



**Bureau
d'économie
théorique
et appliquée
(BETA)**
UMR 7522

Documents de travail

« Implementing a Fiscal Transfer Mechanism in a Heterogeneous Monetary Union: A DSGE approach »

Auteurs

Thierry Betti

Document de Travail n° 2013 – 19

Octobre 2013

**Faculté des sciences
économiques et de
gestion**

Pôle européen de gestion et
d'économie (PEGE)
61 avenue de la Forêt Noire
F-67085 Strasbourg Cedex

Secrétariat du BETA

Géraldine Del Fabbro
Tél. : (33) 03 68 85 20 69
Fax : (33) 03 68 85 20 70
g.delfabbro @unistra.fr
www.beta-umr7522.fr



Implementing a Fiscal Transfer Mechanism in a Heterogeneous Monetary Union: A DSGE approach

Thierry Betti*

October 19, 2013

Abstract

This paper deals with the implementation of a fiscal transfer mechanism among countries of a monetary union. I use a DSGE model of a monetary union close to Beetsma and Jensen (2005) and introduce both national fiscal policies and a transfer mechanism. I show the transfer has two effects: an obvious shift in demand but also a destabilizing effect due to a higher degradation of the term of trade for the recipient member. Then, I focus on two structural heterogeneities: the sensitivity to the transfer and the relative size of the two countries. I discuss in what extent these heterogeneities affect the effectiveness of the transfer.

Keywords: fiscal federalism, transfer mechanism, new-Keynesian models, monetary union

JEL classification: E32, F77

1 Introduction

The EMU (Economic and Monetary Union) is currently going through an unprecedented economic crisis and facing with serious fiscal debt problems. The economic responses of the different members have been heterogeneous : for instance, situations in Germany, Spain or France clearly differ. The current configuration acutely raises the question of how to achieve an efficient stabilization of the different members of a monetary union when asymmetric shocks arise. Indeed, since 1999, some European countries have chosen to form a monetary union: the Euro area, in which the countries of the union share the same currency and therefore implement a common monetary policy. As a result, these countries have lost the exchange rate as an adjustment variable in the case of heterogeneous cyclical fluctuations. When such asymmetries occur, the monetary policy can't be optimal for each country, as shown by Brissimis and Skotida (2008). Indeed, the interest rate is set, taking into account the aggregate fluctuations of inflation and the output gap in the entire union. Therefore, with the creation of a currency union, one of the challenges is to find a structure of economic policies liable to achieve an efficient stabilization of activity and

*University of Strasbourg. E-mail: tbetti@unistra.fr

employment both at the union and at the national level.

One response to this challenge would be to use fiscal policy as an output stabilizer. In a monetary union, fiscal competences can be distributed at different levels of action : various fiscal policy designs exist in current currency unions. In the United States, the federal government is in charge of fiscal competences and leads an active stabilization, with the help of a cyclical budget (about 20% of the US GDP). In the Euro area, national governments have fiscal sovereignty: by voting national budgets, they can implement a countercyclical policy, only constrained by the Stability and Growth Pact.

In this paper, I focus on a specific fiscal tool, already introduced in several monetary unions and/or federal countries: a fiscal transfer mechanism. Such a mechanism exists in the United States, Canada and in other federal countries like Germany or Switzerland. Fiscal transfers occur between countries when their national GDP growth rates diverge. An economy seeing its growth slowing down more sharply than other countries of the currency union will receive a fiscal transfer from the better-off countries, helping its cyclical stabilization. By sharing the cyclical risk between the national economies, a transfer mechanism would allow for smoother cyclical fluctuations of the economies and have potential effects on the output of the union as a whole.

Several estimations has been made concerning the stabilizing ability of a transfer mechanism, for the United States, Canada, Switzerland and Germany. Because of methodological discrepancies, results differ widely between these studies. I provide non-exhaustive summary of the latter in the Figure 1. The outcomes presented concern the United States and Canada, the monetary unions for which the most estimates are available.

Theoretical literature has examined the characteristics of such a insurance mechanism. Beine and Docquier (1997) test the efficiency of transfers in a stochastic model composed of two countries. Migration is allowed between countries and wages are sticky, including new-Keynesian features. The observed variables are income per capita and unemployment. The model is simulated with demand and supply shocks. Four rules, pertaining to unemployment and income-per-capita fluctuations are tested. The authors conclude that rules based on unemployment are less efficient than those based on income. This is due to more volatile fluctuations, especially for prices and it yields counter-productive effects. Thus, rules based on income would be more effective. Furthermore, the authors set dynamic rules which take into account lagged values of observed variables and conclude that they are more efficient than static rules. Evers (2006), in a "new open macroeconomics framework", based on a proposal from The Mac Dougall Report (1977), tests two kinds of transfers: direct transfers among the households (private sector) and indirect transfers via governments. He presents the models of two countries, one being simulated with a supply shock, the second one with a demand shock. The latter is a preference shock, shifting the demand for tradable goods produced in one country to tradable goods produced in the second country. The author wants to determine what transfer is the most efficient to stabilize consumption and output. In the case of a demand shock, intergovernmental transfers allow a perfect insurance. However, when supply shocks occur, direct transfers among households are necessary to achieve a perfect insurance,

Sources	USA	CANADA
Sala-i-Martin and Sachs (1990)	38	
Von Hagen (1992)	9-10	
Italianer and Pisani-Ferry (1992)	17	
Goodhart et Smith (1993)	13	12-14
Gros and Jones (1994)	4-14	
Bayoumi and Masson (1995)	30.2	17.4
Asdrubali, Sorensen and Yosha (1996)	13	
Obstfeld and Peri (1997)	10	13
Melitz and Zumer (2002)	20.3	14.4

Figure 1: Stabilizing abilities of insurance mechanism in the United States and Canada, in percent of the shock

avoiding heterogeneous consumption shifts. Therefore, a combination of the two transfers seems to be relevant for an efficient stabilization of employment and consumption even though it does not permit a stabilization of national fluctuations.

More recently, Kim and Kim (2012) and Fahri and Werning (2012) focus on the relevance of a fiscal risk-sharing mechanism when the households are liquidity-constrained. Both papers find that the higher the restrictions on the financial markets are, the more useful the transfers are to obtain a perfect risk-sharing.

In this paper, I reassess an insight developed in Von Hagen (1998). The author uses a new-Keynesian aggregate model. Using a two-country model, he describes several features of a transfer mechanism based on output fluctuations, introducing structural heterogeneities between the two economies. In this article, I adapt the same methodology to a DSGE (dynamic and stochastic general equilibrium) framework. The aim is to describe some characteristics of such a transfer system as a cyclical stabilizer. I introduce economic policies (monetary, national fiscal policies and fiscal transfers) with simple rules and simulate my model with supply and demand shocks (both symmetric and asymmetric). My model is rather similar to the models of the currency union developed by Beetsma and Jensen (BJ, 2005) and Gali and Monacelli (GM, 2008) in that I don't model the funding of fiscal policy as well as private investment. I diverge from these models by using simple rules, GM (2008) and BJ (2005) determining optimal policies with the help of a process of welfare maximization by governments. My contribution consist is analyzing the effects of a transfer mechanism in a DGSE framework, introducing asymmetric shocks and structural heterogeneities, which are key elements for this study as they allow to create cyclical heterogeneities within the monetary union.

In the cases of asymmetric shocks and heterogeneity concerning price stickiness, I show that the transfer mechanism is an efficient stabilizing tool. In this model, the transfer has two main effects. Firstly, the positive effect is of course a shift in demand among countries. However, there is a negative effect (lower than

the initial positive effect) due to the term of trade. I show that the differential between both countries is due to the term of trade and that the mechanism magnifies this effect. To my knowledge, it is the first time this effect is pointed out in the literature.

Von Hagen (1998) shows that in the case of an heterogeneity among countries bearing upon the fiscal multiplier, transfers can be counterproductive, if the transfer is made from the country which has the highest fiscal multiplier to the country with the lowest one. Indeed, the author argues that in this case the transfer could have a negative effect on the output of the union and even a destabilizing effect for the recipient economy. I reproduce this heterogeneity in the DSGE model and find these results: I need to introduce a large difference between the two sensibilities to the fiscal transfer in order to obtain a significant negative effect for the output of the union. I argue it is unlikely that such an effect could be important in reality. Furthermore, with usual values for the parameters, the model always produces a positive effect for the recipient economy contrary to the intuition developed in Von Hagen (1998).

Finally, I take into account an other heterogeneity which could produce a counterproductive transfer mechanism: the relative size of the two economies. By varying the size of both economies, I am trying to point out that the efficiency of the transfer mechanism varies too. In the model, I show that a transfer carried out from a small country to a large country is likely more efficient than the contrary. In the model, this effect is due to the term of trade. In this paper, I briefly discuss whether we can find a positive link between the size of the fiscal multiplier and the size of the economy.

Many economists argue for the implementation of such transfers within Euro area countries. I have summarized below in Figures 3 and 4 the growth rates of the Euro-area countries since the birth of EMU. Using these descriptive statistics and taking into account the heterogeneity concerning the size of the economies, I try to evaluate whether transfers would have occurred from the largest countries to the smaller ones or the opposite.

The rest of the article is organized as follows. The second section presents the model; the third one describes the simulations and the analysis. Then I introduce hereafter an asymmetric supply shock and a symmetric demand shock. In the latter case, the two economies of the model have a different level of nominal rigidity: the effects of this structural heterogeneity and the ability of the transfer mechanism to provide an efficient stabilization of the output of both economies will be described. In the fourth section, the addition of heterogeneity concerning the fiscal multiplier will be tested. Von Hagen (1998) has found that, in this configuration, the transfer mechanism can be counter-productive. I also test the introduction of different sizes for the economies. Ultimately, I conclude that this result depends on the relative size of both economies.

2 Model

I build a model containing two economies, $i = H, F$. The "H" superscript denotes the home country while variables with a "F" superscript correspond to the foreign country. Finally, the "W" superscript represents variables concerning the monetary union as a whole.

The union is populated by a continuum of agents with an interval $[0, 1]$. The agents of the home economy are represented by the interval $[0, n]$; agents of the foreign country by the interval $]n, 1]$.

2.1 The demand side

Households

Each agent of the economy seeks to maximize an intertemporal utility function, defined for the home agents by:

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_t^H, L_t^H) \quad (1)$$

with:

$$U(C_t^H, L_t^H) = \hat{\epsilon}_t^H \left(\log C_t^H - \frac{(L_t^H)^{1+\zeta}}{1+\zeta} \right) \quad (2)$$

Where C_t^H is the consumption of the home household and L_t^H the hours worked by the agent. ζ is the elasticity of substitution of the labor supply and ϵ designs a demand shock, following an AR(1) process : $\hat{\epsilon}_t^H = \rho_\epsilon \hat{\epsilon}_{t-1}^H + \kappa_t^H$, with κ_t^H a white noise. This shock impacts the intertemporal trade-off of the agent. The "hat" represents the log-deviation of the variables from their steady-state such as $\hat{x}_t = x_t - x$, where x is the steady-state value of the variable.

The maximization of (1) is subject to a budget constraint defined by

$$P_t^W C_t^H + \left(\frac{E_t(B_{t+1}^H)}{1+i_t^W} \right) \leq B_t^H + W_t^H L_t^H \quad (3)$$

where P_t^W defines the consumer price index (CPI) of the home household, B_t^H is a riskless asset held by the home agent in the period t . W_t^H is the nominal wage and i_t^W is the short-term nominal interest rate set by the monetary authority.

With the help of the Lagrangian method, first order conditions yield:

$$U_{C^H,t} = \frac{\hat{\epsilon}_t}{C_t^H} \quad (4)$$

$$\beta \frac{1}{1+i_t^W} = \left(\frac{E_t(U_{C^H,t+1})}{U_{C^H,t}} \right) \left(\frac{P_t^W}{P_{t+1}^W} \right) \quad (5)$$

$$\frac{U_{L^H,t}}{U_{C^H,t}} = \frac{W_t^H}{P_t^W} \quad (6)$$

Equation (5) is the traditional Euler equation describing the intertemporal trade-off of the Ricardian agent. Equation (6) defines the intratemporal trade-off between consumption and leisure.

Determination of the price system and individual demands

There is a continuum of differentiated goods produced in both economies, n goods h for the country H, $(1 - n)$ goods f for the country F. I assume that goods are perfectly tradable within the monetary union.

The consumer leads 3 maximizations. First, he determines his total consumption level C_t^H and then he splits his consumption between home goods and foreign goods. Finally, he leads an optimal allocation for each basket of goods between all the differentiated goods produced in each economy.

The total consumption C_t^H of the household is defined by an index such as:

$$C_t^H = \frac{(C_{H,t}^H)^n (C_{F,t}^H)^{1-n}}{n^n (1-n)^{(1-n)}} \quad (7)$$

Where $C_{H,t}^H$ defines the home consumption for home goods and $C_{F,t}^H$ the home consumption for foreign goods.

The consumption $C_{H,t}^H$ is defined by a CES (constant elasticity of substitution) function such as:

$$C_{H,t}^H = \left(\left(\frac{1}{n} \right)^{1-\theta} \int_0^n (C_{H,t}^H(h))^{\frac{\theta-1}{\theta}} dh \right)^{\frac{\theta}{\theta-1}} \quad (8)$$

where $C_{H,t}^H(h)$ is the consumption in the home country for a good h and $\theta > 1$ defines the elasticity of substitution between the goods within the same country.

In the same manner, the consumption in the foreign country for a good f is defined such as:

$$C_{F,t}^H = \left(\left(\frac{1}{1-n} \right)^{1-\theta} \int_n^1 (C_{F,t}^H(f))^{\frac{\theta-1}{\theta}} df \right)^{\frac{\theta}{\theta-1}} \quad (9)$$

The optimal allocation for the household between goods produced in the same country is described by the following demand functions:

$$C_{H,t}^H(h) = \left(\frac{P_t^H(h)}{P_t^H} \right)^{-\theta} C_{H,t}^H \quad (10)$$

$$C_{F,t}^H(f) = \left(\frac{P_t^F(f)}{P_t^F} \right)^{-\theta} C_{F,t}^H \quad (11)$$

Where $P_t^H(h)$ defines the price of the good h , P_t^H is the price index of the home goods, such as $P_t^H = \left[\left(\frac{1}{n} \right) \int_0^n (P_t^H(h))^{1-\theta} dh \right]^{\frac{1}{1-\theta}}$. In the same manner, P_t^F , the

price index for the foreign goods, is defined such as $P_t^F = \left[\left(\frac{1}{1-n} \right) \int_0^n (P_t^F(f))^{1-\theta} df \right]^{\frac{1}{1-\theta}}$.

I assume that the purchasing power parity (PPP) condition holds, thus price indexes are identical for both home and foreign consumers. Finally, $P_t^W = (P_t^H)^n (P_t^F)^{1-n}$ defines the consumer price index (CPI) of the union as a whole. This is the index which is present in the fiscal constraint (equation (2)).

I write the optimal allocation between home and foreign goods such as:

$$C_{H,t}^H = n \left(\frac{P_t^W}{P_t^H} \right) C_t^H \quad (12)$$

$$C_{F,t}^H = (1-n) \left(\frac{P_t^W}{P_t^F} \right) C_t^H \quad (13)$$

I define now the term of trade, such as:

$$S_t^H = \frac{P_t^F}{P_t^H} \quad (14)$$

$$S_t^F = \frac{P_t^H}{P_t^F} \quad (15)$$

I can rewrite the CPI such as:

$$P_t^W = (P_t^H)^n (P_t^F)^{1-n} \quad (16)$$

$$P_t^W = P_t^H \left(\frac{P_t^F}{P_t^H} \right)^{1-n} \quad (17)$$

$$P_t^W = P_t^H S_t^{1-n} \quad (18)$$

Governments and public spending

In this paper, a national fiscal policy is the purchase of goods and services of a country by a country's government. The aim of the government is to stabilize output, following a simple rule (see equation (42)).

The total spending carried out by the home government can be written such as:

$$G_t^H = \left(\int_0^n (G_t(h)^H)^{\frac{\theta-1}{\theta}} dh \right)^{\frac{\theta}{\theta-1}} \quad (19)$$

Like households, government seeks to minimize spending. Therefore, the optimal allocation between goods of the same country is defined by:

$$G_t^H(h) = \left(\frac{P_t^H(h)}{P_t^H} \right)^{-\theta} G_t^H \quad (20)$$

The aggregate demand

The aim is to define the aggregate demand for each economy. First, I want to set the demand for one good h , produced in the home country, such as:

$$Y_t^H(h) = C_{H,t}^H(h) + C_{H,t}^F(h) + G_t^H(h) \quad (21)$$

$$Y_t^H(h) = \left(\frac{P_t^H(h)}{P_t^H} \right)^{-\theta} \left[n \left(\frac{P_t^W}{P_t^H} \right) C_t^H + (1-n) \left(\frac{P_t^W}{P_t^H} \right) C_t^F + G_t^H \right] \quad (22)$$

$$Y_t^H(h) = \left(\frac{P_t^H(h)}{P_t^H} \right)^{-\theta} \left[n(S_t^H)^{1-n} C_t^H + (1-n)(S_t^H)^{1-n} C_t^F + G_t^H \right] \quad (23)$$

$$Y_t^H(h) = \left(\frac{P_t^H(h)}{P_t^H} \right)^{-\theta} \left[(S_t^H)^{1-n} C_t^W + G_t^H \right] \quad (24)$$

where $C_t^W = nC_t^H + (1-n)C_t^F$ corresponds to the entire consumption in the union.

Furthermore, the aggregate demand is defined by :

$$Y_t^H = \left(\int_0^n Y_t^H(h)^{1-\frac{1}{\theta}} dh \right)^{\frac{\theta}{\theta-1}} \quad (25)$$

Both previous results yield the home aggregate demand :

$$Y_t^H = (S_t^H)^{1-n} C_t^W + G_t^H \quad (26)$$

In logs around the steady state, I obtain: ²

$$\hat{y}_t^H = (1-\Gamma)(\hat{c}_t^W + (1-n)\hat{s}_t^H) + \Gamma\hat{g}_t^H \quad (27)$$

where $\Gamma = \frac{G}{Y}$ corresponds to the share of public spending in the aggregate demand at the steady state.

¹See Gali et Monacelli (2008) for calculations which lead to this result.

In the same manner I obtain for the foreign country:

$$\hat{y}_t^F = (1 - \Gamma)(\hat{c}_t^W - n\hat{s}_t^H) + \Gamma\hat{g}_t^F \quad (28)$$

With the help of equations (3) and (4), I obtain the Euler equation for the households, such as

$$\hat{c}_t^H = E_t(\hat{c}_{t+1}^H) - (\hat{i}_t^W - E_t(\hat{\pi}_{t+1}^W) - \rho) + \hat{\epsilon}_t^H \quad (29)$$

with $\rho = -\log\beta$ et $\hat{\pi}_{t+1}^W = \hat{p}_{t+1}^W - \hat{p}_t^W$, corresponding to the CPI inflation.

Equation (5) can be log-linearized, such as:

$$\hat{w}_t^H - \hat{p}_t^W = \hat{c}_t^H + \zeta_t^H \quad (30)$$

Finally, the whole consumption can be written as:

$$\hat{c}_t^W = n\hat{c}_t^H + (1 - n)\hat{c}_t^F \quad (31)$$

2.2 The supply side

Firms

Each agent of the union produces a differentiated good in a monopolistic competition framework, n goods in the home country and $1 - n$ in the foreign country.

I assume each firm produces with a linear technology, introducing the fact that the productivity shock is common to all firms. For simplicity, there is no investment in private capital.

The production function only contains labor and an exogenous technological shock, such as:

$$Y_t^H(h) = A_t^H L_t^H(h) \quad (32)$$

A_t^H is a productivity shock common to all firms of the home country, following an AR(1) process such as, in logs:

$$\hat{a}_t^H = \rho_a \hat{a}_{t-1}^H + \xi_t^H \quad (33)$$

where $\rho_a \in [0, 1]$ is the persistence degree and ξ_t^H a white noise.

I introduce the real marginal cost such as:

$$\hat{m}c_t^H = \hat{w}_t^H - \hat{p}_t^H - \hat{a}_t^H \quad (34)$$

I introduce a new-Keynesian feature, namely a degree of price rigidity. I assume that firms set prices à la Calvo (1983). Therefore, only $(1 - \nu)$ firms can set new prices (re-optimizing) in each period and the probability of re-optimizing

in any given period is independent of the last period where the individual firm had the opportunity to reset its price.

The optimal behavior of the firm can be approximated by the log-linear rule: ¹

$$\hat{p}_t^H = \psi + (1 - \beta\nu) \sum_{k=0}^{\infty} (\beta\nu)^k E_t \hat{m}c_{t+k}^H + \hat{p}_{t+k}^H \quad (35)$$

where, \bar{p}_t^H is the set new price in logs, $\psi = \log \frac{\theta}{\theta-1}$ corresponds to the optimal mark-up in the flexible price situation.

New-Keynesian Phillips Curve and inflation dynamic

As previously seen, I use a Calvo (1983) price setting mechanism and I define the inflation dynamic in a new-Keynesian framework such as:

$$\hat{\pi}_t^H = \beta E_t \hat{\pi}_{t+1}^H + \lambda \hat{m}c_t^H \quad (36)$$

where $\lambda = \frac{(1-\beta\nu)(1-\nu)}{\nu}$.

With equation (22), I can redefine the real marginal cost such as:

$$\begin{aligned} \hat{m}c_t^H &= \hat{w}_t^H - \hat{p}_t^H - \hat{a}_t^H \\ &= (\hat{w}_t^H - \hat{p}_t^H) + (\hat{p}_t^H - \hat{p}_t^H) - \hat{a}_t^H \\ &= \hat{c}_t^W + \zeta \hat{l}_t^H + \alpha \hat{s}_t^H - \hat{a}_t^H \\ &= \left(\frac{1}{1-\Gamma} + \zeta\right) \hat{y}_t^H - \frac{\Gamma}{1-\Gamma} \hat{g}_t^H - (1 + \zeta) \hat{a}_t^H \end{aligned} \quad (37)$$

I note that the effect of public spendings on inflation is positive in the model. I

find:
 $\frac{\partial \hat{m}c_t^H}{\partial \hat{g}_t^H} = \Gamma \zeta > 0$.

I combine equations (35) and (36) in order to obtain the following new-Keynesian Phillips Curve:

$$\hat{\pi}_t^H = \beta E_t \hat{\pi}_{t+1}^H + \lambda \left(\frac{1}{1-\Gamma} + \zeta \right) \hat{y}_t^H - \left(\frac{\lambda \Gamma}{1-\Gamma} \right) \hat{g}_t^H - \lambda(1 + \zeta) \hat{a}_t^H \quad (38)$$

Finally, the inflation of the entire union, corresponding to the CPI inflation, is represented by:

$$\hat{\pi}_t^W = \hat{p}_t^W - \hat{p}_{t-1}^W \quad (39)$$

Wage setting

I want to introduce wage setting quite simply. As for prices, there is a rigidity for wages, which are partly indexed on the CPI inflation, such as:

$$\hat{w}_t^H = \hat{w}_t^F = \Phi \hat{\pi}_t^W \quad (40)$$

²See Galí and Monacelli (2008) for an explanation about method and calculations.

Parameter	Symbol	Value	Source
Size of the home economy	n	0.5	Assumption
Elasticity of substitution between goods	θ	10	Standard
Elasticity of the labor supply	ζ	1.1	Standard
Nominal price rigidity	ν	0.25	Standard
Nominal wage rigidity	Φ	0.5	Standard
Degree of persistence of the demand shock	ρ_ϵ	0.7	Jondeau and Sahuc (2008)
Degree of persistence of the supply shock	ρ_a	0.95	Standard
Persistence of the monetary union	ρ_i	0.9	Smets and Wouters (2003)
Sensitivity of monetary policy to inflation	α_π	1.5	Gali and al. (2007)
Sensitivity of monetary policy to activity	α_y	0.5	Gali and al. (2007)
Sensitivity of fiscal policy to activity	α_C	0.5	Average value found
Sensitivity of the transfer mechanism	α_T	0.5	Assumption

Figure 2: Model calibration. Most of parameters are "standard" so does not apply to a particular economy. The persistence of the monetary policy is estimated for the Euro area. Only the sensitivity of the transfer mechanism is an assumption.

where $\phi \in [0, 1]$ defines the degree of indexation of the wages on the CPI inflation.

2.3 Economic policies: simple rules and macroeconomic stabilization

The aim of this article is to focus on economic policies. In particular, I set out to study some characteristics of a federal transfer mechanism for purposes of macroeconomic stabilization. I set out to implement: a monetary policy, national fiscal policies and a transfer mechanism. In the recent theoretical literature, have been proposed three ways to implement economic policies. The first one consists in defining optimal policies, as in GM (2008), or in BJ (2005), among others. The second consists in defining policies as simple rules, which is the method used in this article. Policies are simple rules and I want to study their efficiency, setting structural heterogeneities and asymmetric shocks among both countries. The third consists in introducing policies as exogenous shocks, in order to analyze the effects of policy shocks on the economy. Concerning fiscal policy, a wide body of literature has attempted to define the fiscal multipliers in new Keynesian models, like Forni, Monteforte and Sessa (2010) or Hall (2009).

Monetary policy: a version of the Taylor rule

The central bank of the union only has the nominal interest rate as a stabilization tool. The rule is a well-known Taylor rule, to which I add a degree of

smoothing of the interest rate fluctuations as an objective of the central bank ³, such as:

$$\hat{i}_t = \rho_i \hat{i}_{t-1} + (1 - \rho_i)(\alpha_\pi \hat{\pi}_t^W + \alpha_y \hat{y}_t^W) \quad (41)$$

where ρ_i defines the degree of smoothing of the interest rate, α_π the sensitivity of the central bank to inflation and α_y is the parameter which defines the sensitivity of the central bank to output variations. I set $\alpha_\pi = 1.5$ and $\alpha_y = 0.5$. Following the Taylor rule, the central bank reacts to inflation fluctuations more than to output fluctuations, and the parameter α_π is bigger than one.

The national fiscal policies

As seen previously, a national fiscal policy is merely purchases of goods and services by the government. In the model, governments react to output fluctuations, as automatic stabilizers do. I implement the rule as in BJ (2005), such as:

$$\begin{cases} \hat{g}_t^H &= -\alpha_C^H \hat{c}_t^W - \alpha_S^H (1 - n) \hat{s}_t \\ \hat{g}_t^F &= -\alpha_C^F \hat{c}_t^W + \alpha_S^F n \hat{s}_t \end{cases} \quad (42)$$

I set $\alpha_C = \alpha_S = \alpha_C^* = \alpha_S^* = 0.5$. In the recent literature, several papers aim to estimate a fiscal policy rule for OECD countries and especially for EMU countries. Oftentimes, the estimated dependent variable is the cyclical adjusted primary balance (CAPB). It consists on the fiscal balance for which we remove the cyclical component (automatic stabilizers) to obtain the discretionary component of the fiscal balance. In other words, the CAPB allows us to observe government behavior, unbiased by automatic stabilizers, in order to extract the discretionary part. The aim is also to observe whether the discretionary fiscal policies have been counter-cyclical or pro-cyclical. Thus, Gali and Perotti (2003) estimate a fiscal policy rule for EMU countries, 3 non-EMU UE countries and 5 non-UE OECD countries over the period 1980-2002. In the regression, CAPB depends on output-gap fluctuations, expected by the government at the previous period, and the size of the debt (relative to potential GDP), observed at the previous period and the CAPB at the previous period, inserting a degree of inertia in the fiscal policy rule. According to Gali and Perotti (2003), the fiscal policy rules for the EMU countries have been pro-cyclical before the Maastricht treaty and acyclical after the Maastricht treaty. Furthermore, the discretionary fiscal policies seem to take the size of the debt into account. If the debt increases, a government will reduce its deficit, leading a more restrictive policy. Using a SURE model (seemingly unrelated regression equations), Garcia, Arroyo, Minguez and Uxo (GAMU, 2009) estimate a fiscal policy rule for EMU countries over the period 1984-2005. The SURE methodology allows to simultaneously estimate national policy rules, and "to use the information derived from both common and specific factors" (GAMU). Thus, such a model allows to consider both a common behavior (the convergence of the fiscal policy rules would be increased by the implementation of the Euro-area) and the specific characteristics of the behavior of the national governments. Explanatory variables are the same as in Gali and Perotti (2003); likewise, the authors seek to know whether the implementation of the Maastricht Treaty and the Stability

³Smets and Wouters (2003) estimate a DSGE model for the Euro-area by bayesian inference and find a degree of inertia of the interest rate of 0.9

Growth Pact (SGP) caused a shift in the national policy rules. The main outcome is the procyclicality of the estimated policy rules and the implementation of the SGP would have engendered a less procyclical behavior. As in Gali et Perotti (2003), the parameters defining the sensitivity of CAPB to the size of the debt and to the CAPB of the previous period are significant. A degree of inertia exists in government behavior and the estimation clearly argues for a governmental action to ensure debt sustainability. Furthermore, GAMU conclude that there is a significant heterogeneity within the EMU countries concerning the fiscal policy rule.

The works previously quoted argue for a procyclicality of the discretionary fiscal policy. Others make opposite or at least qualified conclusions. OECD (2005) analyzes the procyclicality (or countercyclicality) of the discretionary fiscal policy rule, and finds different outcomes, changing within the period. In a panel data model is estimated the sensitivity of the CAPB to the cyclical component of the balance and to the level of debt; the authors add a dummy variable equals to 1 if the estimated economy is in recession. When the economy is in a period of expansion, the policy rule would be countercyclical, an increase of 1% of the cyclical component corresponding to a decrease of 0.2% of the CAPB. By contrast, when the economy is in recession (which is characterized by a dummy variable in the specification), governments behavior depends on the current size of the debt. Thus, if the debt is high, governments will follow a pro-cyclical policy during the recession in order to reduce the public debt. This finding suggests that debt level is a key factor in government behavior regarding discretionary fiscal policy.

In this paper, fiscal policy is considered to be counter-cyclical. This assumption is relevant and realistic if the rule is interpreted as automatic stabilizers or as a counter-cyclical discretionary fiscal policy. The purchase of goods by governments is a discretionary fiscal tool and not a component of automatic stabilizers. Thus, by making the assumption of a counter-cyclical fiscal policy and by representing the action of governments as purchase of goods and services, I clearly make the assumption of a counter-cyclical discretionary fiscal policy.

Furthermore, I don't model the financing of fiscal policy, thus the latter obligatorily has a positive effect on the activity since Ricardian effects don't existing in the model. However, consumption crowds-out following a rise on public spending in the model but this is due to a rise of the interest rate. Households lead an inter-temporal trade-off between consumption and saving and when the interest rate rises, households save (or invest) more today, decreasing consumption (equation (33)). But the latter is clearly lower than the direct fiscal stimulus : fiscal policy is broadly efficient in the model. Once again, this assumption, however strong, can be criticized. Indeed, recent literature doesn't settle on the efficiency of fiscal policy or on the size of the fiscal multiplier: it seems to depend on the fiscal tool used and on the specification of the model (the existence of non-Ricardian households for example).³ In this work, I make this assumption because my aim isn't to study the efficiency of fiscal policy in DSGE models

³See for example Furceri and Mourougane [2010]. The authors analyze the efficiency of different fiscal tools such as public investment or direct transfers in a DSGE model with a share of non-Ricardian households.

but to investigate which fiscal design a monetary union should use to achieve an efficient output stabilization in the case of asymmetric shocks and structural heterogeneities.

The absence of funding has an other consequence. It doesn't allow to observe fiscal deficit and debt. It's the natural reason why I don't construct a fiscal policy-rule based on the size of the debt, as applied in the estimated fiscal policy-rule in the literature. Consequently, I set a simple rule, only based on the output fluctuations. It would be interesting to quantitatively analyze to which extent a transfer mechanism helps to restrict the deterioration of the national debts but this is beyond the scope of this paper.

I also introduce the transfer mechanism with a simple rule. The mechanism reacts when there is a differential between the fluctuations of the output of both economies, such as:

$$\hat{t}_t = \alpha_t(\hat{y}_t^H - \hat{y}_t^F) \quad (43)$$

with $\alpha_t \in [0, 1]$.

I can rewrite the output of both economies, such as:

$$\begin{cases} \hat{y}_t^H &= (1 - \Gamma)(\hat{c}_t^W + (1 - n)\hat{s}_t^H) + \Gamma(\hat{g}_t^H - \hat{t}_t) \\ \hat{y}_t^F &= (1 - \Gamma)(\hat{c}_t^W - n\hat{s}_t^H) + \Gamma(\hat{g}_t^F + \hat{t}_t) \end{cases} \quad (44)$$

3 Simulations and analysis

4

3.1 Case of an asymmetric supply shock

I simulate the model with the productivity shock introduced herein-above. The shock is asymmetric because it only occurs in the home economy and is negative, causing inflation. I simulate a variation of 1% of the productivity shock. Impulse responses are represented in Figure 5 and Figure 6.

Before studying the efficiency of the economic policies, I want to describe the present mechanisms when a shock occurs. When a negative productivity shock arises, both home inflation and CPI inflation increase. The consequence of this increase is that the central bank raises its nominal interest rate. In the model, consumption is reduced by an increase of the interest rate. Indeed, this negative relationship between interest rate and consumption is caused by the inter-temporal trade-off between consumption and saving led by the households. When the interest rate increases, the households prefer to consume less and therefore save more. The inflationary shock has a negative effect on the output of both economies. There is also another important mechanism: fluctuations of the term of trade. In the beginning, home inflation increases thus the term of trade fluctuates unfavorably for the home economy: the foreign goods are

⁴To solve the model, I have log-linearized the model around the steady state and have simulated the obtained linear model with the help of the Dynare program.

more competitive and the aggregate demand turns to the foreign firms. With the term of trade, there is also a positive effect for the foreign economy. In such models of a currency union with perfectly tradable goods, the term of trade is the transmission channel causing the differential between both countries when asymmetric shocks occur. This last effect also causes an increase of foreign inflation: the the term of trade dynamic progressively stabilizes the differential between the economies.

Introduction of the national fiscal policies

With the slowdown of the activity of both countries, governments increase their public spending. The home government does so to a greater extent, as the slowdown affects the home economy more. I have to describe an another effect of the fiscal policy. When governments increase their public spending, it causes additional inflationary pressures. Therefore, the consumption of the households is reduced, this is again the well-known crowding-out effect of the fiscal policy on private demand. Consumption decreases with the rise on the interest rate. There are no Ricardian effects in this model since I assume fiscal expansions are debt-financed.

Introduction of the transfer mechanism

In this model, the transfer has two main transmission channels on output. The first positive effect is obvious: by shifting public demand from the foreign economy to the home one, the transfer reduces the output differential between both countries. A second transmission channel is more interesting: indeed the differential between home output and foreign output is due to the term of trade. The negative supply shock on the home economy causes inflationary pressure and foreign goods become more competitive, shifting the households' demand towards foreign goods. When the transfer is carried out, additional demand for the home goods leads to supplementary inflationary pressures, lowering the term of trade compared to the situation without transfer. In other words, the real exchange rate (through the progressive stabilization of the term of trade) stabilizes the output differential between both economies and the transfer reduces the stabilizing effect of the dynamic of the term of trade. The total effect on the differential remains largely positive, but I want to point out this effect exists and influences the efficiency of the transfer mechanism.

Another characteristic of such a mechanism is to restrict national public spending. This is one of the best arguments for the implementation of such a mechanism for the Euro area. Currently, in the Euro area, the public debate on fiscal policy turns to the excessive deficits of several countries of the monetary union. Such a mechanism could allow to restrict the deficit of a struggling country. Unfortunately, in the model, I cannot give quantitative results about the ability of a such mechanism to contain the deterioration of national deficits, especially because I don't model the funding of fiscal policy.

3.2 Introduction of a structural asymmetry and a symmetric demand shock

In such a model, a demand shock is inherently symmetric. It is one preference shock affecting the level of consumption of the households. With the assumption that all goods are perfectly tradable, one shift on the behavior of the consumer, living in the home country or in the foreign country, will cause an identical effect for all the economies of the monetary union. Such a shock would be asymmetric if we assumed that there is a share of non-tradable goods in the economy as in Okano (2010) for instance.

In this case, I add a structural heterogeneity on the coefficient ν , affecting price stickiness. In the baseline model I set $\nu = 0.75$. Now I set $\nu = 0.70$ for home firms and $\nu = 0.80$ for foreign firms. See Figure 7 and Figure 8 for results.

Before introducing fiscal policies, let us consider the observed fluctuations in this case. With a symmetric negative demand shock, both consumptions (home and foreign) decrease, having a negative effect on the level of activity for both economies. On the supply side, the structural heterogeneity has an importance : with a lower nominal rigidity, the foreign inflation decreases more sharply than the home inflation. Indeed, home firms reset their price less so the dynamic of the home inflation is less volatile. The term of trade deteriorates, unfavorably for the home activity which decreases more sharply than the foreign one.

Furthermore, the shock is more quickly absorbed by the foreign economy. Indeed, with a lower price rigidity, foreign inflation reaches its steady state faster than home inflation. The foreign inflation even becomes lower than the home inflation from the third period on. However, the term of trade remains lower than one until its return to the steady state since the term of trade is set as prices in level and not as inflation.

Introduction of the transfer mechanism

As I have previously seen with the asymmetric supply shock, in a configuration where a differential exists between output fluctuations of the economies, the mechanism helps to stabilize this differential and the level of activity of the most affected economy. Once again, the mechanism plays a "risk-sharing" role between economies of a monetary union and is efficient in the case of structural asymmetries. In the case of an asymmetric demand shock (produced by the heterogeneity bearing upon the degree of price stickiness), the two mechanisms described with the supply shock remain, especially the destabilizing effect of the transfer through a higher volatility of the term of trade.

This analysis is led with a demand shock. But it could be applied by considering a monetary shock. Indeed, I want to argue for the efficiency of such a mechanism in the case of an asymmetric transmission of the monetary policy between the countries of a monetary union. With the creation of a monetary union between economies, monetary policy becomes common to all the economies of the union. Brissimis and Skotida (2008) show that if the economies have heterogeneous fluctuations, monetary policy cannot be optimal for all the countries

of the union. Empirical studies widely show that this is a reality for the Euro area.⁴ Thus, in the case of a currency union with structural heterogeneities and/or asymmetric cyclical fluctuations, a transfer mechanism could help the monetary policy to be efficient by smoothing the differential between countries when a common monetary shock arises.

4 Focus on two structural heterogeneities: the sensitivity to the transfer and the relative size of both economies

4.1 The link between a heterogeneity concerning the fiscal multiplier and the efficiency of a transfer mechanism

In this section, I want to discuss one result expounded in Von Hagen (1998). The author talks about the efficiency of a transfer mechanism in the case of a heterogeneity bearing upon the fiscal multiplier. The result is that a mechanism can be counterproductive in this case. The model depicts a monetary union composed by two countries. The first one has a lower fiscal multiplier. When a negative demand shock occurs in the first country, a transfer is implemented from the second country to the first one. With the assumption that the fiscal multiplier is lower in the first economy, the implemented transfer becomes counterproductive. Firstly, Von Hagen (1998) argues that the output of the monetary union will be lower with the transfer because the impact of the fiscal stimulus is lower in the first economy (less sensitive to the transfer) than in the second economy, leading to a final negative effect for the union as a whole. Furthermore, Von Hagen (1998) even argues there is a negative destabilizing effect for the first economy, because of the sharp decrease of the output on the second economy. However, the author does not simulate the model and therefore does not provide any quantitative results. In this section, I want to test this hypothesis by introducing a heterogeneity concerning the sensitivity of the two economies to the transfer, such as:

$$\begin{cases} \hat{y}_t^H &= (1 - \Gamma)(\hat{c}_t^W + (1 - n)\hat{s}_t^H) + \Gamma(\hat{g}_t^H - \omega\hat{t}_t) \\ \hat{y}_t^F &= (1 - \Gamma)(\hat{c}_t^W - n\hat{s}_t^H) + \Gamma(\hat{g}_t^F + \hat{t}_t) \end{cases} \quad (45)$$

with ω a parameter defining the sensitivity of the home activity to the transfer stimulus. It could be argued that the heterogeneity bears upon only the sensitivity to the transfer and not to sensitivity to governments spending since both are public consumption (thus the same fiscal tool). However, I introduce it for convenience in order to capture only the effects of such a heterogeneity on the transfer mechanism.

The rest of the model is strictly the same as previously. I simulate the model

⁴See a working paper from the European parliament (1998) and Amisano, Giammarioli and Stracca (2009) among others. For the latter, heterogeneities concerning shocks have decreased with the implementation of the EMU but still exist.

with an asymmetric supply shock, affecting the home economy and I set for the next simulations $\omega = 0.5$. My goal is to compare the fluctuations between the case with and without the mechanism. See Figure 9 for impulse responses. Graphs correspond to the difference between variables' fluctuations without transfers and variables' fluctuations when the transfer is set. Thus, if the curve has negative values, a transfer has a positive effect on output and conversely.

In the case with the transfer mechanism, I observe that the activity of the home economy is more stable, at the expense of the stabilization of the foreign economy. Furthermore, the output of the union is less stable in the presence of a mechanism. More precisely, with usual parameter values, it is unlikely that the home economy be destabilized by the transfer, as argued by Von Hagen (1998). The positive effect of the received transfer is largely higher than a negative effect due to a decrease of the foreign output with the transfer. More exactly, the effect here is that, with the transfer, the foreign output is lower causing lower inflation in the foreign economy. Thus, there is a negative effect on the home economy through the term of trade.

However, I observe with $\omega = 0.5$ that the union's output is lower with the transfer because of the difference on the sensitivity to the transfer. Thus, I can reproduce in this model the insight developed in Von Hagen (1998): a conflict can arise between intra-regional stabilization and stabilization at the level of the union.

Another important fact must be taken into account, which qualifies the possibility of such a counterproductive effect of the transfer mechanism. The recent literature analyzing the size of the fiscal multipliers along the cycle conclude that multipliers are higher in negative output-gap periods.⁵ In other words, the lower the standing of an economy on the cycle, the higher the fiscal multiplier and for now, a consensus exists among studies to my knowledge. Let's assume that two countries have the same fiscal multiplier for a same position over the cycle. When an asymmetric shock occurs, the recipient economy will probably have a higher fiscal multiplier than the other one. This allows to limit the occurrence of counter-productive transfer mechanisms. However, in this model I cannot introduce this intuition.

4.2 The size of the economies and the term of trade

In the model developed in Von Hagen (1998), the total effect on the home economy depends on the sensitivity of each economy to the real exchange rate. In the model, such as it is specified, this sensitivity of the output to the real exchange rate (the term of trade) depends on the relative size of the economies, namely the parameter n in the equation (31). The larger an economy is, the less it is sensitive to a movement of the term of trade. In the model, I set $n = 0.5$, both

⁵See for instance Creel, Heyer and Plane (2011), Michailat (2012) or Baum and Koester (2011).

countries are equal, so a 1% increase of the term of trade reduces by $0.5(1-\Gamma)\%$ the demand for the home goods. I also want to show that the total effect of the mechanism on the output of the entire union depends on the size of the economies. I carry out another simulation with a supply shock affecting the home economy but this time I set $n = 0.7$. The home economy, which receives the transfer, is larger than the foreign one. Furthermore, I maintain the heterogeneity concerning the sensitivity to the transfer, such as $\omega = 0.5$. See Figure 10 for impulse responses.

I see that the effect of the transfer on the output of the union is positive. This result is due to the relative size of both economies. The recipient economy is now larger and is less sensitive to the term of trade. With the inflationary shock on the home economy, the term of trade decreases, leading to a higher output for the foreign economy. The home economy, now larger, is less sensitive to this negative price-competitiveness effect. With the transfer, as we can see in figure 5, the term of trade deteriorates more, causing additional inflation pressures for the home country and having the opposite effect on the foreign economy. If we consider only the term of trade channel, the transfer mechanism increases the output's differential between the economies by increasing the deterioration of the term of trade.⁶ The home economy is now larger thus less sensitive to the deterioration of the term of trade and having the opposite effect on the foreign economy. Through this channel, the relative size of the economies influences the stabilizing effect of the transfer mechanism in such models.

Is there a link between the size of an economy and its fiscal multiplier?

To my knowledge, there is no study about the link between the level of the fiscal multiplier and the size of an economy. However, there may be a positive relationship between the two. A small economy will have a greater degree of openness than a large economy, importing more goods and services. OECD (2009) establishes a negative link between degree of openness and fiscal multiplier, with the help of the "Interlink" model. Ilzetzki, Mendoza and Vegh (2011) make similar conclusions. A determinant of the fiscal multiplier seems to be the degree of openness. The intuition of this result is that with a significant degree of openness, a fiscal stimulus will increase importations rather than increase the demand for home goods, reducing the positive effect on the output. So, a positive relationship between the size of an economy and its fiscal multiplier seems likely. Following the result found in the simulations, a transfer from a small economy to a large economy tends to be more efficient.

It would be interesting to observe the evolution of the GDP of large and small countries of the Euro area since the creation of the monetary union and also conclude about the direction of the transfers if such a mechanism had implemented in the Euro area. The data used comes from Eurostat databases. I split the sample into two parts: the first sample covers the 2000-2007 period, from the creation of the EMU to the beginning of the recent crisis. The second

⁶This effect is however lower than the initial stabilizing effect of the transfer

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Germany (30.34%)	3.5	3.7	0.8	1.4	0.8	3.3	1.7	2.7	2.9
France (21.40%)	3.3	3.7	1.8	0.9	0.9	2.5	1.8	2.5	2.3
Italy (17.82%)	1.5	3.7	1.9	0.5	0	1.7	0.9	2.2	1.7
3 largest countries (69.53%)	2.23	3.5	1.73	0.46	0.16	1.8	1.13	2.8	2.43
Belgium (3.72%)	3.5	3.7	0.8	0.4	0.8	3.3	1.7	2.7	2.9
Spain (9.53%)	4.7	5	3.7	2.7	3.1	3.3	3.6	4.1	3.5
Ireland (1.62%)	9.9	9.3	4.8	5.9	4.2	4.5	5.3	5.3	5.2
Greece (2.10%)	3.4	3.5	4.2	3.4	5.9	4.4	2.3	5.5	3
Luxembourg (0.33%)	8.4	8.4	2.5	4.1	1.5	4.4	5.4	5	6.6
Finland (1.97%)	3.9	5.3	2.3	1.8	2	4.1	2.9	4.4	5.3
Netherlands (6.22%)	4.7	3.9	1.9	0.1	0.3	2.2	2	3.4	3.9
Austria (3.07%)	3.5	3.7	0.9	1.7	0.9	2.6	2.4	3.7	3.7
Portugal (1.90%)	4.1	3.9	2	0.8	-0.9	1.6	0.8	1.4	2.4
Small countries (30.47%)	5.12	5.18	2.56	2.43	1.97	3.37	2.93	3.94	4.05

Figure 3: Real GDP growth rates of EMU-12 countries over the period 1999-2007 (percentage change on previous year). The figures next to the countries are the ratio of the national GDP on the GDP of the Euro area. Source: Eurostat

sample covers the period 2008-2012, in order to analyze national output fluctuations during the current crisis where economies have been particularly hit by recession in 2008-9, we can also use the word crisis to refer to for the following years, characterized by weak growth, high unemployment rates and the rising "debt crisis" within the Euro area. For the 2000-2007 period, the countries under studies are EMU-11, to which I add Greece, a member since 2001. For the second period, 2007-2012, I have also added Slovenia, Slovakia, Malta and Cyprus. I deliberately excluded Estonia, which has been an EMU member only since 2011. In the following tables, I have represented real growth rates and, for each country, a ratio of national GDP to overall GDP of the union as its entire, in order to evaluate the relative size of each country in the EMU. Finally, in order to have representative results, I calculated average growth rates for "large" countries and "small" countries. I include in the "large countries" group France, Germany and Italy. This could be seen as restrictive: for example, I could also include Spain, with a ratio of 9,53%. However, if I add ratios from France, Germany and Italy, I obtain 69,53%, which is large. Thus, in order to balance the two groups of countries, I included medium-sized countries in the "small countries" group. Ratios are calculated with data for 2001 for the first sample and with data for 2010 for the second one.

From 2000 to 2007, the growth rates of the 3 largest EMU countries have been lower than in the small countries. The difference is marked. For each year, means for small countries are broadly higher than means for large countries. This result must be qualified. Weak mean rates for the "largest countries" group are due to Italy. Furthermore, if I include Spain in the large countries, means would be higher. Spain, a relatively large country, has a high growth, at the top of EMU countries. However, I observe that several very small economies

	2008	2009	2010	2011	2012
Germany (27.11%)	1.1	-5.1	3.7	3	0.8
France (21.11%)	-0.1	-2.7	1.5	1.6	0.6
Italy (17.07%)	-1.2	-5.1	1.5	0.5	0.1
3 largest countries (65.29%)	-0.06	-4.3	2.23	1.7	0.5
Belgium (3.83%)	1	-2.8	2.3	2.2	0.9
Spain (11.53%)	0.9	-3.7	-0.1	0.7	0.7
Ireland (1.76%)	-3	-7	-0.4	1.1	1.1
Greece (2.46%)	-0.2	-3.3	-3.5	-5.5	-2.8
Luxembourg (0.42%)	0.8	-5.3	2.7	1.6	1
Finland (1.98%)	1	-8.2	3.6	3.1	1.4
Netherlands (6.39%)	1.8	-3.5	1.7	1.8	0.5
Austria (3.07%)	1.4	-3.8	2.3	2.9	0.9
Portugal (1.90%)	0	-2.9	1.4	-1.9	-3
Malta		-2.6	2.9	2.1	1.3
Cyprus		-1.9	1.1	0.3	0
Slovakia		-4.9	4.2	2.9	1.1
Slovenia	3.6	-8	1.4	1.1	1
Small countries (34.71%)	1.16	-4.45	1.50	0.95	0.31

Figure 4: Real GDP growth rates of EMU-12 countries during the crisis period 2008-2012 (percentage change on previous year). Source: Eurostat

have the highest growth rates: Ireland, Greece and Luxembourg. On the contrary, Portugal, one of the smallest EMI countries (1,90%), has lower growth rates than other small countries. I can conclude that small EMU countries have higher growth rates than larger EMU countries. Thus, transfers would have been carried out from small countries to large countries for the period 2000-2007 if a transfer mechanism had been implemented during this period in the EMU. Following the previous analysis, transfers would have been efficient, going from countries with smaller fiscal multipliers to countries with larger ones.

Over the period 2008-2012, results are less clear. I observe that the evolution of the growth rates is heterogeneous among countries. The size doesn't seem to be a relevant factor to analyze growth fluctuations of EMU countries over the crisis period. The evolution of each economy is determined by its own characteristics. Greece, Portugal and Ireland are the countries most affected by an extended recession. Failures in the Greek fiscal management and the collapse of the Irish banking system are examples of country-specific determinants of national economic cycles. A common feature is a strong downturn in 2009 and a weak growth thereafter. However, I observe a relatively more favorable conjuncture for large countries, overall more stable than for small countries. This outcome is mainly attributable to the good performance of the German economy and to the relative stability of the French economy.

As I have already noted, output fluctuations among countries are very heterogeneous. This was the case during the recession of 2008-2009 and also after 2011, since countries have been affected by the sovereign debt crisis to various extents.

This heterogeneity is an argument for the implementation of an insurance fiscal mechanism. By pooling the risk, it could have limited the deterioration of the debt of struggling EMU countries such as Greek, Ireland, Spain. Transfers would have enabled these countries to reduce their excessive deficits and debts more easily, by allowing to implement less restrictive policies with a lower cost on growth. This is true especially for countries facing financing constraints: transfers are potential additional fiscal margins for struggling economies. In this way, their role is similar to the one played by the recent Euro Stabilization Fund (ESF): the idea is to share risk among EMU countries in order to maintain the stability of the Euro area. However, a transfer mechanism has an automatic feature and involves a united behavior on the part of the members: the ESF consists in loans and not in transfers. The ESF and a mechanism transfer would complement each other: the ESF is a powerful and potentially responsive tool in the case of urgent needs while a risk-sharing mechanism is a permanent tool which prevents growth and deficits fluctuations. Finally, I am aware of the moral hazard issue relative to such interactions⁷. Removing this potential inefficiency involves monitoring the national budgets. This is why the SGP and the recent decision increasing the monitoring role of the European commission would complement the federal tools, by developing the analysis and monitoring of the national budgets and allowing federal institutions to make fiscal policy recommendations.

⁷Barbier-Gauchard (2005), among others, studies the problem of adverse selection in a game with a federal government and two national governments.

Conclusion

In a monetary union prone to asymmetric fluctuations, a risk-sharing mechanism can achieve output stabilization. Through there is one in several monetary unions, no such mechanism exists in the Euro area, nor it is being discussed. Indeed, current debates bear upon national debt issues, and the only suggested answer is the implementation of more restrictive fiscal policies and the strengthening of the SGP. The current design of the fiscal policy within the EMU would not be changed in the coming years. National governments will continue to pursue fiscal policy restrained by increasingly stringent monitoring of national deficits and debts. Decentralized constraining policies without effective coordination are unlikely to efficiently stabilize national outputs.

In this work, I point out an effect of the transfer mechanism never discussed in the literature, what I name the "terms of trade" effect. I show that structural heterogeneities can affect the effectiveness of the transfer mechanism. In the case of different sizes for the economies, the term of trade effect is at the basis of the key role of this heterogeneity.

In future research, I attend to extend this analysis by focusing on different fiscal tools. Indeed, existing transfers are not always based on public consumption. In the United States for instance, more than 500 kinds of transfers exist and are from different natures. An intuition is that the effects of transfers depend on the fiscal tool considered: public consumption, public investment, public employment and taxes.

Acknowledgments

I'm grateful to Hubert Kempf, my discussant during the 17th T2M conference in Lyon, for his precious remarks about this paper, and to Giancarlo Corsetti. I also want to acknowledge all the participants in the 13th Doctoral Meetings in International Trade and International Finance in Paris. Special thanks go to my thesis supervisors, Giuseppe Diana and Amélie Barbier-Gauchard. I finally thank Francesco de Palma, my reviewer for the BETA working paper version, for his proofreading and precious comments. This paper received support from the Excellence Initiative of the University of Strasbourg funded by the French government's Future Investments program.

References

- Andersen T. M.**, 1998, *"The macroeconomic policy mix in a monetary union with flexible inflation targeting"*, working paper n° 2003-02, University of Aarhus
- Amisano G., Giammarioli N. and Stracca L.**, 2009, *"EMU and the adjustment to asymmetric shocks: the case of Italy"*, Working Paper Series 1128, European Central Bank
- Asdrubali P., Sorensen B., Yosha O.**, 1996, *"Channels of Interstate Risk Sharing: United States 1963-1990"*, The Quarterly Journal of Economics, MIT Press, vol. 111(4), pages 1081-1110, November
- Barbier-Gauchard A.**, 2005, *"Fiscal federalism, discipline and selection adverse : Lessons from a theoretical model"*, Economics Bulletin, vol 5, no 1, p.1-8
- Baum A., Koster G.B.**, 2011, *"The impact of fiscal policy on economic activity over the business cycle-evidence from a threshold VAR analysis"*, Discussion Paper Series 1: Economic Studies n° 03/2011
- Bayoumi T., Masson P.**, 1995, *"Fiscal flows in the United States and Canada: Lessons for monetary union in Europe"*, European Economic Review, Elsevier, vol. 39(2), pages 253-274, February
- Beetsma R., Jensen H.**, 2005, *"Monetary and fiscal policy in a micro-founded model of a monetary union"*, Journal of International Economics 67
- Beine M., Docquier F.**, 1997, *"Fédéralisme fiscal dans un modèle de zone monétaire optimale"*, Revue Economique, volume 48, n°3
- Brissimis S. N., Skotida I.**, 2008, *"Optimal monetary policy in a euro area in the presence of heterogeneity"*, Journal of international Monetary and Finance n° 27
- Calvo G.**, 1983, *"Staggered prices in a utility-maximizing framework"*, Journal of Monetary Economics
- Canzoneri M, Cumby R., Diba B.**, 2005, *"How do monetary and fiscal policy interact in the European Monetary Union?"*, NBER working papers 11055
- Coenen G., Straub R.**, 2005, *"Non-ricardian households and fiscal policy in a estimated DSGE model of the euro-area"*, Computing in Economics and Finance
- Creel J., Heyer E. and Plane M.**, 2011, *Petit précis de politique budgétaire par tous les temps*, Revus de l'OFCE, n° 116, January
- Evers M.**, 2006, *"Federal fiscal transfers in monetary unions: A NOEM approach"*, International Tax and Public Finance, Springer, vol. 13(4), pages 463-488, August.

Document de travail du Parlement Européen, 1998, "*Ajustement aux chocs asymétriques*", Direction générale des études

Farhi E., Werning I., 2012, working paper

Forni L., Monteforte L., Sessa L., 2008, "*The General equilibrium effects of fiscal policy: Estimates for the euro area*", *Journal of Public Economics*, n° 93

Furceri D., Mourougane A., 2010, "*The effects of fiscal policy on output, OECD Economics Department*", working paper n° 770

Gali J., Monacelli T., 2008, "*Optimal monetary and fiscal policy in a currency union, Journal of International Economics*", Elsevier, vol. 76(1), pages 116-132

Gali J., Perotti R., 2003, "*Fiscal policy and monetary integration in Europe*", *Economic Policy*, CEPR and CES and MSH, vol. 18(37), pages 533-572, October

Garcia A., Arroyo M.J., Minguez R., Uxo J., 2009, "*Estimation of a fiscal policy rule for EMU countries (1984-2005)*", *Applied Economics*, Volume 47, Issue 7, page 869-884

Goodhart C., Smith S., 1993, "*Stabilisation*", *The Economics of Community Public Finance*, *European Economy Reports and Studies 5*, European Commission, 417-455

Gros D., Jones E., 1994, "*Fiscal Stabilisers in the US Monetary Union*", CEPS Working Document, n° 83

Hall R.E., 2009, "*By How Much Does GDP Rise If the Government Buys More Output?*", *Brookings Papers on Economic Activity*, *Economic Studies Program*, The Brookings Institution, vol. 40(2 (Fall)), pages 183-249.

Ilzetzki E., Mendoza E.G. and Végh C., 2011, "*How Big (Small?) are Fiscal Multipliers?*", IMF working paper WP/11/52

Italianer A., Pisani-Ferry J., 1992, "*Systèmes budgétaires et amortissement des chocs régionaux : implications pour l'Union économique et monétaire*", *Economie prospective internationale*, n° 51

Jondeau E., Sahuc J.G., 2008, "*Optimal monetary policy in a estimated DSGE Model of the euro area with cross-country heterogeneity*", *International Journal of Central Banking*

Kim J., Kim S., 2012, "*How Much to Share: Fiscal Transfers in Europe*", working paper

MacDougall report, 1977, report of the study group on the role of public finance in European integration, Commission of the European communities

Mankiw N., 2000, "*The savers-spenders theory of fiscal policy*", NBER working papers 7571

Melitz, J. and Zumer, F., 2002, "*Regional redistribution and stabilization by the center in Canada, France, the UK and the US: A reassessment and new tests,*", Journal of Public Economics, Elsevier, vol. 86(2), pages 263-286, November

Michaillat P., 2012, "*Fiscal multipliers over the business cycle*", CEP Discussion Paper n° 1115

Mundell R., 1961, "*A Theory of optimum currency areas*", American Economic Review

Obstfeld M., Peri G., 1998, "*Regional Non adjustment and Fiscal Policy: Lessons for EMU*", Center for International and Development Economics Research (CIDER) Working Papers C98-096, University of California at Berkeley

Okano E., 2010, "*Optimal monetary and fiscal policy in a currency union with nontradables*", Macroéconomie et Finance dans les pays émergents, 2010(1), pages 1-23

Ramaswamy R., Slok T., 1997, "*The real effects of monetary policy in the European union: what are the differences?*", IMF Working papers 97/160

Sachs J., Sala-i-Martin X., 1992, "*Fiscal Federalism and Optimum Currency Areas: Evidence for Europe from the United States*", CEPR Discussion Papers 632, C.E.P.R. Discussion Papers

Smets F., Wouters R., 2003, "*an estimated dynamic and stochastic general equilibrium of the euro area*", Journal of the European Economic Association", MIT Press, vol. 1(5)

Van Aarle B, Huart F., Garrentsen H., 2004, "*Monetary and fiscal rules in the EMU*", German Economic Review 5(4)

von Hagen J., 1998, "*Fiscal arrangements in a monetary union: evidence from the US*", in Boissieu C. and Fair D., Fiscal policy, taxation and the financial system in an increasingly integrated Europe, Kluwer Academic Publishers, page 337-359, chapter 19

von Hagen J., 1998, "*Fiscal federalism and intranational risk-sharing*", Center for European Integration Studies working paper, No. B 13-1998

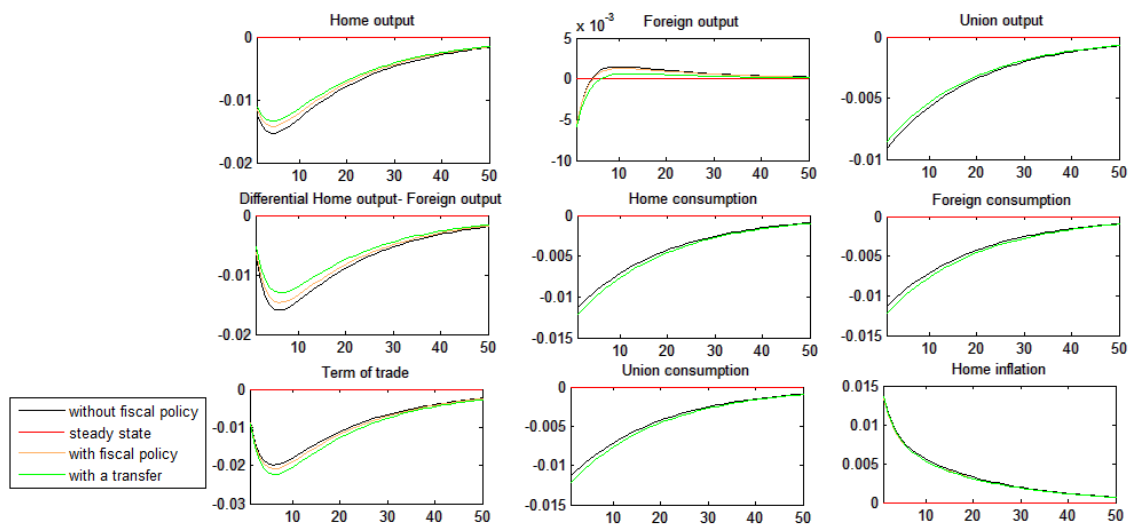


Figure 5: Simulation with an asymmetric supply shock-First part

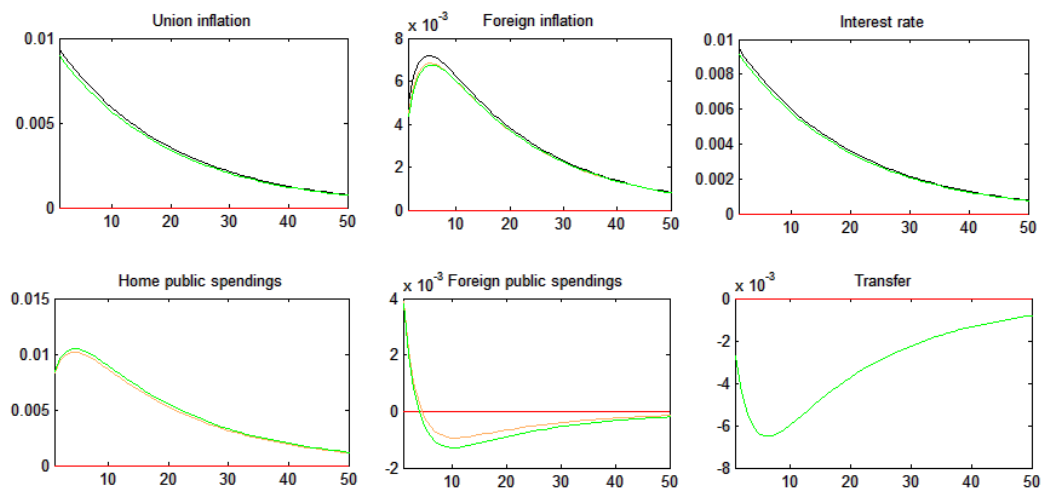


Figure 6: Simulation with an asymmetric supply shock-Second part

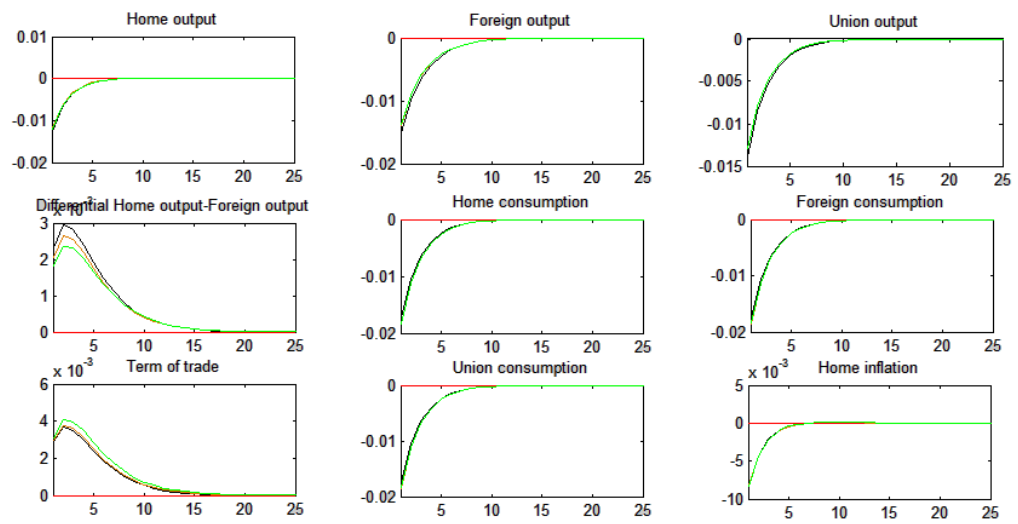


Figure 7: Simulation with a symmetric demand shock-First part

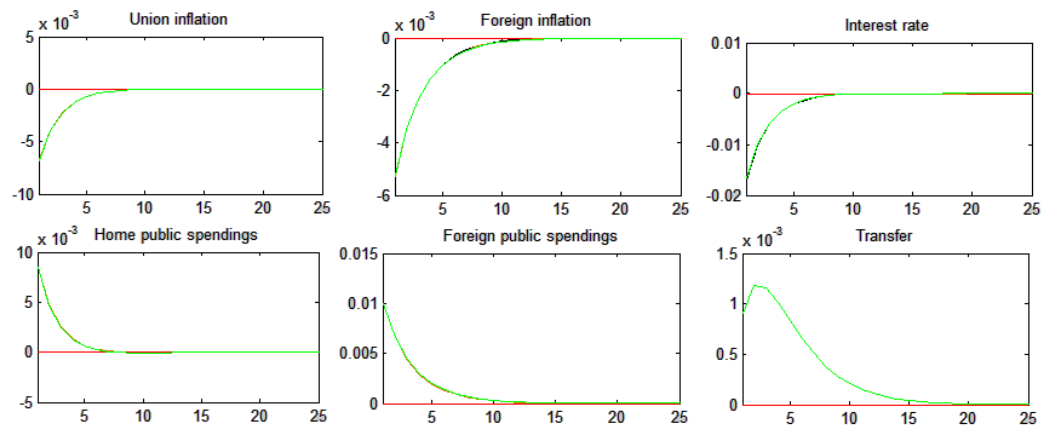


Figure 8: Simulation with a symmetric demand shock-Second part

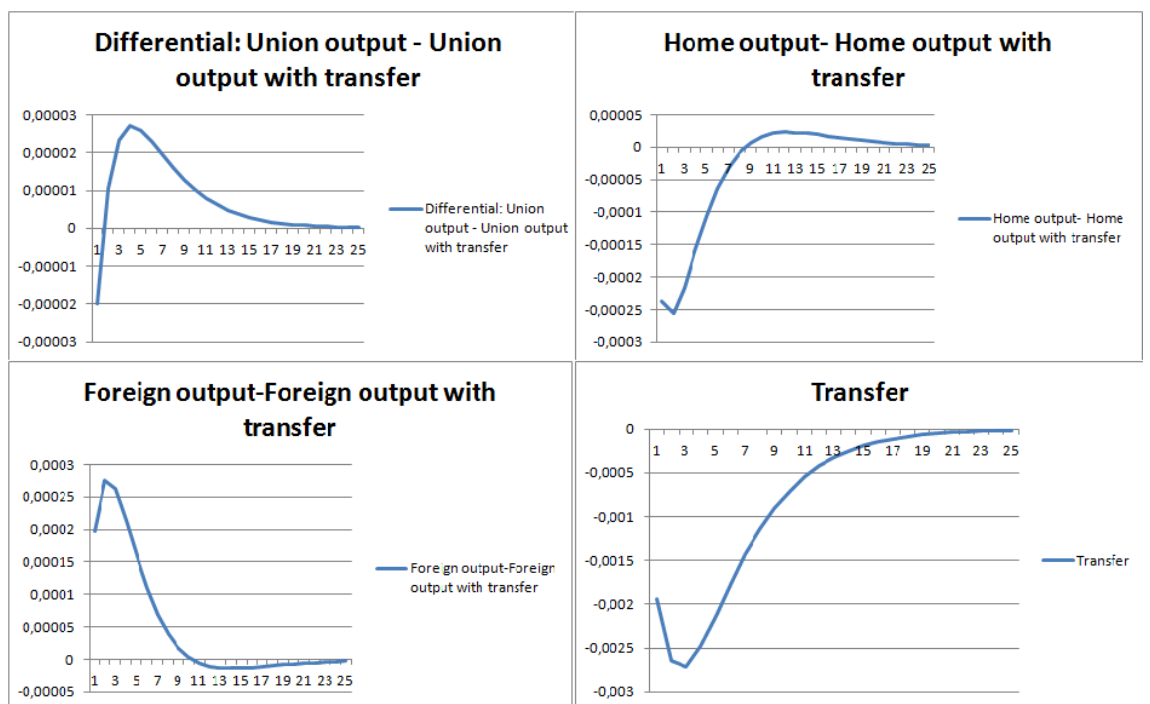


Figure 9: Simulation with an asymmetric supply shock: $\omega = 0.5$, $n = 0.5$

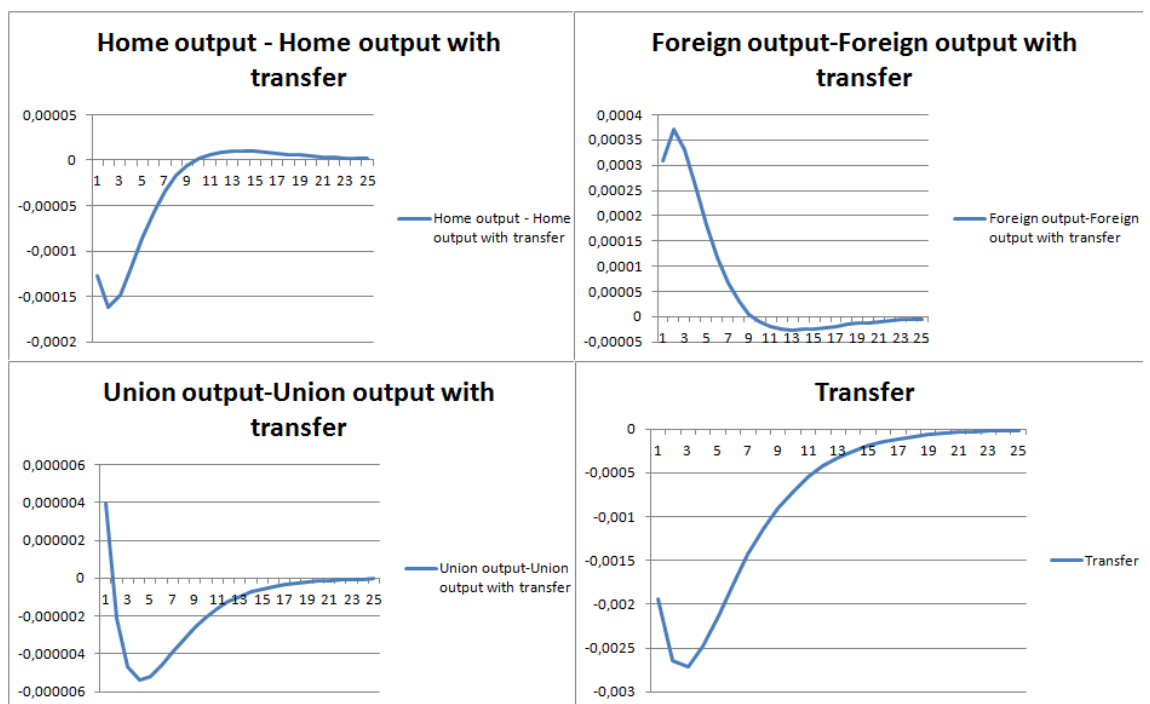


Figure 10: Simulation with asymmetric supply shock: $\omega = 0.5$, $n = 0.7$