Money and risk aversion in a DSGE framework : a bayesian application to the euro zone

Jonathan Benchimol, André Fourçans

HAL Id: hal-00572374

https://hal-essec.archives-ouvertes.fr/hal-00572374

Submitted on 1 Mar 2011

Money and Risk Aversion in a DSGE Framework: A Bayesian Application to the Euro Zone

Jonathan BENCHIMOL
André FOURCANS

APRIL 2010

ESSEC

BUSINESS SCHOOL
PARIS-SINGAPORE

Money and Risk Aversion in a DSGE Framework:
A Bayesian Application to the Euro Zone

Jonathan BENCHIMOL[*] and André FOURÇANS**

April 2010

[*] Department of Economics, ESSEC Business School and CES, University Paris 1 Panthéon-Sorbonne, 106-112 Boulevard de
L'Hôpital, 75647 Paris cedex 13. Email: benchimol@essec.fr
[**] Department of Economics, ESSEC Business School, PB 50150, 95021 Cergy, France. Corresponding author:
fourcans@essec.fr

Money and Risk Aversion in a DSGE Framework:
A Bayesian Application to the Euro Zone

ABSTRACT :

In this paper, we set up and test a model of the Euro zone, with a special emphasis on the role of money. The model follows the New Keynesian DSGE framework, money being introduced in the utility function with a non-separability assumption. By using bayesian estimation techniques, we shed light on the determinants of output and inflation, but also of the interest rate, real money balances, flexible-price output and flexible-price real money balances variances. The role of money is investigated further. We find that its impact on output depends on the degree of agents' risk aversion, increases with this degree, and becomes significant when risk aversion is high enough. The direct impact of the money variable on inflation variability is essentially minor whatever the risk aversion level, the interest rate (monetary policy) being the overwhelming explanatory factor.

Key-Words:

- Bayesian Estimation
- DSGE model
- Euro Area
- Money

RESUME :

Cet article présente un modèle théorique et empirique de la zone euro, en mettant en perspective le rôle de la monnaie. Le modèle s'inscrit dans le cadre « Nouveaux Keynésiens-DSGE », la monnaie étant introduite dans la fonction d'utilité des ménages sous une forme non-séparable. En testant le modèle selon la méthode bayésienne nous expliquons la variance de la production et de l'inflation, mais aussi du taux d'intérêt, des balances réelles, de la production et des balances réelles en prix flexibles. Le rôle de la monnaie est analysé plus particulièrement. Nous montrons que son impact sur la production dépend du degré d'aversion au risque des agents, qu'il augmente avec ce degré, et qu'il devient significatif quand l'aversion au risque inter-temporel est suffisamment élevée. L'impact direct de la monnaie est en revanche très limité pour expliquer la variance de l'inflation, la politique monétaire, via le taux d'intérêt, constituant le facteur dominant.

Mots-clés :

- Estimation bayésienne
- Modèle DSGE
- Monnaie
- Zone euro

JEL classification : E31, E51, E58.

Money and risk aversion in a DSGE framework: a bayesian application to the Euro zone

Jonathan Benchimol[*] and André Fourçans[†]

April 16, 2010

Abstract

In this paper, we set up and test a model of the Euro zone, with a special emphasis on the role of money. The model follows the New Keynesian DSGE framework, money being introduced in the utility function with a non-separability assumption. By using bayesian estimation techniques, we shed light on the determinants of output and inflation, but also of the interest rate, real money balances, flexible-price output and flexible-price real money balances variances. The role of money is investigated further. We find that its impact on output depends on the degree of agents' risk aversion, increases with this degree, and becomes significant when risk aversion is high enough. The direct impact of the money variable on inflation variability is essentially minor whatever the risk aversion level, the interest rate (monetary policy) being the overwhelming explanatory factor.

Keywords: Euro Area, Bayesian Estimation, Money, DSGE.
JEL Classification: E31, E51, E58.

1 Introduction

Standard New Keynesian literature analyses monetary policy practically without reference to monetary aggregates. In this now traditional framework, monetary aggregates do not explicitly appear as an explanatory factor neither in the output gap and inflation dynamics nor in interest rate determination. Inflation is explained by the expected inflation rate and the output gap. In turn, the output gap depends mainly on its expectations and the real rate of interest (Clarida, Galí and Gertler, 1999; Woodford, 2003; Galí and Gertler, 2007; Galí, 2008). Finally, the interest rate is established via a traditional Taylor rule in function of the inflation gap and the output gap.

---

[*]Department of Economics, ESSEC Business School and CES, University Paris 1 Panthéon-Sorbonne, 106-112 Boulevard de l'Hôpital, 75647 Paris cedex 13. Email: benchimol@essec.fr

[†]Department of Economics, ESSEC Business School, Avenue Bernard Hirsch, 95021 Cergy Pontoise Cedex 2, France. Corresponding author: fourcans@essec.fr

In this framework, monetary policy impacts aggregate demand and thus inflation and output, through change in the real interest rate. An increase in the interest rate reduces output, which increases the output gap, thus decreases inflation until a new equilibrium is reached. The money stock and money demand do not explicitly appear. The central bank sets the nominal interest rate so as to satisfy the demand for money (Woodford, 2003; Ireland, 2004).

This view of the transmission mechanism neglects the behavior of real money balances. First, there may exist a real balance effect on aggregate demand resulting from a change in prices. Second, as individuals re-allocate their portfolio of assets, the behavior of real money balances induces relative price adjustments on financial and real assets. In the process, aggregate demand changes, and thus output. By affecting aggregate demand, real money balances become part of the transmission mechanism. Hence, interest rate alone is not sufficient to explain the impact of monetary policy and the role played by financial markets (Meltzer, 1995, 1999, Brunner and Meltzer, 1968).

This monetarist transmission process may also imply a specific role to real money balances when dealing with risk aversion. When risk aversion increases, individuals may desire to hold more money balances to face the implied uncertainty and to optimize their consumption through time. Friedman alluded to this process as far back as 1956 (Friedman, 1956). If this hypothesis holds, risk aversion may influence the impact of real money balances on relative prices, financial assets and real assets, hence on aggregate demand and output.

Other considerations as to the role of money are worth mentioning. In a New Keynesian framework, the expected inflation rate or the output gap may "hide" the role of monetary aggregates, for example on inflation determination. Nelson (2008) shows that standard New Keynesian models are built on the strange assumption that central banks can control the long-term interest rate, while this variable is actually determined by a Fisher equation in which expected inflation depends on monetary developments. Reynard (2007) found that in the U.S. and the Euro area, monetary developments provide qualitative and quantitative information as to inflation. Assenlacher-Wesche and Gerlach (2006) confirm that money growth contains information about inflation pressures and may play an informational role as to the state of different non observed (or difficult to observe) variables influencing inflation or output.

How is money generally introduced in New Keynesian DSGE models ? The standard way is to resort to money-in-the-utility (MIU) function, whereby real money balances are supposed to affect the marginal utility of consumption. Kremer, Lombardo, and Werner (2003) seem to support this non-separability assumption for Germany, and imply that real money balances contribute to the determination of output and inflation dynamics. A recent contribution introduces the role of money with adjustment costs for holding real balances, and shows that real money balances contribute to explain expected future variations of the natural interest rate in the U.S. and the Euro area (Andrés, López-Salido and Nelson, 2009). Nelson (2002) finds that money is a significant determinant of aggregate demand, both in the U.S. and in the U.K. However, the empirical work undertaken by Ireland (2004), Andrés, López-Salido, and Vallés (2006),

and Jones and Stracca (2008) suggests that there is little evidence as to the role of money in the cases of the United States, the Euro zone, and the UK.

Our paper differs in its empirical conclusion, giving a stronger role to money, at least in the Euro zone. It differs also somewhat in its theoretical set up. As in the standard way, we resort to money-in-the-utility function (MIU) with a non-separability assumption. Yet, in our framework, we specify *all* the micro-parameters. This specification permits to extract characteristics and implications of this type of model that cannot be extracted if only aggregated parameters are used. We will see, for example, that the coefficient of relative risk aversion plays a significant role in explaining the role of money.

Our model differs also in its inflation and output dynamics. Standard New Keynesian DSGE models give an important role to endogenous inertia on both output (consumption habits) and inflation (price indexation). In fact, both dynamics may have a stronger forward-looking component than an inertial component. And this appears to be the case at least in the Euro area, if not clearly in the U.S. (Galí, Gertler, and López-Salido, 2001). These inertial components may hide part of the role of money. Hence, our choice to remain as simple as possible on that respect in order to try to unveil a possible role for money balances.

We differ also from the empirical analyses of the Euro zone by using bayesian techniques in a New Keynesian DSGE framework like in Smets and Wouters (2007), while introducing money in the model. We also estimate all micro-parameters of the model, whereas current literature attempts to introduce money only by aggregating of some of these parameters, therefore leaving aside relevant information.

A simulation of the model is conducted in order to analyse the consequences of structural shocks. In the process we unveil transmission mechanisms generally neglected in traditional New Keynesian analyses. This framework highlights in particular the non-negligible role of money in explaining output variations, given a high enough risk aversion. It also highlights the overwhelming role of monetary policy in inflation variability.

The dynamic analysis of the model furthermore sheds light on the change in the role of money in explaining short run fluctuations in output as risk aversion changes. It shows that the higher the risk aversion, the higher the role of money in the transmission process.

Section 2 of the paper describes the theoretical set up. In Section 3, the model is calibrated and estimated with bayesian techniques and by using Euro area data. Impulse response functions and variance decompositions are analyzed in Section 4, with an emphasis on the impact of the coefficient of relative risk aversion. Section 5 concludes.

2   The model

The model consists of households that supply labor, purchase goods for consumption, hold money and bonds, and firms that hire labor and produce and

sell differentiated products in monopolistically competitive goods markets. Each firm sets the price of the good it produces, but not all firms reset their price during each period. Households and firms behave optimally: households maximize the expected present value of utility, and firms maximize profits. There is also a central bank that controls the nominal rate of interest. This model is inspired by Galí (2008), Walsh (2003) and Smets and Wouters (2003).

2.1 Households

We assume a representative infinitely-lived household, seeking to maximize

$$E_t \left[\sum_{k=0}^{\infty} \beta^k U_{t+k} \right] \tag{1}$$

where U_t is the period utility function and $\beta < 1$ is the discount factor.

We assume the existence of a continuum of goods represented by the interval $[0, 1]$. The household decides how to allocate its consumption expenditures among the different goods. This requires that the consumption index C_t be maximized for any given level of expenditures[1]. Furthermore, and conditional on such optimal behavior, the period budget constraint takes the form

$$P_t C_t + M_t + Q_t B_t \leq B_{t-1} + W_t N_t + M_{t-1} \tag{2}$$

for $t = 0, 1, 2...$, where W_t is the nominal wage, P_t is an aggregate price index, N_t is hours of work (or the measure of household members employed), B_t is the quantity of one-period nominally riskless discount bonds purchased in period t and maturing in period $t + 1$ (each bond pays one unit of money at maturity and its price is Q_t where $i_t = -\log Q_t$ is the short term nominal rate) and M_t is the quantity of money holdings at time t. The above sequence of period budget constraints is supplemented with a solvency condition[2].

In the literature, utility functions are usually time-separable. To introduce an explicit role for money balances, we drop the assumption that household preferences are time-separable across consumption and real money balances. Preferences are measured with a CES utility function including real money balances. Under the assumption of a period utility given by

$$U_t = e^{\varepsilon_t^P} \left(\frac{1}{1-\sigma} \left((1-b) C_t^{1-\nu} + b e^{\varepsilon_t^M} \left(\frac{M_t}{P_t} \right)^{1-\nu} \right)^{\frac{1-\sigma}{1-\nu}} - \frac{\chi e^{\varepsilon_t^N} N_t^{1+\eta}}{1+\eta} \right) \tag{3}$$

consumption, labor, money and bond holdings are chosen to maximize (1) subject to (2) and the solvency condition. This CES utility function depends positively on the consumption of goods, C_t, positively on real money balances, M_t/P_t, and negatively on labour N_t. σ is the coefficient of relative risk aversion

---

[1] See Appendix 6.1

[2] Such as $\forall t \lim_{n \to \infty} E_t [B_n] \geq 0$. It prevents engaging in Ponzi-type schemes.

of households (or the inverse of the intertemporal elasticity of substitution), ν is the inverse of the elasticity of money holdings with respect to the interest rate, and η is the inverse of the elasticity of work effort with respect to the real wage. The utility function also contains three structural shocks: ε_t^p is a general shock to preferences that affects the intertemporal substitution of households (preference shock), ε_t^m is a money demand shock and ε_t^n is a shock to the number of hours worked. All structural shocks are assumed to follow a first-order autoregressive process with an *i.i.d.*-normal error term. b and χ are positive scale parameters.

This setting leads to the following conditions[3], which, in addition to the budget constraint, must hold in equilibrium. The resulting log-linear version of the first order condition corresponding to the demand for contingent bonds implies that

$$
\begin{aligned}
\hat{c}_t \;=\; & E_t\left[\hat{c}_{t+1}\right] - \frac{1}{\nu - a_1\left(\nu - \sigma\right)}\left(\hat{\imath}_t - E_t\left[\hat{\pi}_{t+1}\right]\right) \\
& - \frac{\left(1 - a_1\right)\left(\nu - \sigma\right)}{\nu - a_1\left(\nu - \sigma\right)}\left(E_t\left[\Delta\hat{m}_{t+1} - E_t\left[\hat{\pi}_{t+1}\right]\right]\right) + \xi_{t,c}
\end{aligned}
\tag{4}
$$

where $\xi_{t,c} = -\frac{1}{\nu - a_1(\nu - \sigma)}E_t\left[\Delta\varepsilon_{t+1}^P\right] - \frac{(1-a_1)(\nu-\sigma)}{\nu-a_1(\nu-\sigma)}\frac{1}{1-\nu}E_t\left[\Delta\varepsilon_{t+1}^M\right]$ and by using the steady state of the first order conditions $a_1^{-1} = 1 + \left(\frac{b}{1-b}\right)^{\frac{1}{\nu}}\left(1-\beta\right)^{\frac{\nu-1}{\nu}}$. The lowercase ($\hat{\ }$) denotes the log-linearized (around the steady state) form of the original aggregated variables.

The demand for cash that follows from the household's optimization problem is given by

$$
-\nu\left(\hat{m}_t - \hat{p}_t\right) + \nu\hat{c}_t + \varepsilon_t^M = a_2\hat{\imath}_t
\tag{5}
$$

with $a_2 = \frac{1}{\exp(\frac{1}{\beta})-1}$ and where real cash holdings depend positively on consumption with an elasticity equal to unity and negatively on the nominal interest rate. In what follows we will take the nominal interest rate as the central bank's policy instrument. In the literature, due to the assumption that consumption and real money balances are additively separable in the utility function, cash holdings do not enter any of the other structural equations: accordingly, the above equation becomes recursive to the rest of the system of equations.

The first order condition corresponding to the optimal consumption-leisure arbitrage implies that

$$
\eta\hat{n}_t + \left(\nu - a_1\left(\nu - \sigma\right)\right)\hat{c}_t - \left(\nu - \sigma\right)\left(1 - a_1\right)\left(\hat{m}_t - \hat{p}_t\right) + \xi_{t,n} = \hat{w}_t - \hat{p}_t
\tag{6}
$$

where $\xi_{t,n} = -\frac{(\nu-\sigma)(1-a_1)}{1-\nu}\varepsilon_t^M + \varepsilon_t^N$.

Finally, these equations represent the Euler condition for the optimal intratemporal allocation of consumption (equation (4)), the intertemporal optimality condition setting the marginal rate of substitution between money and

---

[3]See Appendix 6.3

consumption equal to the opportunity cost of holding money (equation (5)), and the intratemporal optimality condition setting the marginal rate of substitution between leisure and consumption equal to the real wage[4] (equation (6)).

2.2 Firms

We assume a continuum of firms indexed by $i \in [0, 1]$. Each firm produces a differentiated good but uses an identical technology with the following production function[5],

$$Y_t(i) = A_t N_t(i)^{1-\alpha} \tag{7}$$

where A_t is the level of technology, assumed to be common to all firms and to evolve exogenously over time, and α is the measure of decreasing returns.

All firms face an identical isoelastic demand schedule, and take the aggregate price level P_t and aggregate consumption index C_t as given. As in the standard Calvo (1983) model, our generalization features monopolistic competition and staggered price setting. At any time t, only a fraction $1 - \theta$ of firms, with $0 < \theta < 1$, can reset their prices optimally, while the remaining firms index their prices to lagged inflation[6].

2.3 Price dynamics

Let's assume a set of firms not reoptimizing their posted price in period t. Using the definition of the aggregate price level[7] and the fact that all firms resetting prices choose an identical price P_t^*, leads to $P_t = \left[\theta P_{t-1}^{1-\varepsilon} + (1-\theta) \left(P_t^* \right)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$. Dividing both sides by P_{t-1} and log-linearizing around $P_t^* = P_{t-1}$ yields

$$\pi_t = (1 - \theta)(p_t^* - p_{t-1}) \tag{8}$$

In this setup, we don't assume inertial dynamics of prices. Inflation results from the fact that firms reoptimizing in any given period their price plans, choose a price that differs from the economy's average price in the previous period.

2.4 Price setting

A firm reoptimizing in period t chooses the price P_t^* that maximizes the current market value of the profits generated while that price remains effective. This problem is solved and leads to a first-order Taylor expansion around the zero inflation steady state:

$$p_t^* - p_{t-1} = (1 - \beta\theta) \sum_{k=0}^{\infty} (\beta\theta)^k E_t \left[\widehat{mc}_{t+k|t} + (p_{t+k} - p_{t-1}) \right] \tag{9}$$

---

[4] See Appendix 6.2

[5] For simplicity reasons, we assume a production function without capital.

[6] Thus, each period, $1 - \theta$ producers reset their prices, while a fraction θ keep their prices unchanged.

[7] As shown in Appendix 6.1

where $\widehat{mc}_{t+k|t} = mc_{t+k|t} - mc$ denotes the log deviation of marginal cost from its steady state value $mc = -\mu$, and $\mu = \log(\varepsilon/(\varepsilon - 1))$ is the log of the desired gross markup.

2.5 Equilibrium

Market clearing in the goods market requires $Y_t(i) = C_t(i)$ for all $i \in [0, 1]$ and all t. Aggregate output is defined as $Y_t = \left(\int_0^1 Y_t(i)^{1-\frac{1}{\varepsilon}} di\right)^{\frac{\varepsilon}{\varepsilon-1}}$; it follows that $Y_t = C_t$ must hold for all t. One can combine the above goods market clearing condition with the consumer's Euler equation (4) to yield the equilibrium condition

$$\hat{y}_t = E_t[\hat{y}_{t+1}] - \frac{1}{\nu - a_1(\nu - \sigma)}(\hat{\imath}_t - E_t[\hat{\pi}_{t+1}]) \tag{10}$$
$$+ \frac{(\sigma - \nu)(1 - a_1)}{\nu - a_1(\nu - \sigma)}(E_t[\Delta \hat{m}_{t+1}] - E_t[\hat{\pi}_{t+1}]) + \xi_{t,c}$$

Market clearing in the labor market requires $N_t = \int_0^1 N_t(i)\, di$. By using the production function (7) and taking logs, one can write the following approximate relation between aggregate output, employment and technology as

$$y_t = a_t + (1 - \alpha) n_t \tag{11}$$

An expression is derived for an individual firm's marginal cost in terms of the economy's average real marginal cost:

$$mc_t = (\hat{w}_t - \hat{p}_t) - \widehat{mpn}_t \tag{12}$$
$$= (\hat{w}_t - \hat{p}_t) - \frac{1}{1 - \alpha}(\hat{a}_t - \alpha \hat{y}_t) \tag{13}$$

for all t, where $\widehat{mpn}_t$ defines the economy's average marginal product of labor. As $mc_{t+k|t} = (\hat{w}_{t+k} - \hat{p}_{t+k}) - mpn_{t+k|t}$ we have

$$mc_{t+k|t} = mc_{t+k} - \frac{\alpha\varepsilon}{1 - \alpha}(p_t^* - p_{t+k}) \tag{14}$$

where the second equality[8] follows from the demand schedule combined with the market clearing condition $c_t = y_t$. Substituting (14) into (9) yields

$$p_t^* - p_{t-1} = (1 - \beta\theta)\Theta \sum_{k=0}^{\infty}(\beta\theta)^k E_t[\widehat{mc}_{t+k}] + \sum_{k=0}^{\infty}(\beta\theta)^k E_t[\pi_{t+k}] \tag{15}$$

where $\Theta = \frac{1-\alpha}{1-\alpha+\alpha\varepsilon} \leq 1$.

---

[8] Note that under the assumption of constant returns to scale ($\alpha = 0$), $mc_{t+k|t} = mc_{t+k}$, i.e., the marginal cost is independent of the level of production and, hence, is common across firms.

Finally, (8) and (15) yield the inflation equation

$$\pi_t = \beta E_t [\pi_{t+1}] + \lambda_{mc} \widehat{mc}_t \tag{16}$$

where β, $\lambda_{mc} = \Theta \frac{(1-\theta)(1-\beta\theta)}{\theta}$. λ_{mc} is strictly decreasing in the index of price stickiness θ, in the measure of decreasing returns α, and in the demand elasticity ε.

Next, a relation is derived between the economy's real marginal cost and a measure of aggregate economic activity. From (6) and (11), the average real marginal cost can be expressed as

$$mc_t = \left(\nu - (\nu - \sigma) a_1 + \frac{\eta + \alpha}{1 - \alpha} \right) \hat{y}_t - \hat{a}_t \left(\frac{1 + \eta}{1 - \alpha} \right) \tag{17}$$
$$+ (\sigma - \nu)(1 - a_1)(\hat{m}_t - \hat{p}_t) + \xi_{t,n}$$

Under flexible prices the real marginal cost is constant and equal to $mc = -\mu$. Defining the natural level of output, denoted by y_t^f, as the equilibrium level of output under flexible prices leads to

$$mc = \left(\nu - (\nu - \sigma) a_1 + \frac{\eta + \alpha}{1 - \alpha} \right) \hat{y}_t^f - \hat{a}_t \left(\frac{1 + \eta}{1 - \alpha} \right) \tag{18}$$
$$+ (\sigma - \nu)(1 - a_1) \widehat{mp}_t^f + \xi_{t,n}$$

where $\widehat{mp}_t^f = \hat{m}_t^f - \hat{p}_t^f$, thus implying

$$\hat{y}_t^f = v_a^y \hat{a}_t + v_m^y \widehat{mp}_t^f + v_c^y + v_{sm}^y \varepsilon_t^M + v_{sn}^y \varepsilon_t^N \tag{19}$$

where

$$v_a^y = \frac{1 + \eta}{(\nu - (\nu - \sigma) a_1)(1 - \alpha) + \eta + \alpha}$$

$$v_m^y = \frac{(1 - \alpha)(\nu - \sigma)(1 - a_1)}{(\nu - (\nu - \sigma) a_1)(1 - \alpha) + \eta + \alpha}$$

$$v_c^y = -\frac{\mu(1 - \alpha)}{(\nu - (\nu - \sigma) a_1)(1 - \alpha) + \eta + \alpha}$$

$$v_{sm}^y = \frac{(\nu - \sigma)(1 - a_1)(1 - \alpha)}{(\nu - (\nu - \sigma) a_1)(1 - \alpha) + \eta + \alpha} \frac{1}{1 - \nu}$$

$$v_{sn}^y = -\frac{1 - \alpha}{(\nu - (\nu - \sigma) a_1)(1 - \alpha) + \eta + \alpha}$$

We deduce from (10) that $\hat{\imath}_t^f = (\nu - (\nu - \sigma) a_1) E_t \left[\Delta \hat{y}_{t+1}^f \right]$ and by using (5) we obtain the following equation of real money balances under flexible prices

8

$$\widehat{mp}_t^f = \upsilon_{y+1}^m E_t \left[\hat{y}_{t+1}^f\right] + \upsilon_y^m \hat{y}_t^f + \frac{1}{\nu}\varepsilon_t^M \tag{20}$$

where $\upsilon_{y+1}^m = -\frac{a_2(\nu-(\nu-\sigma)a_1)}{\nu}$ and $\upsilon_y^m = 1 + \frac{a_2(\nu-(\nu-\sigma)a_1)}{\nu}$

Subtracting (18) from (17) yields

$$\widehat{mc}_t = \psi_x \left(\hat{y}_t - \hat{y}_t^f\right) + \psi_m \left(\widehat{mp}_t - \widehat{mp}_t^f\right) \tag{21}$$

where $\widehat{mp}_t = \hat{m}_t - \hat{p}_t$ is the log linearized real money balances around its steady state, $\widehat{mp}_t^f$ is its flexible-price counterpart, $\psi_x = \nu - (\nu - \sigma) a_1 + \frac{\eta+\alpha}{1-\alpha}$ and $\psi_m = (\sigma - \nu)(1 - a_1)$.

By combining (21) with (16) we obtain

$$\hat{\pi}_t = \beta E_t \left[\hat{\pi}_{t+1}\right] + \kappa_x \left(\hat{y}_t - \hat{y}_t^f\right) + \kappa_m \left(\widehat{mp}_t - \widehat{mp}_t^f\right) \tag{22}$$

where $\hat{y}_t - \hat{y}_t^f$ is the *output gap*, $\widehat{mp}_t - \widehat{mp}_t^f$ is the *real money balances gap*,

$$\kappa_x = \frac{1-\alpha}{1-\alpha+\alpha\varepsilon}\left(\frac{1-\theta}{\theta}\right)(1-\beta\theta)\left(\nu - (\nu-\sigma)a_1 + \frac{\eta+\alpha}{1-\alpha}\right)$$

and

$$\kappa_m = \frac{1-\alpha}{1-\alpha+\alpha\varepsilon}\left(\frac{1-\theta}{\theta}\right)(1-\beta\theta)(\sigma-\nu)(1-a_1)$$

Then (22) is our first equation relating inflation to its one period ahead forecast, the output gap and real money balances.

The second key equation describing the equilibrium of the model is obtained by rewriting (10) so as to determine output

$$\hat{y}_t = E_t \left[\hat{y}_{t+1}\right] - \kappa_r \left(\hat{\imath}_t - E_t \left[\hat{\pi}_{t+1}\right]\right) + \kappa_{mp} E_t \left[\Delta\widehat{mp}_{t+1}\right] + z_t^x \tag{23}$$

where $\kappa_r = \frac{1}{\nu-(\nu-\sigma)a_1}$, $\kappa_{mp} = \frac{(\sigma-\nu)(1-a_1)}{\nu-a_1(\nu-\sigma)}$ and $z_t^x = \xi_{t,c} = \kappa_{sp} E_t \left[\Delta\varepsilon_{t+1}^P\right]$ $+ \kappa_{sm} E_t \left[\Delta\varepsilon_{t+1}^M\right]$ where $\kappa_{sp} = -\frac{1}{\nu-a_1(\nu-\sigma)}$ and $\kappa_{sm} = -\frac{(1-a_1)(\nu-\sigma)}{\nu-a_1(\nu-\sigma)}\frac{1}{1-\nu}$. (23) is thus a dynamic IS equation including the real money balances.

The third key equation describes the behavior of the money stock. From (5) we obtain

$$\widehat{mp}_t = \hat{y}_t - \kappa_i \hat{\imath}_t + z_t^m \tag{24}$$

where $\kappa_i = a_2/\nu$ and $z_t^m = \frac{1}{\nu}\varepsilon_t^M$.

The last equation determines the interest rate through a standard smoothed Taylor-type rule:

$$\hat{\imath}_t = (1-\lambda_i)\left(\lambda_\pi \left(\hat{\pi}_t - \pi^*\right) + \lambda_x \left(\hat{y}_t - \hat{y}_t^f\right)\right) + \lambda_i \hat{\imath}_{t-1} + z_t^i \tag{25}$$

where λ_π and λ_x are policy coefficients reflecting the weight on inflation and on the output gap; the parameter $0 < \lambda_i < 1$ captures the degree of interest rate smoothing. z_t^i is an exogenous *ad hoc* shock accounting for fluctuations of the nominal interest rate such that $z_t^i = \rho_i z_{t-1}^i + \varepsilon_{i,t}$ with $\varepsilon_{i,t} \sim N(0;\sigma_i)$. To simplify, we assume that the target inflation rate is equal to zero, i.e. $\pi^* = 0$.

9

3 Estimation

As Schorfheide (1999) or Smets and Wouters (2003), we apply Bayesian techniques to estimate our DSGE model. Contrary to Ireland (2004) or Andrès et *al.* (2006), we did not choose to estimate our model by using the maximum of likelihood because such computation hardly converges toward a global maximum.

3.1 DSGE model

Our model consists of six equations and six dependent variables: inflation, nominal interest rate, output, flexible-price output, real money balances and its flexible-price counterpart. Flexible-price output and flexible-price real money balances are completely determined by shocks: flexible-price output is mainly driven by technology shocks (whereas fluctuations in the output gap can be attributed to supply and demand shocks) whereas the flexible-price real money balances is mainly driven by money shocks and flexible-price output.

$$\hat{y}_t^f = v_a^y \hat{a}_t + v_m^y \widehat{mp}_t^f - v_c^y + v_{sm}^y \varepsilon_t^M + v_{sn}^y \varepsilon_t^N \tag{26}$$

$$\widehat{mp}_t^f = v_{y+1}^m E_t \left[\hat{y}_{t+1}^f \right] + v_y^m \hat{y}_t^f + \frac{1}{\nu} \varepsilon_t^M \tag{27}$$

$$\hat{\pi}_t = \beta E_t [\hat{\pi}_{t+1}] + \kappa_x \left(\hat{y}_t - \hat{y}_t^f \right) + \kappa_m \left(\widehat{mp}_t - \widehat{mp}_t^f \right) \tag{28}$$

$$\hat{y}_t = E_t [\hat{y}_{t+1}] - \kappa_r \left(\hat{\imath}_t - E_t [\hat{\pi}_{t+1}] \right) + \kappa_{mp} E_t \left[\Delta \widehat{mp}_{t+1} \right] \tag{29}$$
$$+ \kappa_{sp} E_t \left[\Delta \varepsilon_{t+1}^P \right] + \kappa_{sm} E_t \left[\Delta \varepsilon_{t+1}^M \right] \tag{30}$$

$$\widehat{mp}_t = \hat{y}_t - \kappa_i \hat{\imath}_t + \frac{1}{\nu} \varepsilon_t^M \tag{31}$$

$$\hat{\imath}_t = (1 - \lambda_i) \left(\lambda_\pi \left(\hat{\pi}_t - \pi^* \right) + \lambda_x \left(\hat{y}_t - \hat{y}_t^f \right) \right) + \lambda_i \hat{\imath}_{t-1} + \rho_i z_{t-1}^i + \varepsilon_{i,t} \tag{32}$$

where

$$v_a^y = \frac{1+\eta}{(\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha}$$
$$v_m^y = \frac{(1-\alpha)(\nu-\sigma)(1-a_1)}{(\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha}$$
$$v_c^y = \frac{\log\left(\frac{\varepsilon}{\varepsilon-1}\right)(1-\alpha)}{(\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha}$$
$$v_{sm}^y = \frac{(\nu-\sigma)(1-a_1)(1-\alpha)}{(\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha} \frac{1}{1-\nu}$$
$$v_{sn}^y = -\frac{1-\alpha}{(\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha}$$
$$v_{y+1}^m = -\frac{a_2(\nu-(\nu-\sigma)a_1)}{\nu}$$
$$v_y^m = 1 + \frac{a_2(\nu-(\nu-\sigma)a_1)}{\nu}$$

$$\kappa_x = \frac{(1-\alpha)(1-\beta\theta)\left(\nu-(\nu-\sigma)a_1+\frac{\eta+\alpha}{1-\alpha}\right)}{1-\alpha+\alpha\varepsilon} \frac{1-\theta}{\theta}$$
$$\kappa_m = \frac{(1-\alpha)(1-\beta\theta)(\sigma-\nu)(1-a_1)}{1-\alpha+\alpha\varepsilon} \frac{1-\theta}{\theta}$$
$$\kappa_r = \frac{1}{\nu-a_1(\nu-\sigma)}$$
$$\kappa_{mp} = \frac{(\sigma-\nu)(1-a_1)}{\nu-a_1(\nu-\sigma)}$$
$$\kappa_{sp} = -\frac{1}{\nu-a_1(\nu-\sigma)}$$
$$\kappa_{sm} = -\frac{(1-a_1)(\nu-\sigma)}{\nu-a_1(\nu-\sigma)} \frac{1}{1-\nu}$$
$$\kappa_i = \frac{a_2}{\nu}$$

with $a_1 = \frac{1}{1+\left(\frac{b}{1-b}\right)^{\frac{1}{\nu}}(1-\beta)^{\frac{\nu-1}{\nu}}}$ and $a_2 = \frac{1}{\exp(\frac{1}{\beta})-1}$.

A static analysis of these coefficients is provided in Appendix 6.7.

3.2 Euro Area data
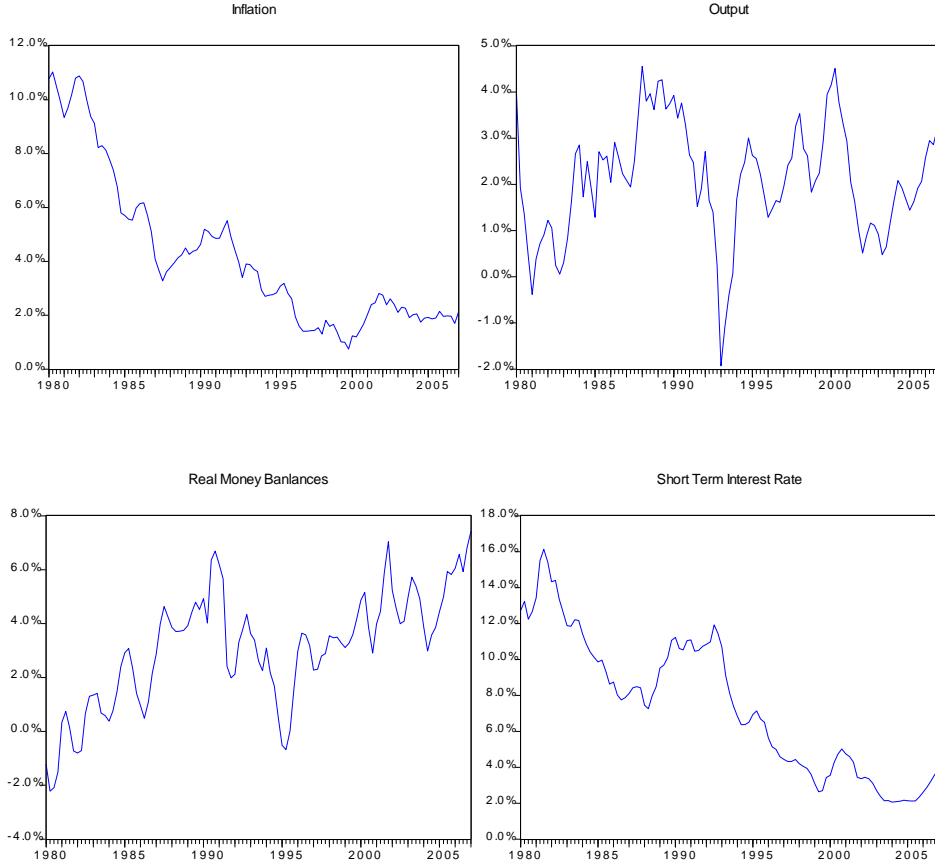
In this model of the Euro zone, $\hat{\pi}_t$ is the log-linearized inflation rate measured as the quarter to quarter change in the GDP Deflator, $\hat{y}_t$ is the log-linearized output measured as the quarter to quarter change in the GDP, and i_t is the short-term (3-month) nominal interest rate. These Data are extracted from the Euro Area Wide Model database (AWM) of Fagan, Henry and Mestre (2001). $\widehat{mp}_t$ is the log-linearized quarter to quarter growth rate of real money balances. We use the $M3$ monetary aggregate from the OECD database. $\hat{y}_t^f$, the trend of the log-linearized output, and $\widehat{mp}_t^f$, the trend of the log-linearized growth rate of real money balances, are completely determined by structural shocks.

Structural shocks $(\varepsilon_t^P, \varepsilon_t^N,$ and $\varepsilon_t^M)$, the exogenous component of the interest

rate (ε_t^i) and of the productivity (ε_t^a) are assumed to follow a first-order autoregressive process with an *i.i.d.*-normal error term such as $\varepsilon_t^k = \mu_k \varepsilon_{t-1}^k + \omega_{k,t}$ where $\varepsilon_{k,t} \sim N(0; \sigma_k)$ for $k = \{P, N, M, i, a\}$.

3.3 Calibration and results

In order to obtain bayesian estimates of all the structural parameters of the model, we need to calibrate the mean and the probability distribution of these parameters. Following Smets and Wouters (2005) and Galí (2007), we linearize the equations describing the model around the steady state and we choose prior distributions for the parameters which are added to the likelihood function[9]; the estimation of the implied posterior distribution of the parameters is done using the Metropolis algorithm (see Smets and Wouters, 2007, and Adolfson et al., 2007).

Table 1: Calibration and estimation of structural parameters[10]

	Law	Prior mean	Posterior deviation	Posterior mean	Standard deviation	Confidence interval
β	beta	0.99	0.005	0.9933	0.0026	[0.9879; 0.9988]
σ	normal	2.0	0.05	1.9746	0.0503	[1.8966; 2.0593]
ν	normal	1.2	0.05	1.3271	0.0378	[1.2647; 1.3915]
η	normal	1.0	0.05	1.0079	0.0498	[0.9219; 1.0884]
θ	beta	0.66	0.05	0.7645	0.0281	[0.7181; 0.8138]
ε	normal	6.0	0.05	6.0029	0.0500	[5.9226; 6.0867]
α	beta	0.33	0.05	0.3921	0.0539	[0.3050; 0.4792]
b	beta	0.4	0.05	0.3981	0.0508	[0.3209; 0.4810]
λ_i	beta	0.6	0.05	0.5346	0.0356	[0.4748; 0.5923]
λ_π	normal	3.5	0.05	3.5154	0.0499	[3.4329; 3.5965]
λ_x	normal	1.5	0.05	1.5288	0.0493	[1.4458; 1.6086]
ρ_a	beta	0.8	0.075	0.8600	0.0360	[0.7829; 0.9440]
ρ_i	beta	0.8	0.075	0.9892	0.0039	[0.9824; 0.9962]
ρ_p	beta	0.8	0.075	0.8841	0.0167	[0.8580; 0.9102]
ρ_m	beta	0.8	0.075	0.9389	0.0177	[0.9117; 0.9680]
ρ_n	beta	0.8	0.075	0.8105	0.0776	[0.6819; 0.9455]
σ_a	invgamma	1	1	0.8976	0.0914	[0.6269; 1.1568]
σ_i	invgamma	1	1	0.6118	0.0660	[0.4953; 0.7232]
σ_p	invgamma	5	1	7.2887	0.8491	[5.9397; 8.7002]
σ_m	invgamma	1	1	1.4097	0.1016	[1.2402; 1.5757]
σ_n	invgamma	1	1	1.2876	0.2204	[0.3410; 2.4605]

Results are based on 10 chains, each with 100000 draws based on the Metropolis algorithm.

Following standard conventions, we choose beta distributions for parameters that fall between zero and one, inverted gamma distributions for parameters

---

[9] The solution takes the form of a state-space model that is used to compute the likelihood function.

[10] See Appendix 6.5 for the prior and posterior distributions.

that need to be constrained to be greater than zero, and normal distributions in other cases. As in Smets and Wouters (2003), the standard errors of the innovations are assumed to follow inverse gamma distributions and we choose a beta distribution for shock persistence parameters (as well as for the backward component of the Taylor rule) with 0.8 mean and 0.05 standard error. We estimate the model with 106 observations from 1980 (Q4) to 2007 (Q2) in order to avoid high volatility periods before 1980 and during the latest financial crisis.

The estimates of the macro-parameters (aggregated structural parameters) are

$$
\begin{array}{ll}
\upsilon_a^y = 0.79327 & \kappa_x = 0.06334 \\
\upsilon_m^y = -0.02733 & \kappa_m = 0.00173 \\
\upsilon_c^y = 0.04376 & \kappa_r = 0.53741 \\
\upsilon_{sm}^y = 0.08356 & \kappa_{mp} = 0.06116 \\
\upsilon_{sn}^y = -0.236\,68 & \kappa_{sp} = -0.53741 \\
\upsilon_{y+1}^m = -0.80737 & \kappa_{sm} = -0.18698 \\
\upsilon_y^m = 1.8074 & \kappa_i = 0.43389
\end{array}
$$

4 Interpretation

4.1 Impulse response functions

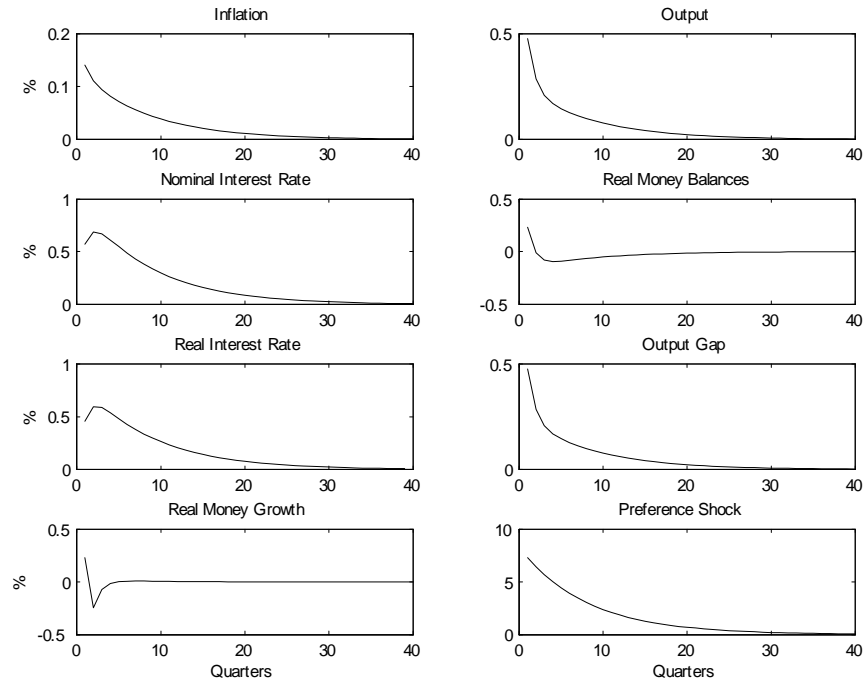The impulse response functions of all structural shocks are as follows.

Figure 1: Preference shock

Figure 1 presents the response of key variables to a preference shock. In response to the shock, the inflation rate, the output, the output gap, real money balances, the nominal and the real rate of interest rise; real money growth displays a little overshooting process in the first periods, then returns quickly to its steady state value.
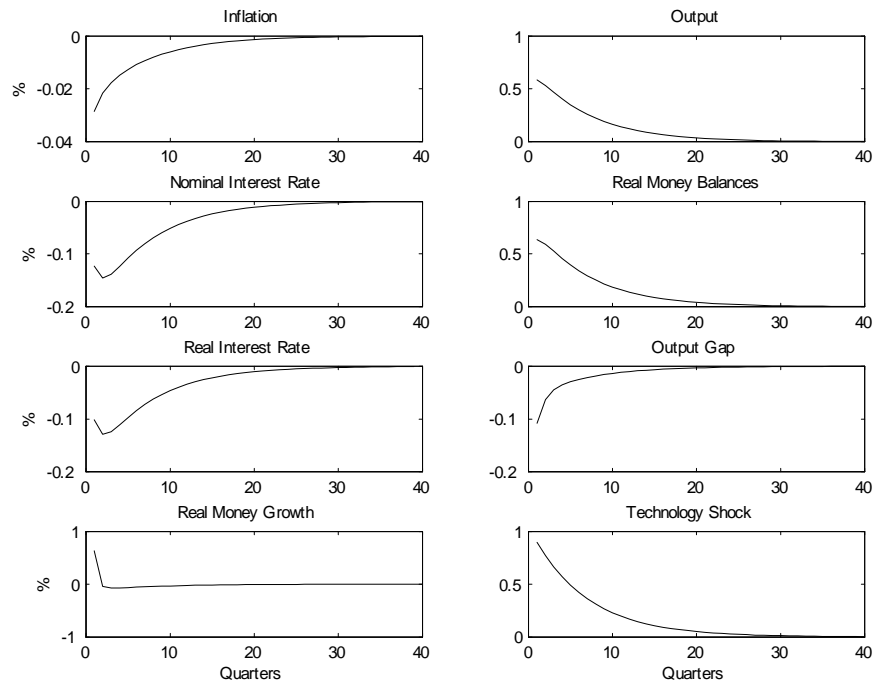
Figure 2: Technology shock

In Figure 2, we plot the response of the same variables to a technology shock. The output gap, the inflation, the nominal and the real interest rate decrease whereas output as well as real money balances and real money growth rise.
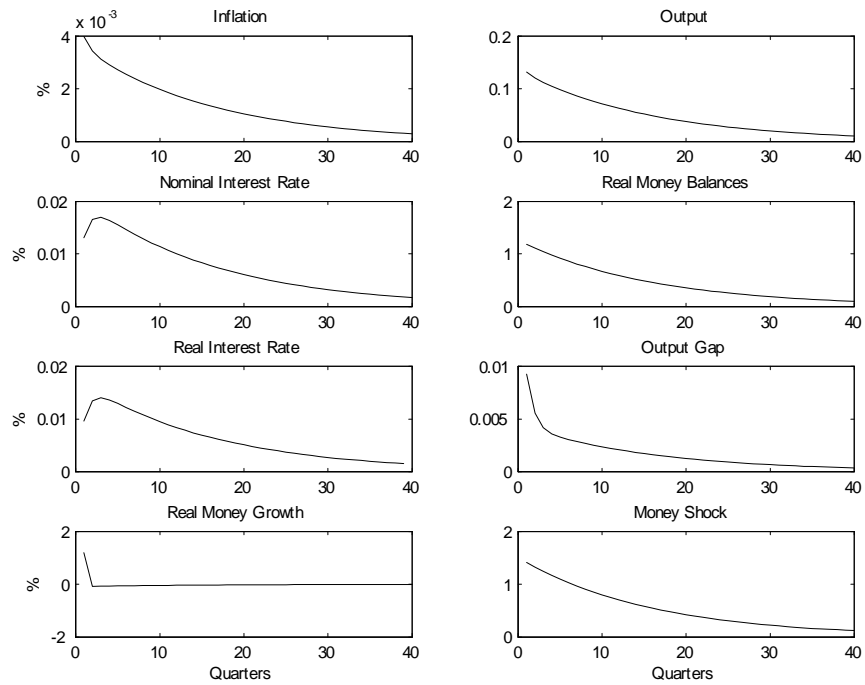
Figure 3: Money shock

Figure 3 exhibits the response to a money shock. Inflation, the nominal and the real rate of interest, the output and the output gap rise.
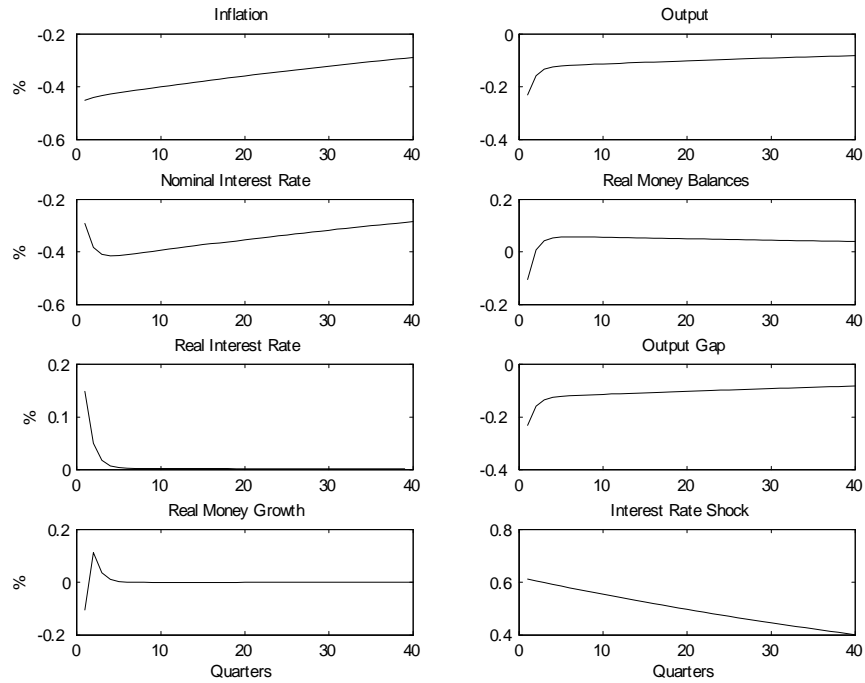
16

Figure 4: Interest rate shock

Figure 4 presents the response to an interest rate shock. Inflation, the nominal rate of interest, output and the output gap fall. The real rate of interest rises. A positive monetary policy shock induces a fall in interest rates due to a low enough degree of intertemporal substitution (i.e. the risk aversion parameter is high enough) which generates a large impact response of current consumption relative to future consumption. This result has been noted in, *inter alia*, Jeanne (1994) and Christiano et *al.* (1997).
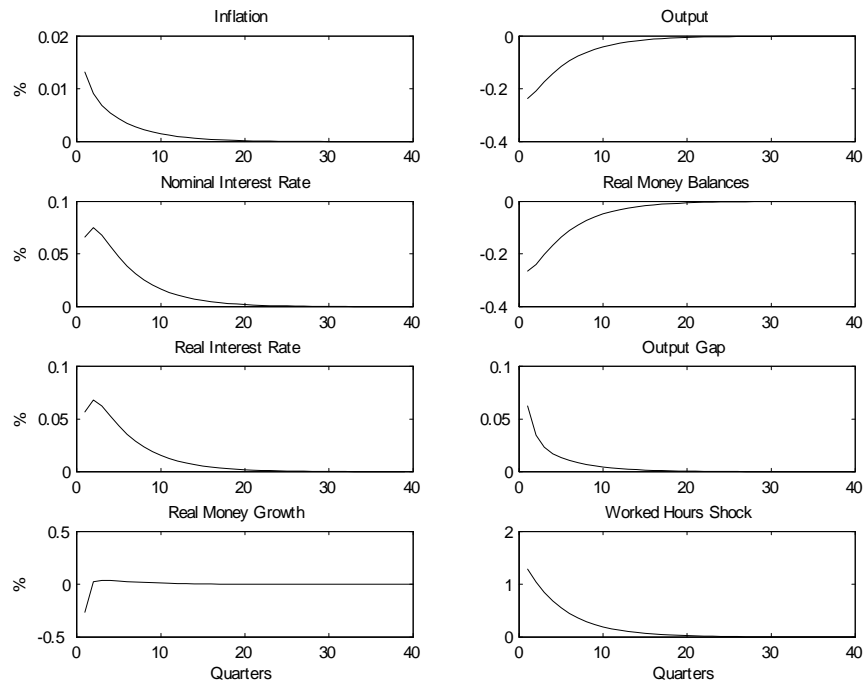
Figure 5: Labor shock

When there is a labor shock (Figure 5), inflation, the real and the nominal rate of interest, and the output gap increase. Output and real money balances decrease.

All these results are in line with the DSGE literature, especially with Galí (2007) and other studies on impulse response functions.

4.2 Variance decompositions

Here we analyze in two different ways the forecast error variance of each variable following exogenous shocks. The analysis is conducted first via an unconditional variance decomposition (Table 3), and second via a conditional variance decomposition (Figures 6 to 17).

Table 3: Unconditional variance decomposition (%)

	With $\sigma = 2$					With $\sigma = 6$				
	ε_t^N	ε_t^P	ε_t^i	ε_t^M	ε_t^a	ε_t^N	ε_t^P	ε_t^i	ε_t^M	ε_t^a
$\hat{y}_t$	6.19	15.6	25.7	4.47	48.1	0.20	10.1	22.6	17.0	50.2
$\hat{\pi}_t$	0.00	0.77	99.2	0.00	0.03	0.00	0.37	99.3	0.01	0.36
$\hat{\imath}_t$	0.21	25.5	73.3	0.03	0.98	0.14	21.1	67.7	0.26	10.8
$\widehat{mp}_t$	1.77	0.77	1.27	83.2	13.0	0.12	0.58	0.13	76.4	22.8
$\hat{y}_t^f$	11.8	0.00	0.00	5.67	82.6	0.55	0.00	0.00	16.5	82.9
$\widehat{mp}_t^f$	2.37	0.00	0.00	82.2	15.5	0.25	0.00	0.00	72.1	27.7

The unconditional variance decomposition shows that with a standard calibration of our model ($\sigma = 2$), about half of the variance of output results from the productivity shock, about a quarter from the interest rate shock, the remaining quarter from the other shocks. If money plays some role, this role is rather minor (an impact of less than 5%).

Yet, as Table 3 shows, the money shock contribution to the business cycle depends on the value of agents' risk aversion. Indeed, an estimation of our model with a higher risk aversion[11] ($\sigma = 6$) gives interesting information as to the role of money, and more generally as to the role of each shock.

Notably, it shows that a higher coefficient of relative risk aversion increases significantly the role of money in a business cycle.

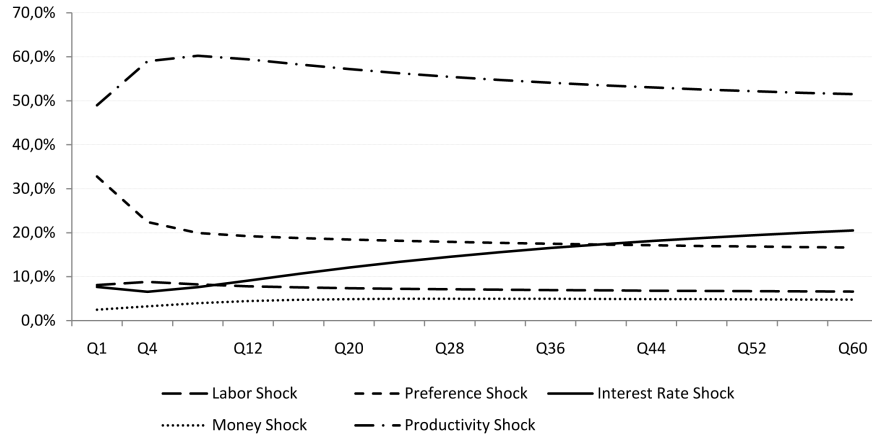---

[11] See Appendix 6.4, Table 4.

Figure 6: Forecast error variance decomposition of $\hat{y}_t$ with $\sigma = 2$
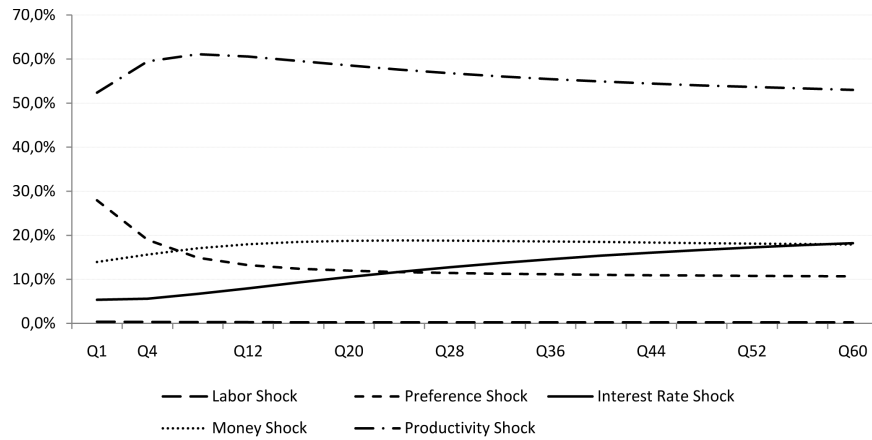

Figure 7: Forecast error variance decomposition of $\hat{y}_t$ with $\sigma = 6$

If about half of the variance of output is still explained by the productivity shock, the role of the interest rate shock and especially the role of preference and labor shocks decrease notably whereas the impact of the money shock increases from about 4% to 17%, i.e. is multiplicated by a factor of four.

The analysis through time (Figures 6 and 7) also shows that the impact of the money shock, and especially of the interest rate shock, increases a bit with the time horizon whereas it is the reverse for the preference shock.
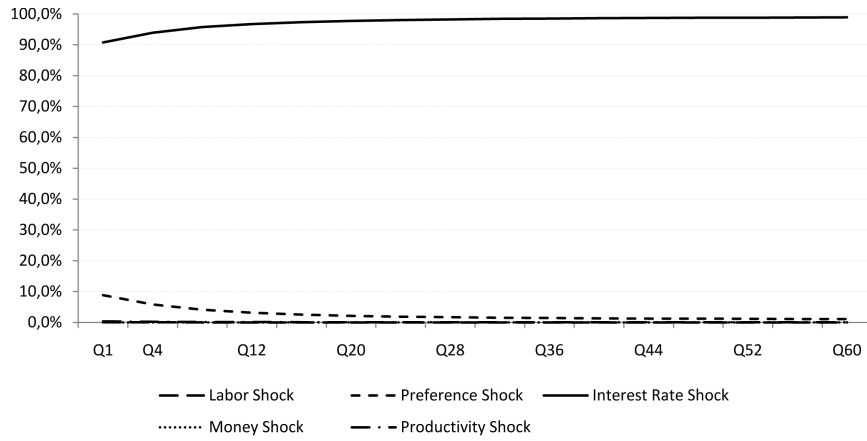
Figure 8: Forecast error variance decomposition of $\hat{\pi}_t$ with $\sigma = 2$
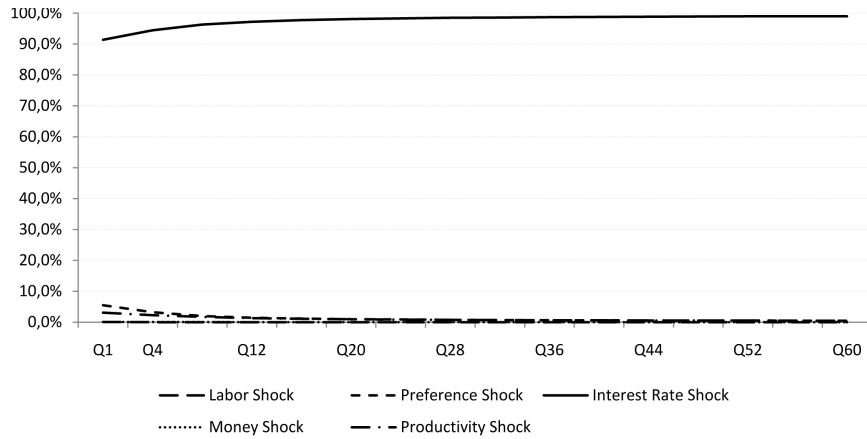

Figure 9: Forecast error variance decomposition of $\hat{\pi}_t$ with $\sigma = 6$

A look at the conditional and unconditional inflation variance decomposition shows the overwhelming role of the interest rate shock (the monetary policy shock) which explains more than 99% of the variance. It must be noted that the change in risk aversion (when σ goes from 2 to 6) does not affect this result, and there is no significant change of the respective impacts through time (Figures 8 and 9).

21

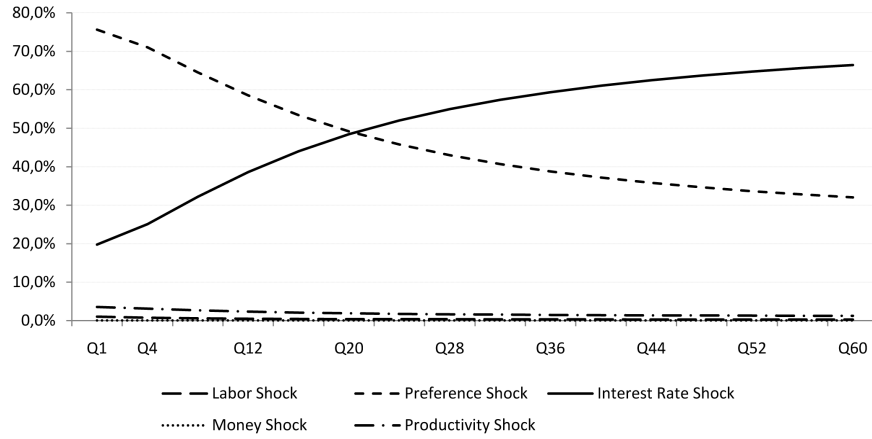Figure 10: Forecast error variance decomposition of $\hat{\imath}_t$ with $\sigma = 2$
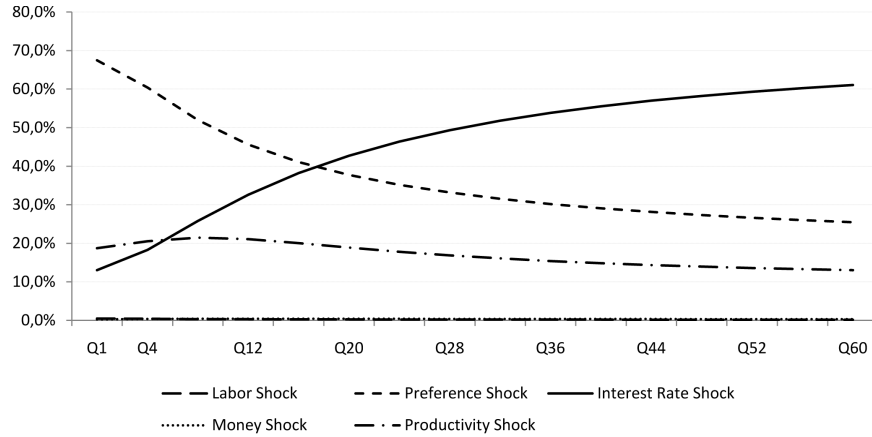

Figure 11: Forecast error variance decomposition of $\hat{\imath}_t$ with $\sigma = 6$

The interest rate variance is dominated by the direct shock on the interest rate. Yet, as risk aversion increases, the role of the productivity shock increases. The relative importance of each of these shocks changes through time (Figures 10 and 11). Over short horizons, the preference shock explains almost 70% of the nominal interest rate variance whereas the interest rate shock explains less than 20%. For longer horizons, there is an inversion: the nominal interest rate shock explains close to 70% of the variance and the preference shock a bit more than 20%.
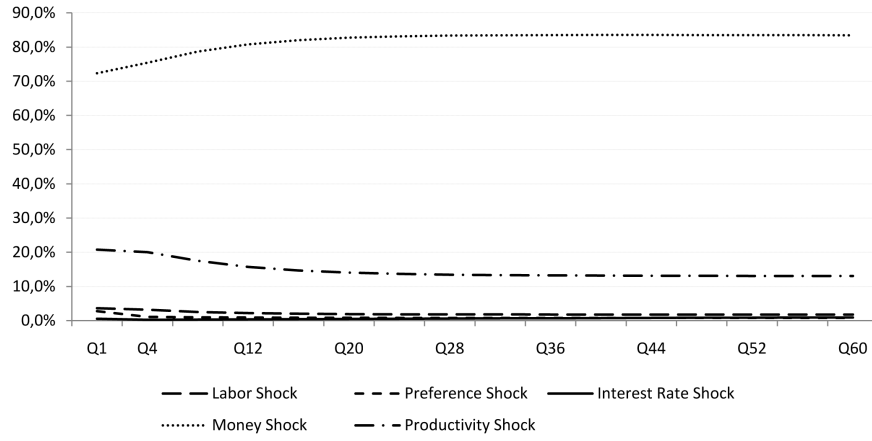
Figure 12: Forecast error variance decomposition of $\widehat{mp}_t$ with $\sigma = 2$
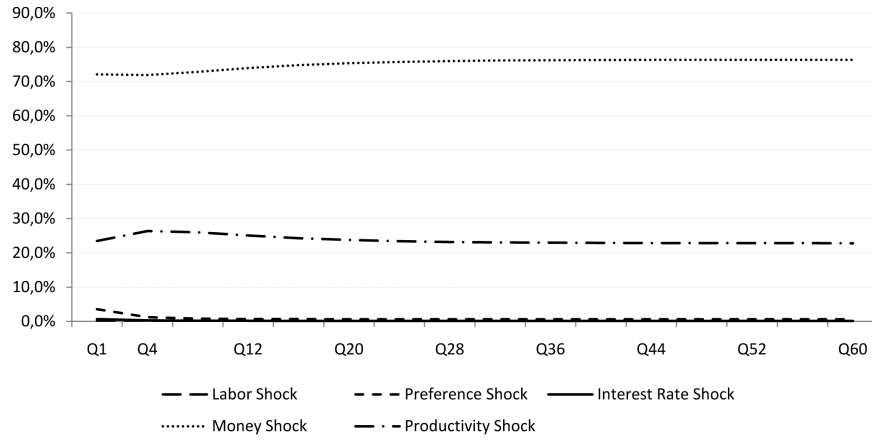

Figure 13: Forecast error variance decomposition of $\widehat{mp}_t$ with $\sigma = 6$

Table 3 as well as Figures 12 and 13 show that real money balances are mainly explained by the real money balances shock and the productivity shock, with a small increase in the role of the productivity shock as risk aversion increases. The respective role of these two shocks barely changes through time.

Figure 14: Forecast error variance decomposition of $\hat{y}_t^f$ with $\sigma = 2$
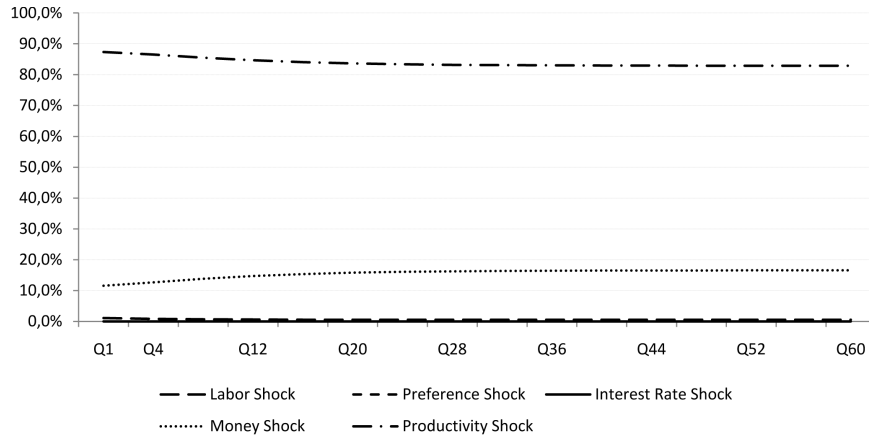
Figure 15: Forecast error variance decomposition of $\hat{y}_t^f$ with $\sigma = 6$

It is also interesting to notice that the same type of analysis applies to the flexible-price output variance decomposition (Figures 14 and 15). Productivity is the main explanatory factor with a weight greater than 82%, the role of money increasing also with the relative risk aversion coefficient (from a weight of about 6% to almost 17%) whereas monetary policy plays no role and labor only a minor one.
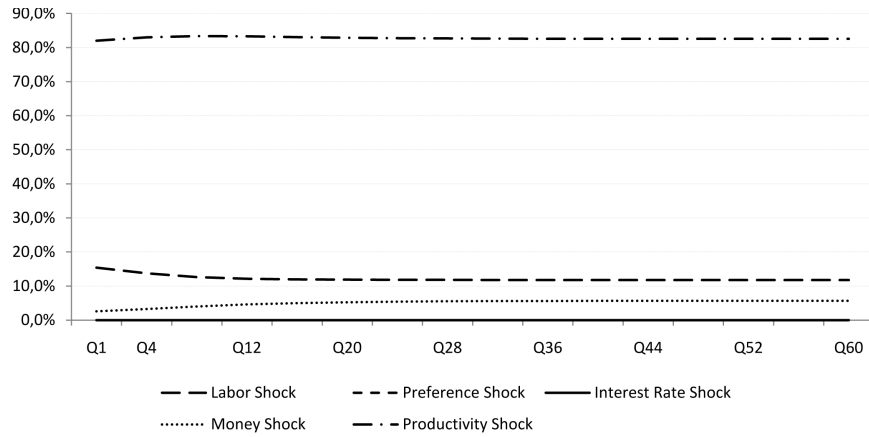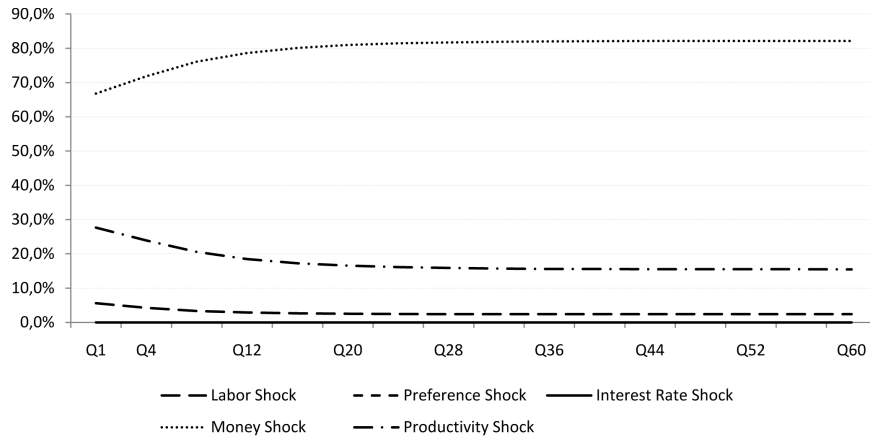
Figure 16: Forecast error variance decomposition of $\widehat{mp}_t^f$ with $\sigma = 2$

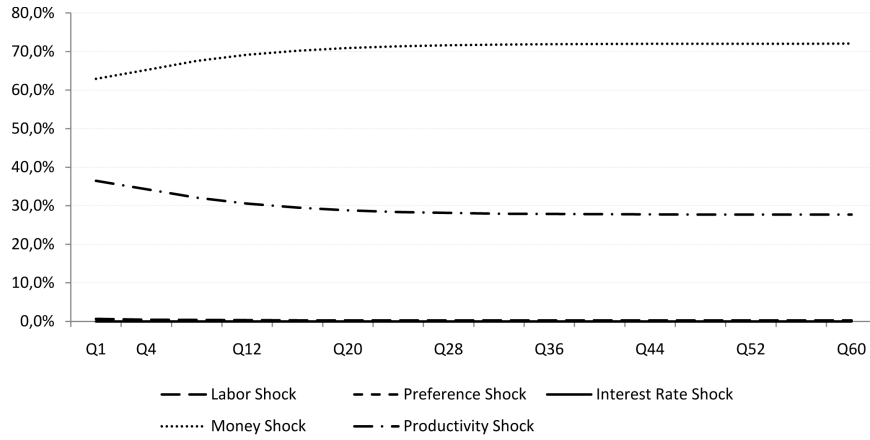Figure 17: Forecast error variance decomposition of $\widehat{mp}_t^f$ with $\sigma = 6$

As Figures 16 and 17 show, the flexible-price real balances variance is mainly explained by the money shock, with a significant impact of the productivity shock. The impact of each of these shocks does not vary much through time, but when risk aversion increases the impact of the productivity shock also increases.

5 Conclusion

In this paper, we built and empirically tested a model of the Euro zone, with a special emphasis on the role of money. The model follows the New Keynesian DSGE framework, but with money in the utility function whereby real money balances affect the marginal utility of consumption. By using bayesian estimation techniques, we shed light on the determinants of output and inflation, but also of interest rate, real money balances, flexible-price output and flexible-price real money balances variances. On that respect we further investigate the role of money, especially when intertemporal risk aversion changes.

Half of the variance of output is explained by the productivity shock, the other half by a combination of labor, preference, interest rate and money shocks. Almost the totality of the inflation variance is a consequence of the interest rate shock. The interest rate variance depends mainly on the interest rate shock, but the preference shock is also significant, as well as, to a lesser extent, the productivity shock. Real balances react essentially to money shocks, with a significant role left to the productivity shock. Interestingly, the flexible-price output variability depends strongly on the productivity shock, but the money shock remains significant. The flexible-price real balances variance is mainly explained by the money shock, with a significant impact of the productivity shock. These results are sensible and rather in line with prior expectations. We believe that this corroborates the credibility of our model.

To investigate further the role of each shock, especially the money shock, we calibrated the model with different risk aversion coefficients.

The first calibration of the model with a standard risk aversion shows that money plays a minor role in explaining output variability, a result in line with current literature (Andrès et *al.*, 2006; Ireland, 2004). Other calibrations with higher risk aversion imply that money plays a non-negligible role in explaining output fluctuations. And the more agents are risk averse, the higher the impact of money on output. This result differs from existing literature using New Keynesian DSGE frameworks with money, neglecting the role of a high enough risk factor.

On the other hand, the explicit money variable does not appear to have a notable direct role in explaining inflation variability, the overwhelming explanatory factor being the interest rate (monetary policy) whatever the level of risk aversion.

If these results are trustworthy, it can be inferred that the last financial crisis, by changing economic agents' perception of risks, may have increased the role of real money balances in the transmission mechanisms and in output changes.

6 Appendix

6.1 Aggregate consumption and price index

Let $C_t = \left(\int_0^1 C_t(i)^{1-\frac{1}{\varepsilon}} di \right)^{\frac{\varepsilon}{\varepsilon-1}}$ be a consumption index where $C_t(i)$ represents the quantity of good i consumed by the household in period t. This requires that C_t be maximized for any given level of expenditures $\int_0^1 P_t(i) C_t(i) di$ where $P_t(i)$ is the price of good i at time t. The maximization of C_t for any given expenditure level $\int_0^1 P_t(i) C_t(i) di = Z_t$ can be formalized by means of the Lagrangian

$$\mathcal{L} = \left[\int_0^1 C_t(i)^{1-\frac{1}{\varepsilon}} di \right]^{\frac{\varepsilon}{\varepsilon-1}} - \lambda \left(\int_0^1 P_t(i) C_t(i) di - Z_t \right) \tag{33}$$

The associated first-order conditions are $C_t(i)^{-\frac{1}{\varepsilon}} C_t^{\frac{1}{\varepsilon}} = \lambda P_t(i)$ for all $i \in [0,1]$. Thus, for any two goods (i,j),

$$C_t(i) = C_t(j) \left(\frac{P_t(i)}{P_t(j)} \right)^{-\varepsilon} \tag{34}$$

which can be substituted into the expression for consumption expenditures to yield $C_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\varepsilon} \frac{Z_t}{P_t}$ for all $i \in [0,1]$ where $P_t = \left(\int_0^1 P_t(i)^{1-\varepsilon} di \right)^{\frac{1}{1-\varepsilon}}$ is an aggregate price index. The latter condition can then be substituted into the definition of C_t to obtain

$$\int_0^1 P_t(i) C_t(i) di = P_t C_t \tag{35}$$

Combining the two previous equations yields the demand schedule equation $C_t(i) = \left(\frac{P_t(i)}{P_t} \right)^{-\varepsilon} C_t$ for all $i \in [0,1]$.

6.2 Optimization problem

Our Lagrangian is given by

$$L_t = E_t \left[\sum_{k=0}^{\infty} \beta^k U_{t+k} - \lambda_{t+k} V_{t+k} \right] \tag{36}$$

where

$$V_t = C_t + \frac{M_t}{P_t} + Q_t \frac{B_t}{P_t} - \frac{B_{t-1}}{P_t} - \frac{W_t}{P_t} N_t - \frac{M_{t-1}}{P_t} \tag{37}$$

and

$$U_t = e^{\varepsilon_t^P} \left(\frac{1}{1-\sigma} X_t^{1-\sigma} - \frac{\chi e^{\varepsilon_t^N} N_t^{1+\eta}}{1+\eta} \right) \tag{38}$$

27

where $X_t = \left((1-b) C_t^{1-\nu} + b e^{\varepsilon_t^M} \left(\frac{M_t}{P_t} \right)^{1-\nu} \right)^{\frac{1}{1-\nu}}$ is the non-separable part of the utility function.

The first order condition related to consumption expenditures is given by

$$\lambda_t = e^{\varepsilon_t^P} (1-b) C_t^{-\nu} X_t^{\nu-\sigma} \tag{39}$$

where λ_t is the Lagrange multiplier associated with the budget constraint at time t.

The first order condition corresponding to the demand for contingent bonds implies that

$$Q_t = \beta E_t \left[\frac{\lambda_{t+1}}{\lambda_t} \frac{P_t}{P_{t+1}} \right] \tag{40}$$

The demand for cash that follows from the household's optimization problem is given by

$$b e^{\varepsilon_t^M} e^{\varepsilon_t^P} \left(\frac{M_t}{P_t} \right)^{-\nu} X_t^{\nu-\sigma} = \lambda_t - \beta E_t \left[\lambda_{t+1} \frac{P_t}{P_{t+1}} \right] \tag{41}$$

which can be naturally interpreted as a demand for real balances. The latter is increasing in consumption and inversely related to the nominal interest rate, as in conventional specifications.

$$\chi e^{\varepsilon_t^P} e^{\varepsilon_t^N} N_t^\eta = \lambda_t \frac{W_t}{P_t} \tag{42}$$

6.3   Log linearization

Log linearizing the Lagrangian multiplier (39) around its steady state yields

$$\hat{\lambda}_t = \varepsilon_t^P - \nu \hat{c}_t + (\nu - \sigma) \left(a_1 \hat{c}_t + (1 - a_1) \left(\hat{m}_t - \hat{p}_t + \frac{1}{1-\nu} \varepsilon_t^M \right) \right) \tag{43}$$

where $a_1 = \frac{(1-b)C^{1-\nu}}{(1-b)C^{1-\nu}+b\left(\frac{M}{P}\right)^{1-\nu}}$ is a constant term where C and $\frac{M}{P}$ are respectively consumption and real money balances at the steady state[12]. We obtain from (39), (40) and (41) the following expression for a_1

$$a_1 = \frac{1}{1 + \left(\frac{b}{1-b} \right)^{\frac{1}{\nu}} (1-\beta)^{\frac{\nu-1}{\nu}}}$$

Log linearizing (40) around its steady state yields (with $Q_t = e^{-i_t}$)

$$-\hat{i}_t = E_t \left[\begin{array}{c} \Delta\varepsilon_{t+1}^P + (a_1(\nu-\sigma)-\nu)\Delta\hat{c}_{t+1} \\ + (1-a_1)(\nu-\sigma)\left(\Delta\hat{m}_{t+1} - \Delta\hat{p}_{t+1} + \frac{1}{1-\nu}\Delta\varepsilon_{t+1}^M\right) - \hat{\pi}_{t+1} \end{array} \right] \tag{44}$$

---

[12] In order to determine (43), (44) and (46), we need to log linearize X_t around its steady state: $\hat{X}_t = a_1 \hat{c}_t + (1 - a_1) \left(\frac{1}{1-\nu} \hat{\varepsilon}_t^M + (\hat{m}_t - \hat{p}_t) \right)$

28

Log linearizing (41) around its steady state and up to an uninteresting constant yields

$$\varepsilon_t^M - \nu\left(\hat{m}_t - \hat{p}_t\right) + \nu\hat{c}_t = a_2\hat{\imath}_t \tag{45}$$

where a_2 is such as $\widehat{1 - Q}_t = a_2\hat{\imath}_t$ i.e. $a_2 = \frac{1}{\exp(\frac{1}{\beta})-1}$ because $\frac{1}{\beta}$ is the steady state interest rate.

Equation (45) is the intertemporal optimality condition setting the marginal rate of substitution between money and consumption equal to the opportunity cost of holding money.

Log linearizing (42) around its steady state yields

$$\eta\hat{n}_t - \left(a_1\left(\nu - \sigma\right) - \nu\right)\hat{c}_t - \left(\nu - \sigma\right)\left(1 - a_1\right)\left(\hat{m}_t - \hat{p}_t + \frac{1}{1 - \nu}\varepsilon_t^M\right) + \varepsilon_t^N = \hat{w}_t - \hat{p}_t \tag{46}$$

Equation (46) is the condition for the optimal consumption-leisure arbitrage, implying that the marginal rate of substitution between consumption and labor is equated to the real wage.

6.4 Calibration and results ($\sigma = 6$)

Table 4: Calibration and estimation of structural parameters[13]

	Law	Prior mean	Posterior deviation	Posterior mean	Standard deviation	Confidence interval
β	beta	0.99	0.005	0.9922	0.0030	$[0.9860; 0.9985]$
σ	normal	6.0	0.05	5.9906	0.0500	$[5.9105; 6.0723]$
ν	normal	1.2	0.05	1.4075	0.0357	$[1.3493; 1.4678]$
η	normal	1.0	0.05	1.0100	0.0498	$[0.9322; 1.0996]$
θ	beta	0.66	0.05	0.8224	0.0232	$[0.7807; 0.8602]$
ε	normal	6.0	0.05	6.0024	0.0500	$[5.9211; 6.0829]$
α	beta	0.33	0.05	0.4700	0.0583	$[0.3794; 0.5631]$
b	beta	0.4	0.05	0.3984	0.0508	$[0.3180; 0.4752]$
λ_i	beta	0.6	0.05	0.5781	0.0358	$[0.5203; 0.6378]$
λ_π	normal	3.5	0.05	3.5038	0.0499	$[3.4128; 3.5846]$
λ_x	normal	1.5	0.05	1.5280	0.0493	$[1.4479; 1.6089]$
ρ_a	beta	0.8	0.075	0.9006	0.0248	$[0.8641; 0.9425]$
ρ_i	beta	0.8	0.075	0.9882	0.0042	$[0.9812; 0.9957]$
ρ_p	beta	0.8	0.075	0.8251	0.0255	$[0.7849; 0.8667]$
ρ_m	beta	0.8	0.075	0.9352	0.0179	$[0.9047; 0.9639]$
ρ_n	beta	0.8	0.075	0.7987	0.0759	$[0.6862; 0.9152]$
σ_a	invgamma	1	1	2.1607	0.2511	$[1.7459; 2.5606]$
σ_i	invgamma	1	1	0.5743	0.0675	$[0.4415; 0.6864]$
σ_p	invgamma	5	1	7.7275	0.7471	$[6.4409; 8.9630]$
σ_m	invgamma	1	1	1.4870	0.1059	$[1.3021; 1.6521]$
σ_n	invgamma	1	1	0.9438	0.2150	$[0.3243; 1.6599]$

Results are based on 10 chains, each with 100000 draws based on the Metropolis algorithm.
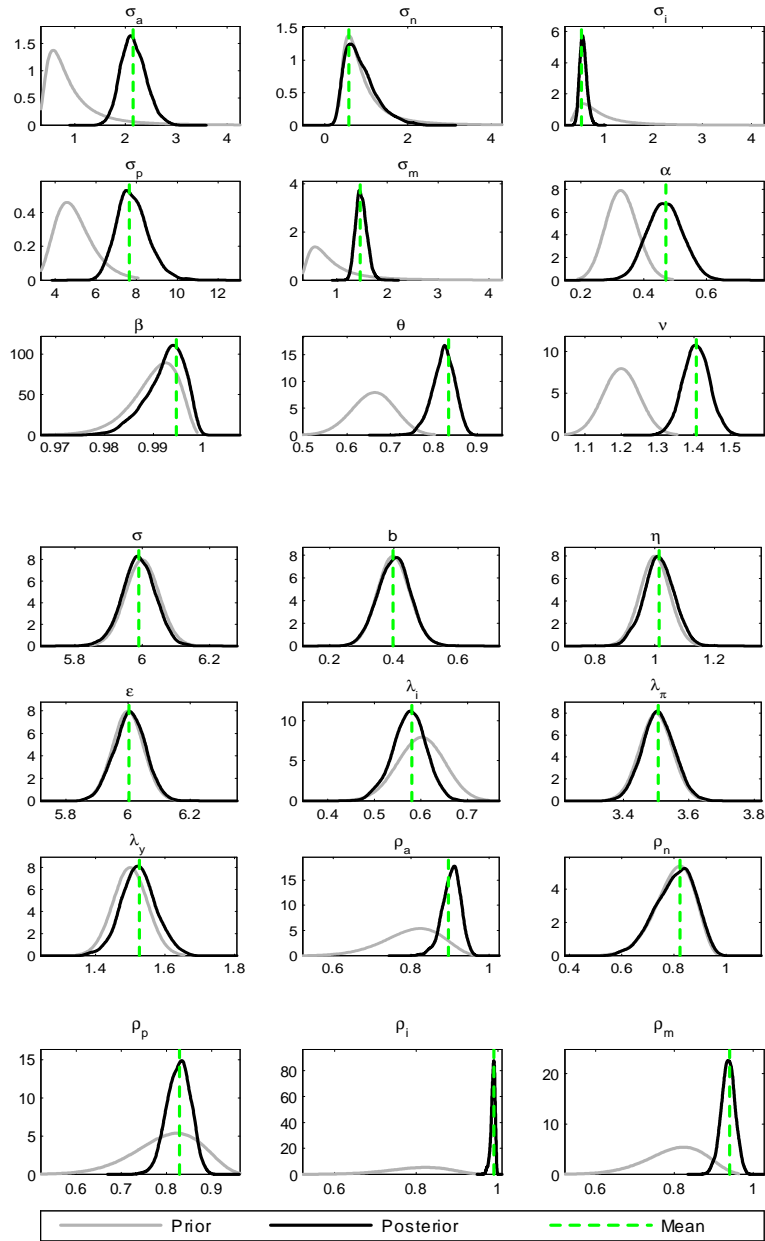
---

[13] See Apendix 6.6 for the prior and posterior distributions.

6.5 Priors and posteriors ($\sigma = 2$)
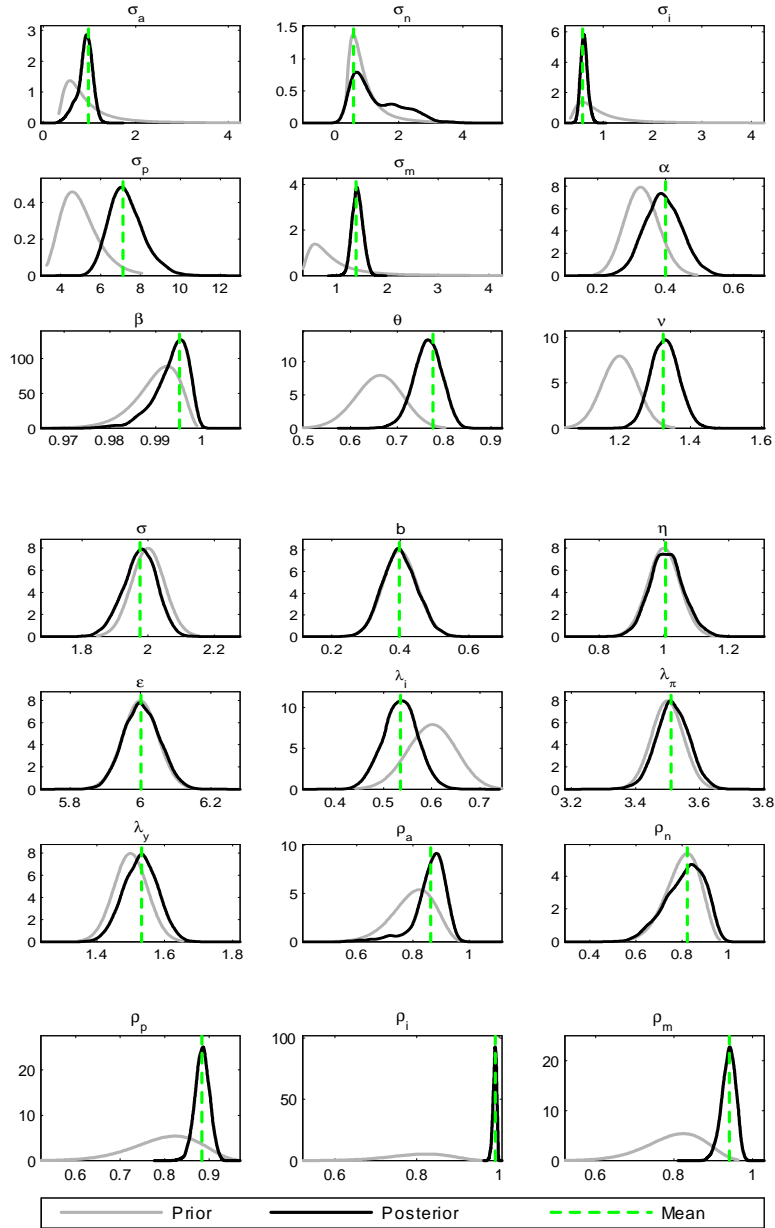
The vertical line denotes the posterior mode, the grey line is the prior distribution, and the black line is the posterior distribution.

6.6 Priors and posteriors ($\sigma = 6$)

	Prior	Posterior	— — Mean

6.7 Static analysis

The following table highlights the derivatives of the macro-coefficients with respect to σ, knowing that a_1 and a_2 are independent of σ, $\nu = 1.2$, and $\sigma \geq 2$.

	$\frac{\partial}{\partial \sigma}$
υ_a^y	$\frac{-a_1(1-\alpha)(1+\eta)}{\left((\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha\right)^2} < 0$
υ_m^y	$\frac{-(1-\alpha)(1-a_1)(\alpha+\eta+\nu(1-\alpha))}{\left((\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha\right)^2} < 0$
υ_c^y	$\frac{-a_1 \log\left(\frac{\varepsilon}{\varepsilon-1}\right)(1-\alpha)^2}{\left((\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha\right)^2} < 0$
υ_{sm}^y	$-\frac{1}{1-\nu}\frac{(1-\alpha)(1-a_1)(\alpha+\eta+\nu(1-\alpha))}{\left((\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha\right)^2} > 0$
υ_{sn}^y	$\frac{a_1(1-\alpha)^2}{\left((\nu-(\nu-\sigma)a_1)(1-\alpha)+\eta+\alpha\right)^2} > 0$
υ_y^m	$\frac{a_1 a_2}{\nu} > 0$
υ_{y+1}^m	$\frac{a_1 a_2}{\nu} < 0$
κ_x	$a_1 \frac{(1-\alpha)(1-\theta\beta)}{1-\alpha+\alpha\varepsilon}\frac{1-\theta}{\theta} > 0$
κ_m	$\frac{(1-\alpha)(1-a_1)(1-\theta\beta)}{1-\alpha+\alpha\varepsilon}\frac{1-\theta}{\theta} > 0$
κ_r	$-\frac{a_1}{(\nu-a_1(\nu-\sigma))^2} < 0$
κ_{mp}	$\frac{\nu(1-a_1)}{(\nu-a_1(\nu-\sigma))^2} > 0$
κ_{sp}	$\frac{a_1}{(\nu-a_1(\nu-\sigma))^2} > 0$
κ_{sm}	$\frac{1-a_1}{(\nu-a_1(\nu-\sigma))^2}\frac{\nu}{1-\nu} < 0$
κ_i	0

References

[1] Adolfson, Malin, Stefan Laseen, Jesper Linde and Mattias Villani. (2007). 'Bayesian estimation of an open economy DSGE model with incomplete pass-through.' *Journal of International Economics*, vol. 72(2), pp. 481-511.

[2] Assenlacher-Wesche, Katrin and Stefan Gerlach. (2006). 'Understanding the link between money growth and inflation in the Euro area.' CEPR Discussion Paper No. 5683.

[3] Andrés, Javier, J. David López-Salido and Edward Nelson. (2009). 'Money and the natural rate of interest: Structural estimates for the United States and the euro area.' *Journal of Economic Dynamics and Control*, vol. 33(3), pp. 758-776.

[4] Andrés, Javier, J. David López-Salido, and Javier Vallés. (2006). 'Money in an Estimated Business Cycle Model of the Euro Area.' *The Economic Journal*, vol. 116(511), pp. 457-477.

[5] Bhattacharjee, Arnab and Christoph Thoenissen. (2007). 'Money and Monetary Policy in Dynamic Stochastic General Equilibrium Models.' *The Manchester School*, vol. 75(S1), pp. 88-122.

[6] Berger, Hlege and Pär Österholm. (2008). 'Does money growth Granger-cause inflation in the Euro Area ? Evidence from out-of-sample forecasts using Bayesian VARs.' IMF Working Paper No. 53.

[7] Brunner, Karl, and Allan H. Meltzer (1968). 'Liquidity Traps for Money, Bank Credit and Interest Rates.' *Journal of Political Economy*, vol. 76, pp. 1-37.

[8] Casares, Miguel. (2007). 'Monetary Policy Rules in a New Keynesian Euro Area Model.' *Journal of Money, Credit and Banking*, vol. 39(4), pp. 875-900.

[9] Christiano, Lawrence, Roberto Motto and Massimo Rostagno. (2007). 'Two reasons why money and credit may be useful in monetary policy.' NBER Working Paper No. 13502.

[10] Clarida, Richard, Jordi Galí and Mark Gertler. (1999). 'The science of monetary policy: a new Keynesian perspective.' *Journal of Economic Literature*, vol. 37(4), pp. 1661-1707.

[11] Dixit, Avinash K. and Joseph E. Stiglitz. (1977). 'Monopolistic Competition and Optimum Product Diversity.' *American Economic Review*, vol. 67(3), pp. 297-308.

[12] Fagan, Gabriel, Jérôme Henry and Ricardo Mestre. (2001). 'An area-wide model (AWM) for the euro area.' European Central Bank, Working Paper No. 42.

[13] Fourçans, André and Radu Vranceanu. (2006). 'The ECB monetary policy: Choices and challenges.' *Journal of Policy Modelling*, vol. 29(2), pp. 181-194.

[14] Friedman, Milton. (1956). 'The Quantity Theory of Money: A Restatement.' Studies in the Quantity Theory of Money, IL.: University of Chicago Press.

[15] Galí, Jordi and Mark Gertler. (2007). 'Macroeconomic modelling for monetary policy evaluation.' *Journal of Economic Perspectives*, vol. 21(4), pp. 25-45.

[16] Galí, Jordi. (2008). Monetary Policy, Inflation and the Business Cycle: An Introduction to the New Keynesian Framework. Princeton, NJ.: Princeton University Press.

[17] Garcia-Iglesias, Jesus M. (2007). 'How the European Central Bank decided its early monetary policy ?.' *Applied Economics*, vol. 39(7), pp. 927-936.

[18] Gerlach, Stefan. (2004). 'The Two Pillars of the European Central Bank.' *Economic Policy*, vol. 19(40), pp. 389-439.

[19] Golinelli, Roberto and Sergio Pastorello. (2002). 'Modelling the demand for M3 in the Euro area.' *The European Journal of Finance*, vol. 8(4), 371-401.

[20] Hofmann, Boris. (2008). 'Do monetary indicators lead Euro area inflation ?.' European Central Bank, Working Paper No. 867.

[21] Ireland, Peter N. (2004). 'Money's Role in the Monetary Business Cycle.' *Journal of Money, Credit and Banking*, vol. 36(6), pp. 969-983.

[22] Jones, Barry E. and Livio Stracca. (2008). 'Does Money Matter In The Is Curve? The Case Of The UK.' *The Manchester School*, vol. 76(S1), pp. 58-84.

[23] Kremer, Jana, Giovanni Lombardo and Thomas Werner. (2003). 'Money in a New-Keynesian model estimated with German data.' Deutsche Bundesbank, Working Paper No. 15.

[24] Kaufmann, Sylvia and Peter Kugler. (2008). 'Does Money Matter for Inflation in the Euro Area ?.' *Contemporary Economic Policy*, vol. 26(4), pp. 590-606.

[25] Leeper, Eric and Jennifer Roush. (2003). 'Putting "M" back in monetary policy.' *Journal of Money, Credit and Banking*, vol. 35(6), pp. 1217-1256.

[26] Lindé, Jesper. (2005). 'Estimating New-Keynesian Phillips curves: A full information maximum likelihood approach.' *Journal of Monetary Economics*, vol. 52(6), pp. 1135-1149.

[27] Meltzer, Allan H. (1995). 'Monetary, Credit, and (other) Transmission Processes.' *Journal of Economic Perspectives*, vol. 9(4), pp. 49-73.

[28] Meltzer, Allan H. (1999). 'The Transmission Process.' mimeo, March.

[29] Nelson, Edward. (2008). 'Why money growth determines inflation in the long run: Answering the Woodford critique.' *Journal of Money, Credit and Banking*, vol. 40(8), pp. 1791-1814.

[30] Nelson, Edward. (2002). 'Direct effects of base money on aggregate demand: theory and evidence.' *Journal of Monetary Economics*, vol. 49(4), pp. 687-708.

[31] Neumann, Manfred J.M. and Claus Greiber. (2004). 'Inflation and core money growth in the Euro Area.' Deutsche Bundesbank, Discussion Paper No. 36.

[32] Reynard, Samuel. (2007). 'Maintaining low inflation: Money, interest rates, and policy stance.' *Journal of Monetary Economics*, vol. 54(5), pp. 1441-1471.

[33] Smets, Frank and Raf Wouters. (2003). 'An Estimated Dynamic Stochastic General Equilibrium Model for the Euro Area.' *Journal of the European Economic Association*, vol. 1(5), pp. 1123-175.

[34] Stark, Jürgen. (2006). 'The role of money: Money and monetary policy in the twenty-first century.' Fourth ECB Central Banking Conference, Frankfurt am Main.

[35] Surico, Paolo. (2007). 'The monetary policy of the European Central Bank.' *Scandinavian Journal of Economics*, vol. 109(1), pp. 115-135.

[36] Söderström, Ulf. (2005). 'Targeting Inflation with a Role for Money.' *Economica*, vol. 72(288), pp. 577-596.

[37] Walsh, Carl E. (1998). Monetary Theory and Policy. Cambridge, MA.: The MIT Press.

[38] Woodford, Michael. (2003). Interest and prices: Foundations of a theory of monetary policy. Princeton, NJ.: Princeton University Press.

ESSEC

LISTE DES DOCUMENTS DE RECHERCHE DU CENTRE DE RECHERCHE DE L'ESSEC
(Pour se procurer ces documents, s'adresser au CENTRE DE RECHERCHE DE L'ESSEC)

LISTE OF ESSEC RESEARCH CENTER WORKING PAPERS
(Contact the ESSEC RESEARCH CENTER for information on how to obtain copies of these papers)

RESEARCH.CENTER@ESSEC.FR

2006

06001   CAZAVAN-JENY Anne, JEANJEAN Thomas
Levels of Voluntary Disclosure in IPO prospectuses: An Empirical Analysis

06002   BARONI Michel, BARTHELEMY Fabrice, MOKRANE Mahdi
Monte Carlo Simulations versus DCF in Real Estate Portfolio Valuation

06003   BESANCENOT Damien, VRANCEANU Radu
Can Incentives for Research Harm Research? A Business Schools Tale

06004   FOURÇANS André, VRANCEANU Radu
Is the ECB so Special? A Qualitative and Quantitative Analysis

06005   NAIDITCH Claire, VRANCEANU Radu
Transferts des migrants et offre de travail dans un modèle de signalisation

06006   MOTTIS Nicolas
Bologna: Far from a Model, Just a Process for a While…

06007   LAMBERT Brice
Ambiance Factors, Emotions and Web User Behavior: A Model Integrating and Affective and Symbolical Approach

06008   BATISTA Catia, POTIN Jacques
Stages of Diversification and Capital Accumulation in an Heckscher-Ohlin World, 1975-1995

06009   TARONDEAU Jean-Claude
Strategy and Organization Improving Organizational Learning

06010   TIXIER Daniel
Teaching Management of Market Driven Business Units Using Internet Based Business Games

06011   COEURDACIER Nicolas
Do Trade Costs in Goods Market Lead to Home Bias in Equities?

06012   AVIAT Antonin, COEURDACIER Nicolas
The Geography of Trade in Goods and Asset Holdings

06013   COEURDACIER Nicolas, GUIBAUD Stéphane
International Portfolio Diversification Is Better Than You Think

06014   COEURDACIER Nicolas, GUIBAUD Stéphane
A Dynamic Equilibrium Model of Imperfectly Integrated Financial Markets

06015   DUAN Jin-Chuan, FULOP Andras
Estimating the Structural Credit Risk Model When Equity Prices Are Contaminated by Trading Noises

06016   FULOP Andras
Feedback Effects of Rating Downgrades

06017   LESCOURRET Laurence, ROBERT Christian Y.

Preferencing, Internalization and Inventory Position

06018 BOURGUIGNON Annick, SAULPIC Olivier, ZARLOWSKI Philippe
Management Accounting Change in the Public Sector: A French Case Study and a New Institutionalist
Perspective

06019 de BEAUFORT Viviane
One Share – One Vote, le nouveau Saint Graal ?

06020 COEURDACIER Nicolas, MARTIN Philippe
The Geography of Asset Trade and the Euro: Insiders and Outsiders

06021 BESANCENOT Damien, HUYNH Kim, VRANCEANU Radu
The "Read or Write" Dilemma in Academic Production: A European Perspective

2007

07001 NAIDITCH Claire, VRANCEANU Radu
International Remittances and Residents' Labour Supply in a Signaling Model

**07002 VIENS G., LEVESQUE K., CHAHWAKILIAN P., EL HASNAOUI A., GAUDILLAT A., NICOL G.,
CROUZIER C.**
Évolution comparée de la consommation de médicaments dans 5 pays européens entre 2000 et 2004 :
analyse de 7 classes pharmaco-thérapeutiques

07003 de BEAUFORT Viviane
La création d'entreprise au féminin dans le monde occidental

07004 BOARI Mircea
Rationalizing the Irrational. The Principle of Relative Maximization from Sociobiology to Economics and Its
Implications for Ethics

07005 BIBARD Laurent
Sexualités et mondialisation

07006 VRANCEANU Radu
The Moral Layer of Contemporary Economics: A Virtue Ethics Perspective

07007 LORINO Philippe
Stylistic Creativity in the Utilization of Management Tools

07008 BARONI Michel, BARTHELEMY Fabrice, MOKRANE Mahdi
Optimal Holding Period for a Real Estate Portfolio

07009 de BEAUFORT Viviane
One Share - One Vote, the New Holy Graal?

07010 DEMEESTERE René
L'analyse des coûts : public ou privé ?

07011 TIXIER Maud
Appreciation of the Sustainability of the Tourism Industry in Cyprus

07012 LORINO Philippe
Competence-based Competence Management: a Pragmatic and Interpretive Approach. The Case of a
Telecommunications Company

07013 LORINO Philippe
Process Based Management and the Central Role of Dialogical Collective Activity in Organizational Learning.
The Case of Work Safety in the Building Industry

07014 LORINO Philippe
The Instrumental Genesis of Collective Activity. The Case of an ERP Implementation in a Large Electricity
Producer

07015 LORINO Philippe, GEHRKE Ingmar
Coupling Performance Measurement and Collective Activity: The Semiotic Function of Management Systems.
A Case Study

07016 **SALLEZ Alain**
Urbaphobie et désir d'urbain, au péril de la ville

07017 **de CARLO Laurence**
The Classroom as a Potential Space - Teaching Negotiation through Paradox

07019 **ESPOSITO VINZI Vincenzo**
Capturing and Treating Unobserved Heterogeneity by Response Based Segmentation in PLS Path Modeling.
A Comparison of Alternative Methods by Computational Experiments

07020 **CHEVILLON Guillaume, Christine RIFFLART**
Physical Market Determinants of the Price of Crude Oil and the Market Premium

07021 **CHEVILLON Guillaume**
Inference in the Presence of Stochastic and Deterministic Trends

07023 **COLSON Aurélien**
The Ambassador, between Light and Shade. The Emergence of Secrecy as the Norm of International
Negotiation

07024 **GOMEZ Marie-Léandre**
A Bourdieusian Perspective on Strategizing

07025 **BESANCENOT Damien, VRANCEANU Radu**
Multiple Equilibria in a Firing Game with Impartial Justice

07026 **BARONI Michel, BARTHELEMY Fabrice, MOKRANE Madhi**
Is It Possible to Construct Derivatives for the Paris Residential Market?

2008

08001 **BATISTA Catia, POTIN Jacques**
International Specialization and the Return to Capital, 1976-2000

08002 **BESANCENOT Damien, FARIA Joan Ricardo, VRANCEANU Radu**
Why Business Schools Do So Much Research: a Signaling Explanation

08003 **de BEAUFORT Viviane**
D'un effet vertueux de l'art. 116 de la loi NRE en matière de RSE ? La problématique est posée à échelle de
l'Union européenne

08004 **MATHE Hervé**
Greater Space Means More Service: Leveraging the Innovative Power of Architecture and Design

08005 **MATHE Hervé**
Leading in Service Innovation: Three perspectives on Service Value delivery in a European Context

08006 **ROMANIUK Katarzyna, VRANCEANU Radu**
Asset Prices and Asymmetries in the Fed's Interest Rate Rule: A Financial Approach

08007 **MOTTIS Nicolas, WALTON Peter**
Measuring Research Output across Borders - A Comment

08008 **NAPPI-CHOULET Ingrid, MAURY Tristan-Pierre**
A Spatiotemporal Autoregressive Price Index for the Paris Office Property Market

08009 **METIU Anca, OBODARU Otilia**
Women's Professional Identity Formation in the Free/Open Source Software Community

08010 **SIBIEUDE Thierry, VIDAL Rodolphe**
Le programme « Une grande école : pourquoi pas moi ? ® ». D'une action de responsabilité sociétale de
l'ESSEC à la responsabilité sociétale des grandes écoles françaises

08011 **SIBIEUDE Thierry, VIDAL Rodolphe**
Enjeux et perspectives du sociétariat des groupes mutualistes complexes face aux stratégies de
développement à l'échelle groupe : quelques enseignements du cas du groupeMACIF

08012 **FOURÇANS André, VRANCEANU Radu**
Money in the Inflation Equation: the Euro Area Evidence

08013 CAZAVAN-JENY Anne, JEANJEAN Thomas
Supply and Demand for European Accounting Research. Evidence from EAA Congresses

08014 FAYARD Anne-Laure, METIU Anca
Beyond Orality and Literacy: Letters and Organizational Communication

08015 CAZAVAN-JENY Anne, MISSONIER-PIERA Franck, MARGAINE J.
CEO Compensations in a Stakeholders' Regime: An Empirical Investigation with French Listed Companies

08016 METIU Anca, FAYARD Anne-Laure
Letters and Scientific Communities

08017 BESANCENOT Damien, VRANCEANU Radu
Migratory Policy in Developing Countries: How to Bring Best People Back?

08018 BESANCENOT Damien, VRANCEANU Radu
Financial Distress and Bank's Communication Policy in Crisis Time

08019 AGID Philippe, TARONDEAU Jean-Claude
Les performances des maisons d'Opéra : une explication statistique

2009

09001 POTIN Jacques
The Selection Effect of Two-way Trade in the Melitz Model: An Alternative Approach

09002 NAIDITCH Claire, VRANCEANU Radu
Migratory Equilibria with Invested Remittances

09003 BARONI Michel, BARTHELEMY Fabrice, MOKRANE Mahdi
A Repeat Sales Index Robust to Small Datasets

09004 NAPPI-CHOULET Ingrid, MAURY Tristan-Pierre
A Spatial and Temporal Autoregressive Local Estimation for the Paris Housing Market

09005 BENCHIMOL Jonathan, FOURÇANS André
Money in a DSGE Framework with an Application to the Euro Zone

09006 VRANCEANU Radu
Four Myths and a Financial Crisis

09007 BESANCENOT Damien, VRANCEANU Radu
Banks' Risk Race: A Signaling Explanation

09008 BESANCENOT Damien, HUYNH Kim, VRANCEANU Radu
Desk Rejection in an Academic Publication Market Model with Matching Frictions

09009 BOUTY Isabelle, GOMEZ Marie-Léandre
Unpacking Knowing Integration: A Practice-based Study in Haute Cuisine

09010 GOMEZ Marie-Léandre, BOUTY Isabelle
The Social Dimensions of Idea Work in Haute Cuisine: A Bourdieusian Perspective

09011 GOMEZ Marie-Léandre
Knowledge Dynamics During Planning Practices

09012 GIRAUD Gaël, RENOUARD Cécile
Relational Capability: An Indicator of Collective Empowerment

09013 MOTTIS Nicolas, PONSSARD Jean-Pierre
Création de valeur, 10 ans après…

09014 PRAT Nicolas, COMYN-WATTIAU Isabelle, AKOKA Jacky
Combining Objects with Rules to Represent Aggregation Knowledge in Data Warehouse and OLAP Systems

09015 NAIDITCH Claire, VRANCEANU Radu
Remittances as a Social Status Signaling Device

09016 GIRAUD Gaël, RENOUARD Cécile
Is the Veil of Ignorance Transparent?

2010

10001 VRANCEANU Radu, LAOT Maxime, DUBART Delphine
Une échelle de mesure de la connaissance en raisonnement économique et résultats d'une enquête menée en décembre 2009

10002 de TISSOT Olivier, WAGNER-EDELMAN Francine
Analyse prospective de la rémunération des auteurs, artistes-interprètes et producteurs à l'ère de la numérisation

10003 BESANCENOT Damien, HUYNH Kim, VRANCEANU Radu
A Matching Model of the Academic Publication Market

10004 LORINO Philippe, CLOT Yves, TRICARD Benoît
Research Methods for Non-representational Approaches of Organizational Complexity. The Dialogical and Mediated Inquiry

Pour tous renseignements :

- **Centre de Recherche/Research Center**
  Tél. 33 (0)1 34 43 30 91
  research.center@essec.fr

- **Visitez notre site**
  www.essec.fr

CCI
Chambre de commerce et d'industrie
Versailles Val-d'Oise / Yvelines

AACSB
ACCREDITED

EFMD
EQUIS
ACCREDITED