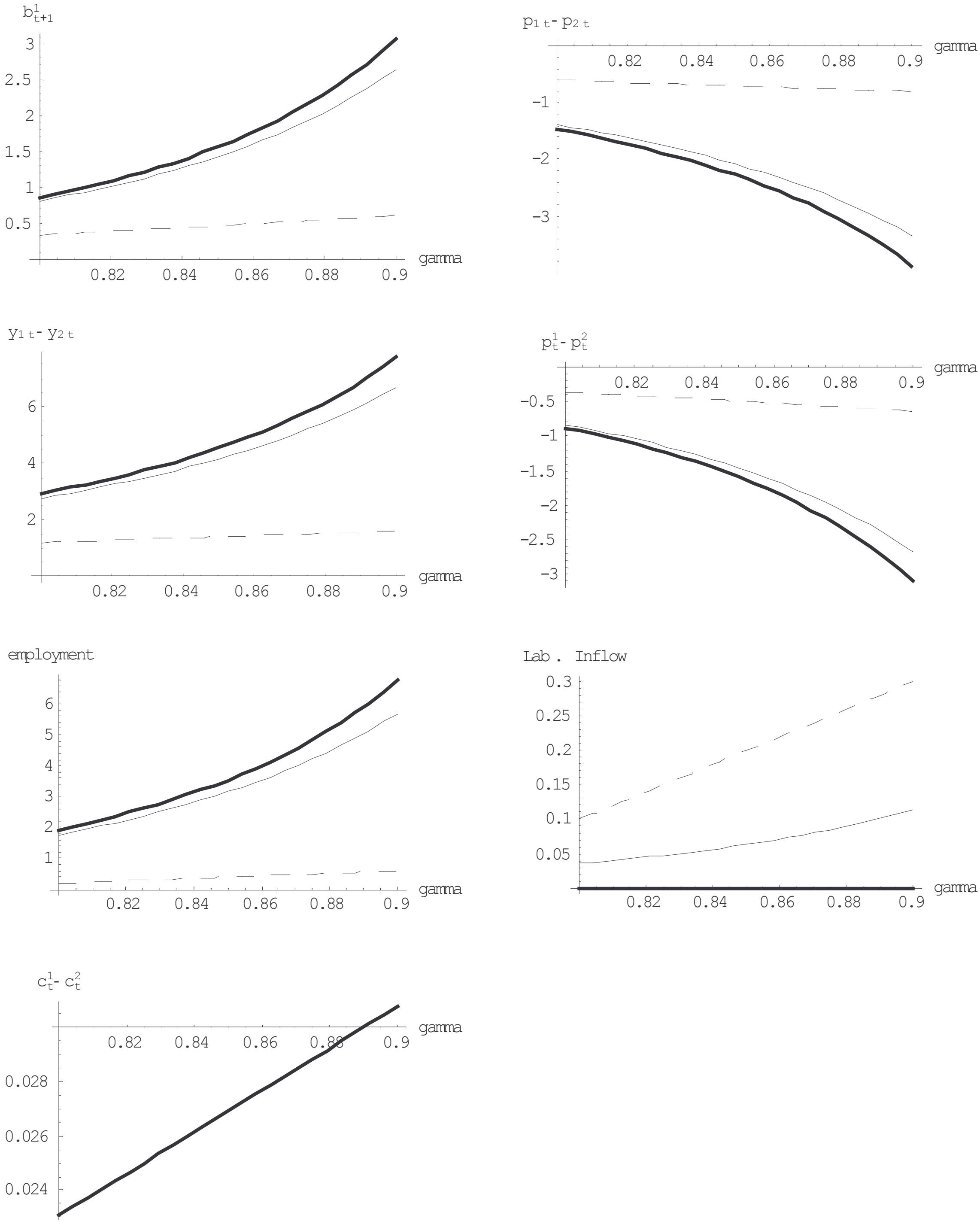

Figure 4
fixed wages ; demand shock

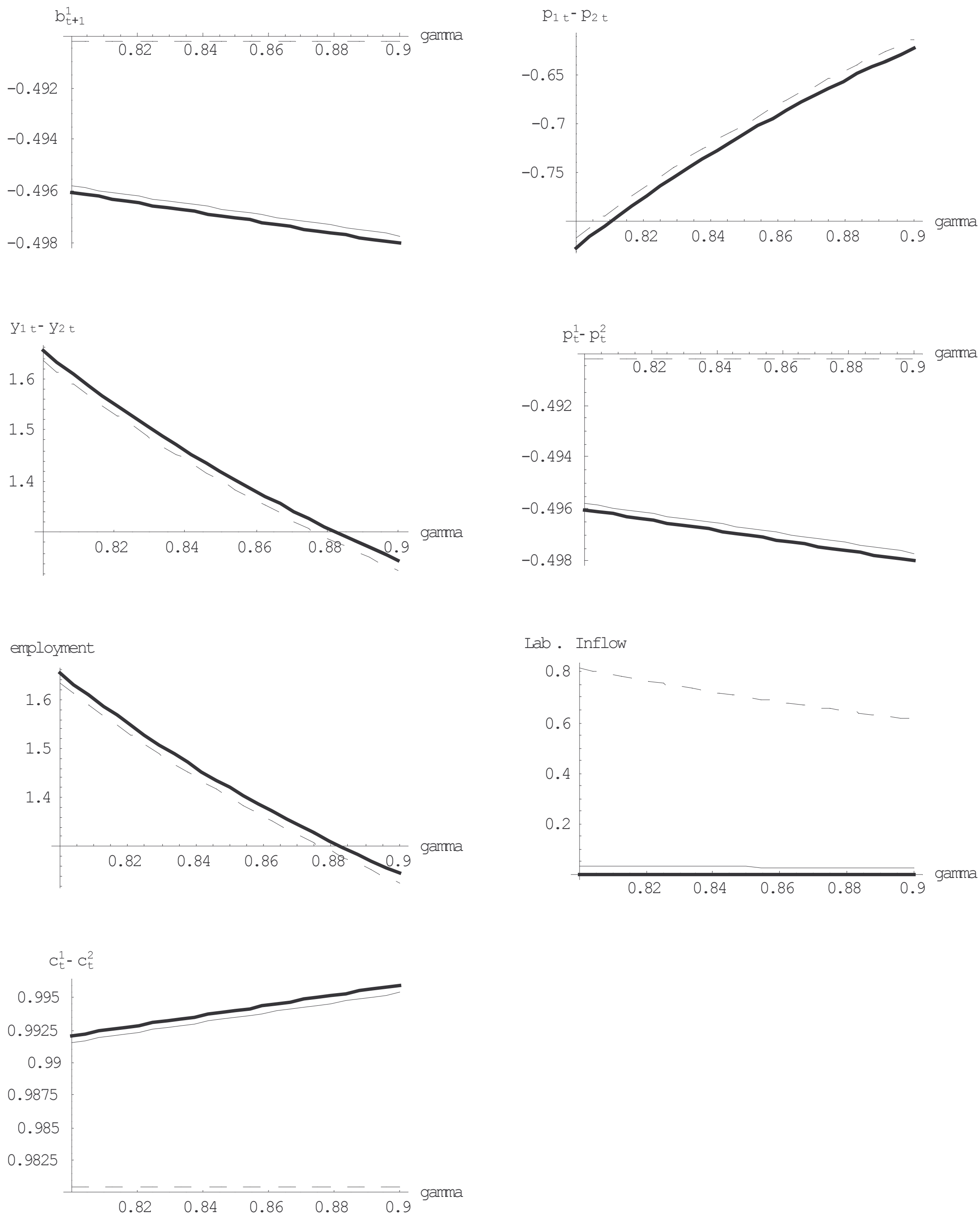

Figure 5
comparison flex/fixed wages for very low labour mobility

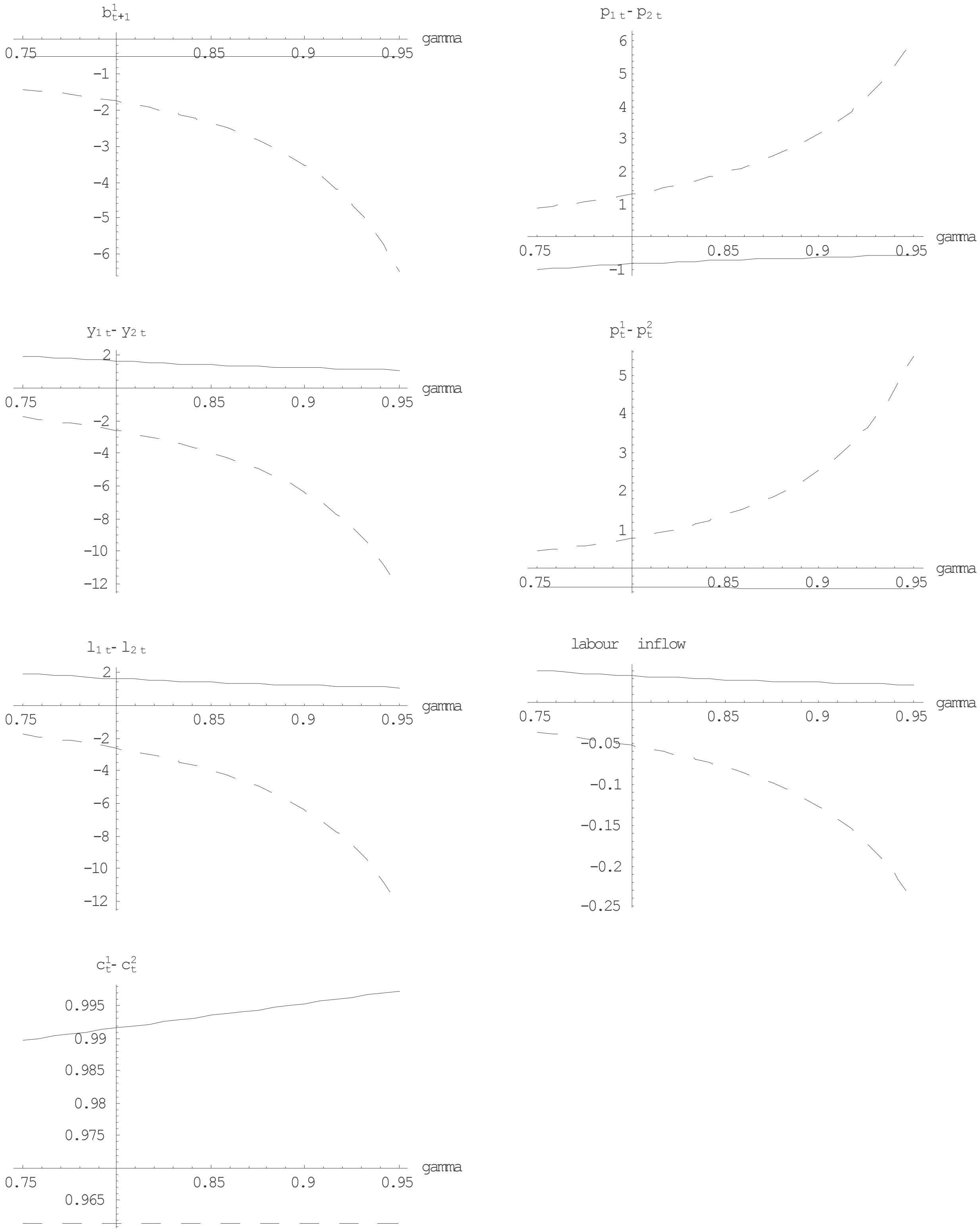

Table 1

Welfare dispersion following an asymmetric 1% demand shock

(fixed wages)

1.28873	1.46127	1.68243	1.97654	2.38734	3.00239	4.02592	6.07069	12.2004
1.15002	1.30531	1.50437	1.76906	2.13879	2.69233	3.61352	5.45381	10.9706
1.01182	1.14986	1.32679	1.56208	1.89073	2.38277	3.20161	4.83743	9.74122
0.874109	0.99489	1.14971	1.35558	1.64316	2.0737	2.79018	4.22153	8.51235
0.736889	0.840415	0.973116	1.14958	1.39607	1.76511	2.37924	3.60611	7.28396
0.600158	0.686429	0.797012	0.944066	1.14947	1.457	1.96878	2.99118	6.05605
0.463914	0.532928	0.621394	0.739037	0.903363	1.14939	1.55881	2.37673	4.82863
0.328152	0.379912	0.44626	0.534491	0.657736	0.842253	1.14932	1.76276	3.60168
0.192872	0.227377	0.271608	0.330428	0.412591	0.535602	0.740313	1.14927	2.37522
0.0580693	0.0753214	0.0974365	0.126846	0.167927	0.229432	0.331788	0.536267	1.14924
0.0762572	0.0762572	0.0762572	0.0762572	0.0762572	0.0762572	0.0762572	0.0762572	0.0762572

(columns : from left to right : $\gamma = 0.95, 0.90, 0.85, 0.80, 0.75, 0.70, 0.65, 0.60, 0.55$; lines : up to down : $\rho = 1, 0.95, 0.90, 0.85, 0.80, 0.75, 0.70, 0.65, 0.60, 0.55, 0.5$)

Table 2

Welfare dispersion following an asymmetric 1% demand shock

(fixed wages)

4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517
4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517	4.76517

(columns : from left to right : γ = 0.95, 0.90, 0.85, 0.80, 0.75, 0.70, 0.65, 0.60, 0.55 ; lines : up to down : ρ = 1, 0.95, 0.90, 0.85, 0.80, 0.75, 0.70, 0.65, 0.60, 0.55, 0.5)

Table 3
Welfare dispersion following an asymmetric 1% supply shock
(flexible wages)

0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615
0.211154	0.187692	0.164231	0.140769	0.117308	0.0938462	0.0703846	0.0469231	0.0234615

(columns : from left to right : γ = 0.95, 0.90, 0.85, 0.80, 0.75, 0.70, 0.65, 0.60, 0.55 ; lines : up to down : ρ = 1, 0.95, 0.90, 0.85, 0.80, 0.75, 0.70, 0.65, 0.60, 0.55, 0.5)