BANCO DE PORTUGAL

Economic Research Department

THE MONETARY TRANSMISSION MECHANISM: IS IT RELEVANT FOR POLICY?

Bernardino Adão
Isabel Correia
Pedro Teles

WP 13-03 August 2003

Please address correspondence to Isabel Correia, Economic Research Department, Banco de Portugal, Av. Almirante Reis nº 71, 1150-165 Lisboa, Portugal, Tel.#351-213128385; Fax#351-213107805; email:mihcarvalho@bportugal.pt.

The Monetary Transmission Mechanism: Is it Relevant for Policy?*

Bernardino Adão
Banco de Portugal

Isabel Correia†
Banco de Portugal, Universidade Católica Portuguesa and CEPR

Pedro Teles
Federal Reserve Bank of Chicago,
Banco de Portugal, Universidade Católica Portuguesa and CEPR

August, 2003

Abstract

We study environments with sticky prices, wages or portfolios where it is feasible and optimal to use monetary policy to replicate the allocation under full flexibility. In these environments the optimal policy does not depend on the scope of the frictions. In this sense, the strength of the monetary transmission mechanism is irrelevant for the conduct of monetary policy. So, asymmetries in the strength of the transmission mechanisms do not impose a cost on a common policy.

---

*We thank Chuck Carlstrom, Tim Fuerst, Jordi Gali and Marvin Goodfriend, for helpful discussions, as well as participants at seminars where this work was presented.

†Corresponding author: Banco de Portugal, DEE, R. Francisco Ribeiro, n. 2, 1150 Lisbon, Portugal, Tel. # 351-21-3128385, mihcarvalho@bportugal.pt

1. Introduction

How should monetary policy be conducted in response to shocks in the economy? How relevant is the transmission mechanism of monetary policy, for the conduct of this optimal policy? How costly can a single monetary policy be when countries don't share a single monetary transmission mechanism? In this paper we analyze a commonly used economic environment where it is possible to obtain answers to these policy questions.

Our model economy is a standard dynamic general equilibrium model where the government must finance exogenous expenditures with distortionary taxation. We consider three types of restrictions on the agents choices that correspond to three types of transmission mechanisms. Agents may be restricted in the setting of prices, wages, or in the choice of portfolio composition. The severity of these restrictions determines the strength of the transmission mechanism.

One example of a transmission mechanism is when monopolistic competitive firms are restricted to set the prices before observing the shocks. With this price stickiness, an unanticipated monetary injection can raise production, lowering the mark-ups and thus inducing a more efficient scale of production. This increase in economic activity is more pronounced the higher is the fraction of firms that set the prices in advance, i.e. the more potent is the monetary transmission.[1] If, instead, prices are perfectly flexible but portfolio choices are not, a different source of non-neutrality of money arises. This is identified in the literature as limited participation or market segmentation models, as in Lucas (1990) and Fuerst (1992). The households choose their portfolios before observing the shocks, which gives rise to the liquidity effects of monetary policy. As the share of households that are unable to adjust the portfolios increases, the impact of the monetary policy is also larger.

Even though monetary policy can have beneficial effects, because of the inefficient scale of production with monopolistic competition, it is not possible to use this policy systematically to take advantage of these effects. However, there is still a role for stabilization policy. Policy can be used in response to technological or other shocks so that the negative welfare effects of the nominal rigidities, together with the other distortions in the economy, are minimized.

Optimal policy in environments like these has been extensively studied in recent literature. In this paper we directly apply the results of Correia, Nicolini and

[1] This is shown, for example, in Christiano, Eichenbaum and Evans (1997) and Chari, Kehoe and McGrattan (1996).

Teles (2002) and Adao, Correia and Teles (2001) on optimal fiscal and monetary policy in economies with nominal rigidities on the setting of prices or choice of portfolios. They obtain that it is optimal to use policy to replicate the optimal allocations under full flexibility.

At first sight one could think that economies with different degrees of monetary transmission should also follow different monetary policy rules. This is the conventional wisdom, that there is a cost for economies with different transmission mechanisms of following a common monetary policy. This is not necessarily the case. Monetary shocks have larger effects, the larger is the extent of the frictions. However, the impact of other types of shocks is also affected by the extent of the frictions. It turns out that optimal monetary policy is the same in response to common shocks, irrespective of the strength of the transmission mechanism. The strength of the monetary transmission mechanism is, thus, irrelevant for the conduct of the optimal monetary policy. This is the main result of the paper.

The paper proceeds as follows: In Section 2 we analyze an economy where prices and wages are perfectly flexible and there are no portfolio restrictions. We show that there are policies such that one of the nominal variables, prices, wages, or money holdings do not change with the history of shocks. Thus, with adequate fiscal and monetary policy it is possible to replicate the behavior of the full flexible economy, when, instead there is either price, wage or portfolio stickiness. Since in Adao, Correia and Teles (2001) and Correia, Nicolini and Teles (2001) it is shown that it is optimal to replicate the flexible allocation, the results in sections 3 follow directly. We assert that the optimal fiscal and monetary policy is independent of the degree of one type of stickiness. Section 4 contains concluding remarks.

2. An economy with flexible prices, wages and portfolio choices

Our model economy is very similar to the one in Christiano, Eichenbaum and Evans (1997). The economy consists of a large number of identical households, a continuum of firms, each producing a distinct good indexed by $i \in [0, 1]$, financial intermediaries and a government. The period t vector of productivity and government expenditure shocks is denoted by $s_t = [A_t, G_t] \in S_t$, and the history of these shocks up to period t (or state at t), $(s_0, s_1, ..., s_t)$, is denoted by $s^t \in S^t$. The initial realization s_0 is given. To simplify the exposition, we assume that the history of shocks has a discrete distribution. The conditional probability of shocks s_t given the history s^{t-1} is denoted by $\Pr(s_t|s^{t-1})$.

2.1. The households

The preferences are described by the utility function:

$$U = E\left\{\sum_{t=0}^{\infty}\beta^{t}u\left(C_{t},L_{t}\right)\right\}, \beta < 1 \tag{2.1}$$

where β is a discount factor, $L_t = 1 - N_t$, where N_t is the level of labor and the composite consumption C_t is $C_t = \left[\int_0^1 c_{it}^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$, $\theta > 1$. Households start period t with wealth $\mathbb{W}_t$. At the start of period t households decide to hold money balances, M_t^h, decide to make deposits at the financial intermediaries, B_t^h, that pay $R_t B_t^h$ at the beginning of period $t+1$, and decide to buy Z_{t+1}^h units of state contingent nominal securities, that cost $z_{t+1}\Pr(s_{t+1}|s^t)$ and pay one unit of money at the beginning of period $t+1$ in a particular state. Thus, in the beginning of period t they face the budget constraint

$$M_t^h + B_t^h + E_t Z_{t+1}^h z_{t+1} \leq \mathbb{W}_t. \tag{2.2}$$

Labor is paid in the beginning of the period in the form of money, $W_t N_t$, where W_t is the net nominal wage rate. The purchases of consumption goods have to be made with money, so

$$\int_0^1 P_{it} c_{it} di \leq M_t^h + W_t N_t \tag{2.3}$$

where P_{it} is the price of final good i. At the end of the period, the households receive the profits net of taxes, $(1-\tau_t^{\pi})\Pi_{it}$. Thus, the nominal wealth households bring to period $t+1$ is

$$\mathbb{W}_{t+1} = M_t^h + R_t B_t^h + Z_{t+1}^h - \int_0^1 P_{it} c_{it} di + W_t N_t + (1-\tau_t^{\pi})\int_0^1 \Pi_{it} di, \tag{2.4}$$

The households choose $\{c_{it}, N_t, M_t^h, B_t^h, Z_{t+1}^h\}_{t=0}^{\infty}$, for a given sequence $\{P_{it}, W_t, \tau_t^{\pi}\}_{t=0}^{\infty}$ and $\{P_{it}, W_t, \tau_t^{\pi}, \Pi_{it}, R_t, z_{t+1}\Pr(s_{t+1}|s^t)\}_{t=0}^{\infty}$ that maximize (2.1) satisfying (2.2), (2.3) and (2.4) together with a no-Ponzi games condition.

Let $P_t = \left[\int P_{it}^{1-\theta} di\right]^{\frac{1}{1-\theta}}$. The households choose consumption of good i according to $\frac{c_{it}}{C_t} = \left(\frac{P_{it}}{P_t}\right)^{-\theta}$. In addition, the following first order conditions must be satisfied

$$\frac{u_L(t)}{u_C(t)} = \frac{W_t}{P_t}, \tag{2.5}$$

$$\frac{u_C(t)}{P_t} = R_t E_t \left[\frac{\beta u_C(t+1)}{P_{t+1}} \right]. \tag{2.6}$$

2.2. Government

The government must finance an exogenous path of purchases $(G_t)_{t=0}^{\infty}$, such that $G_t = \left[\int_0^1 g_{it}^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}}$, $\theta > 1$, where g_{it} is the government consumption of good i. Given the prices on each good, P_{it}, the government decides according to $\frac{g_{it}}{G_t} = \left(\frac{P_{it}}{P_t} \right)^{-\theta}$. A government policy is a sequence of money supplies $\{M_t^g\}_{t=0}^{\infty}$, interest rates, $\{R_t\}_{t=0}^{\infty}$ a sequence of contingent debt $\left\{Z_{t+1}^g\right\}_{t=0}^{\infty}$, a sequence of non-contingent debt $\{B_t^g\}_{t=0}^{\infty}$ and a tax policy $\{\tau_t^n, \tau_t^\pi\}_{t=0}^{\infty}$ satisfying

$$E_t z_{t+1} Z_{t+1}^g + B_t^g + M_t^g + \frac{\tau_t^n W_t}{1-\tau_t^n} N_t + \tau_t^\pi \int_0^1 \Pi_{it} di \geq Z_t^g + R_{t-1} B_{t-1}^g + M_{t-1}^g + P_t G_t, \tag{2.7}$$

and

$$\lim_{T\to\infty} E_0 Q_T \left[M_T^g + B_T^g + E_{T+1} z_{T+1} Z_{T+1}^g \right] \leq 0, \text{ where } Q_T = \Pi_{k=1}^T z_k. \tag{2.8}$$

2.3. Financial Intermediary

The households, at the beginning of the period t, deposit B_t^h with the financial intermediary. The gross interest rate on these deposits is R_t, received at the beginning of period $t+1$. The financial intermediary lends B_{it}^f to the firms. The return on these loans is also R_t, since the intermediary behaves competitively and makes zero profits. In addition the intermediary buys state contingent assets $E_t Z_{t+1}^b z_{t+1}$ and holds government debt B_t^g.

2.4. Firms

The technology used by firms is linear in labor, the only production input. The firms need to borrow the net wage bill from the financial intermediaries as they must pay wages at the beginning of the period. At the beginning of period t, firm i gets loans, B_{it}^f, from the intermediary and decides to hold M_{it}^f of cash balances.

The problem of firm i is to choose $\{P_{it}, n_{it}, y_{it}, B_{it}^f, M_{it}^f\}_{t=0}^{\infty}$, taking as given the sequence $\{Y_t, P_t, W_t, \tau_t^n, R_t, A_t\}_{t=0}^{\infty}$, that solves:

$$\max \; P_{it}y_{it} - \frac{W_t}{1-\tau_t^n} n_{it} - (R_t - 1)B_{it}^f.$$

subject to the demand function,

$$\frac{y_{it}}{Y_t} = \left(\frac{P_{it}}{P_t}\right)^{-\theta},$$

obtained from the households problem, the production function,

$$y_{it} \leq A_t n_{it},$$

the cash-in-advance restriction,

$$W_t n_{it} \leq M_{it}^f,$$

and

$$M_{it}^f \leq B_{it}^f.$$

The firms set the common price equal to a constant mark-up over marginal cost,

$$P_{it} = P_t = \frac{\theta}{(\theta - 1)} \frac{W_t \left[\frac{1}{(1-\tau_t^n)} + (R_t - 1)\right]}{A_t} \tag{2.9}$$

2.5. Market clearing:

Market clearing requires

$$B_t^f + B_t^g = B_t^h, \text{ where } B_t^f = \int_0^1 B_{it}^f di,$$

$$c_{it} + g_{it} = y_{it},$$

$$N_t = \int_0^1 n_{it} \; di,$$

$$Z_t^g = Z_t^h + Z_t^b,$$

$$M_t^g = M_t^f + M_t^h, \text{ where } M_t^f = \int_0^1 M_{it}^f di.$$

2.6. Equilibrium allocations:

An equilibrium in this environment is an allocation, prices, and a government policy such that: (i) given the prices and the government policy, the allocation solves the problems of the households, firms and financial intermediary; and (ii) the allocation satisfies the market clearing conditions.

The government chooses the policy associated with the equilibrium allocation that gives the highest value of welfare, i.e. solves the standard Ramsey problem.[2] Let $\mathbb{W}_0 = 0$. Then, the Ramsey problem can be simplified to the choice of $\{C_t, N_t\}_{t=0}^{\infty}$ and $\{\tau_t^{\pi}\}_{t=0}^{\infty}$ that maximizes utility (2.1) subject to the feasibility condition,

$$C_t \leq A_t N_t - G_t. \tag{2.10}$$

and an implementability condition that summarizes all the competitive equilibrium conditions. The optimal policy is such that $\tau_t^{\pi} = 1$, since the tax on profits is a lump-sum tax.

Let $\{C_t^*, N_t^*\}_{t=0}^{\infty}$ be the Ramsey allocation. Then we obtain the optimal distortion γ_t^* in each period from condition

$$\frac{u_L(t)}{u_C(t)} = \gamma_t A_t, \text{ where } \gamma_t = \frac{\theta - 1}{\theta} \frac{(1 - \tau_t^n)}{(1 + (R_t - 1)(1 - \tau_t^n))}, \tag{2.11}$$

that combines the intra-temporal condition, (2.5) and the pricing condition, (2.9). The sequences of interest rates and taxes rates $\{R_t, \tau_t^n\}_{t=0}^{\infty}$ are not uniquely determined.

The nominal variables, P_t, W_t, and M_t^h, are also not uniquely determined. The relevant equilibrium conditions to determine these variables are:

$$\frac{W_t}{P_t} = \frac{\theta - 1}{\theta} A_t \gamma_t^*, \tag{2.12}$$

$$\frac{u_C^*\left(C_{t-1}^*, 1 - N_{t-1}^*\right)}{P_{t-1}} = R_{t-1} E_{t-1}\left[\frac{\beta u_C^*\left(C_t^*, 1 - N_t^*\right)}{P_t}\right], t \geq 1, \tag{2.13}$$

and

$$M_t^h + W_t N_t^* = P_t C_t^*. \tag{2.14}$$

Let there be one state at date 0 and Φ_t states at date $t \geq 1$. Consider a given sequence for $\{R_t\}_{t=0}^{\infty}$. At $t = 0$, there is one equation (2.12) and one equation

[2] See Ramsey (1927).

(2.14) to determine the three variables P_0, W_0, and M_0^h . At $t \geq 1$ there are Φ_t equations (2.12), Φ_t equations (2.14), and Φ_{t-1} equations (2.13) to determine $3\Phi_t$ variables. There are, thus, $\Phi_t - \Phi_{t-1}$ degrees of freedom in the determination of the nominal variables P_t, W_t, and M_t^h, $t \geq 0$, with $\Phi_{-1} = 0$. This result is stated in the following proposition.

Proposition 2.1. *Given a sequence $\{\gamma_t^*, R_t\}_{t=0}^{\infty}$ the optimal equilibrium allocation is determined but there is nominal indeterminacy. There are multiple sequences for the households' money holdings, the price level and the nominal wage, $\left\{P_t, W_t, M_t^h\right\}_{t=0}^{\infty}$, associated with that real allocation. The degrees of freedom are $\Phi_t - \Phi_{t-1}$ for each $t \geq 0$.*

This indeterminacy result is related to the one in Sargent and Wallace (1975), where it is shown that prices are indeterminate when the monetary authority picks the interest rates. This indeterminacy result was confirmed by Lucas and Stokey (1983) in a dynamic general equilibrium model where the need to finance exogenous government expenditures with distortionary taxes is explicit.[3]

The result in Proposition 2.1. implies that there are monetary policies such that one of the three nominal variables does not depend on the contemporaneous shocks. A related point was made by Carlstrom and Fuerst (1998) in an environment where prices are set in advance by a fraction of firms.

Since in this environment the government can freely choose the path of interest rates provided that the labor income tax is adjusted to satisfy $\gamma_t = \gamma_t^*$, there are Φ_{t-1} additional degrees of freedom in the joint determination of $\left\{R_t, P_t, W_t, M_t^h\right\}_{t=0}^{\infty}$, using the equations above, (2.12), (2.13) and (2.14). The total degrees of freedom are Φ_t for each period $t \geq 0$. This means that there is a unique monetary and fiscal policy, $\{R_t, M_t^g, \tau_t^n\}_{t=0}^{\infty}$ such that one of the three nominal variables, prices, wages or households money holdings, does not depend on the state. It is also straightforward to show that, in general, the policy that achieves state independence of each one of the nominal variables is a different one. This means that, in general, it is not possible to achieve state independence of more than one of the nominal variables. These results are stated in the following proposition:

Proposition 2.2. *The policy instruments $\{\tau_t^n, R_t, M_t^g\}_{t=0}^{\infty}$ can be chosen in such a way that one and only one of the three nominal variables, prices, wages or households money holdings, $\left(P_t, W_t, M_t^h\right)_{t=0}^{\infty}$ does not depend on the state and implements the optimal real allocation $\{C_t^*, N_t^*\}_{t=0}^{\infty}$.*

[3] See also Chari, Christiano and Kehoe (1991) and Correia, Nicolini and Teles (2003).

3. Transmission mechanisms

We have analyzed so far an economy without frictions. As will become clear, the results in the flexible economy can be directly applied to establish the main point of this paper, that the strength of the transmission mechanism is irrelevant for the conduct of optimal policy. We proceed in the following way: We consider three types of frictions, on the decision of prices, wages and portfolios. Each of these frictions is associated with a transmission mechanism. The strength of a particular monetary transmission mechanism depends on the extent of the friction, measured by the fraction of agents that are able to choose either prices, wages or portfolios contemporaneously. We use the results in the literature on optimal fiscal and monetary policy in economies with sticky prices and sticky portfolios, according to which, when fiscal and monetary policy is conducted jointly it is feasible and optimal to replicate the optimal allocation in the flexible environment. Finally, we apply the results in the previous section to show that the policies that replicate the allocations in the flexible economy are the same independently of the extent of the friction.

The literature has studied the second best optimal government policy when there is one of the three types of frictions, on prices, wages or portfolios. Adao, Correia and Teles (2003) characterize optimal monetary policy in an economy with prices set in advance and show that in general it is not optimal to replicate the allocation under flexible prices. Instead, when both fiscal and monetary policy are chosen jointly the result is overturned and it is always optimal to replicate the flexible price allocation. This is shown in Correia, Nicolini and Teles (2002). It is straightforward to extend those results to an environment with sticky wages. The result is confirmed in an environment where portfolios are set in advance by Adao, Correia and Teles (2001). The following proposition states these results.

Proposition 3.1. *In the presence of only one rigidity, in prices, wages, or portfolios, it is optimal to replicate the Ramsey solution of the flexible economy.*

Now we show the main result of the paper, that the strength of the transmission mechanism is irrelevant for the conduct of optimal policy. We use the result in Proposition 3.1, that the Ramsey solution of the flexible economy should be replicated and Proposition 2.2, stating that this allocation can be achieved with a policy such that the path for one of the nominal variables, price, wages or portfolios, is independent of the state.

Consider an economy where only a fraction $\alpha < 1$ of the firms can set the prices contemporaneously. The remaining firms are restricted as they cannot revise the price they charge. If the policy is the one stated in Proposition 2.2 the firms that can revise the price would choose not do it. The restriction would not be binding. As prices are identical for every firm that particular policy would decentralize the optimal flexible price allocation. This is true for any α, which implies that the optimal policy is independent of the size of the α. The same reasoning applies to the other types of frictions. While the degree of rigidity is irrelevant, the type of rigidity matters, as implied by Proposition 2.2. The following proposition states these results.

Proposition 3.2. *The optimal policy* $\{M_t^g, R_t, \tau_t^n\}_{t=0}^{\infty}$ *depends on the type of friction, but is independent of the extent of the friction measured by* α.

We have not been completely explicit about the particular restrictions on the setting of prices, wages or the decisions on portfolios. The results stated above hold for many specifications of these restrictions. In particular, if, for example, prices are set in a staggered manner, as in Calvo (1987), in order to replicate the allocation under flexible prices the prices will have to be constant over time. This is a particular case of state independence of the price sequence that can be achieved with the policies described in the last section. The nominal interest rate will move with the real rate and taxes on labor income will adjust to guarantee the optimal state dependent intra-temporal distortion. The price setting restrictions could be more complex and still the optimal monetary policy would be the same. For instance, firms could be heterogeneous in that a fraction would be setting prices one period in advance, another fraction would be flexible and the remaining fraction would be setting prices according to Calvo.

We have simplified the analysis by assuming that the nominal interest rate does not generate an additional distortion, as in a model with cash and credit goods or a transactions technology. In those models, the movements in the nominal interest rate would be distortionary and therefore under our assumptions on the fiscal instruments it would not be optimal to replicate the flexible price allocation. Assuming consumption taxes, however, allows to recover the results, as shown in Correia, Nicolini and Teles (2002).

The policy conclusion of this paper is that economies with different αs, i.e. with differing strengths of the monetary transmission mechanism, but with the same type of friction, share the same optimal policy in response to aggregate shocks. This result can be explained using the concept of a gap, defined in the following way: Consider an economy with flexible prices and a given fiscal and monetary policy. The same policy in an economy with nominal rigidities will require lump sum taxes to finance the budget. The gap is the difference between the allocations in the two economies. In response to a technological or government expenditure shock, the gap is larger the larger is the extent of the stickiness. However the effect of the policy reaction to those shocks, aiming at closing the gap, is also larger the larger the extent of the stickiness. We show in this paper that the response of monetary policy is the same for all levels of stickiness. Monetary policy is the most effective when it is most necessary.

An empirical implication of the results above is that if policy is conducted optimally, it is not possible to identify the degree of stickiness from the comovements of aggregate variables. The time series generated by economies with very different levels of nominal rigidities are the same. Thus, the real business cycles paradigm would be useful to describe the behavior of macroeconomic aggregates, but not to assess the effects of a monetary policy shock. This may also justify why the quantitative contribution of the monetary shocks for the explanation of business cycles is relatively insignificant, even with microeconomic evidence on price or wage stickiness.

4. Concluding remarks

The existence of different transmission mechanisms has influenced the discussion on the costs of a common monetary policy across countries. The first step to understand these costs is to identify whether economies with different transmission mechanisms should follow different monetary policy rules. We conclude in this paper that this may not be the case. Asymmetries in the monetary transmission mechanisms do not necessarily impose a cost on a common policy.

In economies with frictions, policy shocks will have very different effects depending on the type and strength of the monetary transmission mechanism. The strength of the transmission mechanism is determined here by the fraction of agents that are prevented from making choices, on either prices, wages or portfolios, in response to shocks. However, if policy is conducted optimally, so that the allocation under full flexibility is replicated, the response to common shocks is the same independently of the strength of the transmission mechanism. A monetary shock will have a big impact, when a big impact is necessary.

It may not be feasible to replicate the allocation under full flexibility. In general, monetary policy cannot undo the effects of more than one source of frictions. In this case the monetary transmission mechanism is relevant for policy. But is it really the case that there is such a vast menu of transmission mechanisms as we commonly see in the policy oriented surveys on this issue?

Other cases in which it is not feasible to replicate the full flexibility allocation is when shocks are idiosyncratic, for example when the rigidity is on prices and the technological shocks are idiosyncratic across firms. To replicate flexible prices, the relative prices would have to move with the shocks, and monetary policy is unable to accomplish this.

When monetary and fiscal policies are not jointly determined, under general conditions it is not optimal to replicate the flexible allocation. Also in this case the transmission mechanism would be relevant in the determination of the optimal policy.

References

[1] Adao, B., I. Correia and P. Teles, 2002, Gaps and Triangles, forthcoming, *Review of Economic Studies*.

[2] Adao, B., I. Correia and P. Teles, 2001, Optimal Interest Rate Policy, mimeo, Banco de Portugal.

[3] Calvo, G, 1987, Staggered Prices in a Utility-Maximing Framework, *Journal of Monetary Economics* 12, 383-98.

[4] Carlstrom C. T. and T. Fuerst, 1998, Price Level and Interest Rate Targeting in a model with Sticky Prices, mimeo, Federal Reserve Bank of Cleveland.

[5] Chari, V. V., Lawrence Christiano and Patrick Kehoe, 1991. Optimal Fiscal and Monetary Policy: Some Recent Results, *Journal of Money, Credit, and Banking* 23, 519-539.

[6] Chari, V.V., P.J. Kehoe and E. R. McGrattan, 1996. Sticky Price Models of the Business Cycle: Can the Contract Multiplier Solve the Persistence Problem?, Federal Reserve Bank of Minneapolis Staff Report 217.

[7] Christiano, L., M. Eichenbaum and C. L. Evans, 1997, Sticky Price and Limited Participation models of Money: A Comparison, *European Economic Review* 41, 6, 1201-1249.

[8] Correia, I., J. P. Nicolini and P. Teles, 2002, Optimal Fiscal and Monetary Policy: Equivalence Results, Federal Reserve Bank of Chicago wp-2002-16.

[9] Fuerst, Timothy, 1992, Liquidity, Loanable Funds, and Real Activity, *Journal of Monetary Economics* 29, 3-24.

[10] Lucas, Robert E. Jr., 1990, Liquidity and Interest Rates, *Journal of Economic Theory* 50, 237-264.

[11] R. E. Lucas, Jr. and N. L. Stokey, 1983. Optimal Fiscal and Monetary Policy in an Economy without Capital, *Journal of Monetary Economics* 12, 55-93.

[12] F. P. Ramsey, 1927, A Contribution to the Theory of Taxation, *Economic Journal* 37, 47-61.

[13] Sargent, T. J. and N. Wallace, 1975, Rational Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule, *Journal of Political Economy* 83, 241-254.

WORKING PAPERS

2000

1/00 UNEMPLOYMENT DURATION: COMPETING AND DEFECTIVE RISKS
— *John T. Addison, Pedro Portugal*

2/00 THE ESTIMATION OF RISK PREMIUM IMPLICIT IN OIL PRICES
— *Jorge Barros Luís*

3/00 EVALUATING CORE INFLATION INDICATORS
— *Carlos Robalo Marques, Pedro Duarte Neves, Luís Morais Sarmento*

4/00 LABOR MARKETS AND KALEIDOSCOPIC COMPARATIVE ADVANTAGE
— *Daniel A. Traça*

5/00 WHY SHOULD CENTRAL BANKS AVOID THE USE OF THE UNDERLYING INFLATION INDICATOR?
— *Carlos Robalo Marques, Pedro Duarte Neves, Afonso Gonçalves da Silva*

6/00 USING THE ASYMMETRIC TRIMMED MEAN AS A CORE INFLATION INDICATOR
— *Carlos Robalo Marques, João Machado Mota*

2001

1/01 THE SURVIVAL OF NEW DOMESTIC AND FOREIGN OWNED FIRMS
— *José Mata, Pedro Portugal*

2/01 GAPS AND TRIANGLES
— *Bernardino Adão, Isabel Correia, Pedro Teles*

3/01 A NEW REPRESENTATION FOR THE FOREIGN CURRENCY RISK PREMIUM
— *Bernardino Adão, Fátima Silva*

4/01 ENTRY MISTAKES WITH STRATEGIC PRICING
— *Bernardino Adão*

5/01 FINANCING IN THE EUROSYSTEM: FIXED VERSUS VARIABLE RATE TENDERS
— *Margarida Catalão-Lopes*

6/01 AGGREGATION, PERSISTENCE AND VOLATILITY IN A MACROMODEL
— *Karim Abadir, Gabriel Talmain*

7/01 SOME FACTS ABOUT THE CYCLICAL CONVERGENCE IN THE EURO ZONE
— *Frederico Belo*

8/01 TENURE, BUSINESS CYCLE AND THE WAGE-SETTING PROCESS
— *Leandro Arozamena, Mário Centeno*

9/01 USING THE FIRST PRINCIPAL COMPONENT AS A CORE INFLATION INDICATOR
José Ferreira Machado, Carlos Robalo Marques, Pedro Duarte Neves, Afonso Gonçalves da Silva

10/01 IDENTIFICATION WITH AVERAGED DATA AND IMPLICATIONS FOR HEDONIC REGRESSION STUDIES
— *José A.F. Machado, João M.C. Santos Silva*

2002

1/02 QUANTILE REGRESSION ANALYSIS OF TRANSITION DATA
— *José A.F. Machado, Pedro Portugal*

2/02 SHOULD WE DISTINGUISH BETWEEN STATIC AND DYNAMIC LONG RUN EQUILIBRIUM IN ERROR CORRECTION MODELS?
— *Susana Botas, Carlos Robalo Marques*

3/02 MODELLING TAYLOR RULE UNCERTAINTY
— Fernando Martins, José A. F. Machado, Paulo Soares Esteves

4/02 PATTERNS OF ENTRY, POST-ENTRY GROWTH AND SURVIVAL: A COMPARISON BETWEEN DOMESTIC AND FOREIGN OWNED FIRMS
— José Mata, Pedro Portugal

5/02 BUSINESS CYCLES: CYCLICAL COMOVEMENT WITHIN THE EUROPEAN UNION IN THE PERIOD 1960-1999. A FREQUENCY DOMAIN APPROACH
— João Valle e Azevedo

6/02 AN "ART", NOT A "SCIENCE"? CENTRAL BANK MANAGEMENT IN PORTUGAL UNDER THE GOLD STANDARD, 1854-1891
— Jaime Reis

7/02 MERGE OR CONCENTRATE? SOME INSIGHTS FOR ANTITRUST POLICY
— Margarida Catalão-Lopes

8/02 DISENTANGLING THE MINIMUM WAGE PUZZLE: ANALYSIS OF WORKER ACCESSIONS AND SEPARATIONS FROM A LONGITUDINAL MATCHED EMPLOYER-EMPLOYEE DATA SET
— Pedro Portugal, Ana Rute Cardoso

9/02 THE MATCH QUALITY GAINS FROM UNEMPLOYMENT INSURANCE
— Mário Centeno

10/02 HEDONIC PRICES INDEXES FOR NEW PASSENGER CARS IN PORTUGAL (1997-2001)
— Hugo J. Reis, J.M.C. Santos Silva

11/02 THE ANALYSIS OF SEASONAL RETURN ANOMALIES IN THE PORTUGUESE STOCK MARKET
— Miguel Balbina, Nuno C. Martins

12/02 DOES MONEY GRANGER CAUSE INFLATION IN THE EURO AREA?
— Carlos Robalo Marques, Joaquim Pina

13/02 INSTITUTIONS AND ECONOMIC DEVELOPMENT: HOW STRONG IS THE RELATION?
— Tiago V.de V. Cavalcanti, Álvaro A. Novo

2003

1/03 FOUNDING CONDITIONS AND THE SURVIVAL OF NEW FIRMS
— P.A. Geroski, José Mata, Pedro Portugal

2/03 THE TIMING AND PROBABILITY OF FDI:
An Application to the United States Multinational Enterprises
— José Brandão de Brito, Felipa de Mello Sampayo

3/03 OPTIMAL FISCAL AND MONETARY POLICY: EQUIVALENCE RESULTS
— Isabel Correia, Juan Pablo Nicolini, Pedro Teles

4/03 FORECASTING EURO AREA AGGREGATES WITH BAYESIAN VAR AND VECM MODELS
— Ricardo Mourinho Félix, Luís C. Nunes

5/03 CONTAGIOUS CURRENCY CRISES: A SPATIAL PROBIT APPROACH
— Álvaro Novo

6/03 THE DISTRIBUTION OF LIQUIDITY IN A MONETARY UNION WITH DIFFERENT PORTFOLIO RIGIDITIES
— Nuno Alves

7/03 COINCIDENT AND LEADING INDICATORS FOR THE EURO AREA: A FREQUENCY BAND APPROACH
— António Rua, Luís C. Nunes

8/03 WHY DO FIRMS USE FIXED-TERM CONTRACTS?
— José Varejão, Pedro Portugal

9/03 NONLINEARITIES OVER THE BUSINESS CYCLE: AN APPLICATION OF THE SMOOTH TRANSITION AUTOREGRESSIVE MODEL TO CHARACTERIZE GDP DYNAMICS FOR THE EURO-AREA AND PORTUGAL
— Francisco Craveiro Dias

10/03 WAGES AND THE RISK OF DISPLACEMENT
— Anabela Carneiro, Pedro Portugal

11/03 SIX WAYS TO LEAVE UNEMPLOYMENT
— Pedro Portugal, John T. Addison

12/03 EMPLOYMENT DYNAMICS AND THE STRUCTURE OF LABOR ADJUSTMENT COSTS
— José Varejão, Pedro Portugal

13/03 THE MONETARY TRANSMISSION MECHANISM: IS IT RELEVANT FOR POLICY?
Bernardino Adão, Isabel Correia, Pedro Teles