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

Bernardino Adão
Banco de Portugal and Instituto Superior Técnico

Isabel Correia
Banco de Portugal, Universidade Católica Portuguesa and CEPR

Pedro Teles†
Banco de Portugal, Universidade Católica Portuguesa and CEPR

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Abstract

Monetary shocks have larger effects, the larger is the extent of the frictions that deliver short term non neutrality. The impact of other types of shocks is also affected by the extent of those frictions. Monetary policy can undo the combined effect of the exogenous shocks and the frictions allowing to replicate the allocations in the economy without frictions. We show that this is the case in economies with sticky prices or market segmentation, so that monetary policy does not depend on the scope of these frictions. In this sense, the strength of the monetary transmission mechanism is irrelevant for the conduct of monetary policy. So, asymmetry in monetary transmission does not impose a cost on a common policy.

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†Corresponding author: Banco de Portugal, DEE, R. Francisco Ribeiro, n. 2, 1150 Lisbon, Portugal, Tel. # 351-21-3128397, Fax# 351-21-8132221, pmpteles@bportugal.pt

1. Introduction

How should monetary policy be conducted in response to shocks in the economy? How relevant are the transmission mechanisms 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.

In our model economy, monopolistic competitive firms may be 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. This is shown in Christiano, Eichenbaum and Evans (1997).[1]

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.[2] However, it is still possible to use policy to neutralize the effects of other types of exogenous shocks in the technology or preferences. This is in line with recent literature, such as Ireland (1996), Goodfriend and King (1997), Carlstrom and Fuerst (1998), King and Wolman (1998), Rotemberg and Woodford (1998). These are all close relatives to this paper, in particular Carlstrom and Fuerst (1998).

In this environment if 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), Fuerst (1992), Christiano and Eichenbaum (1992, 1995) and Christiano, Eichenbaum and Evans (1997). Optimal monetary policy in this environment has been studied by Carlstrom and Fuerst (1995) and Aiyagari and Braun (1996). The households choose their portfolios before observing the shocks, which gives rise to liquidity effects of monetary policy. Aggregate shocks also have liquidity effects that can be neutralized by monetary policy. Optimal monetary policy undoes the effect of those shocks by replicating the desired portfolio choices through monetary transfers. Here the measure of the monetary transmission mechanism is given by

[1] See also Chari, Kehoe and McGrattan (1996)

[2] See Ireland (1994), that builds on the work on sustainable equilibria of Chari and Kehoe (1990).

the share of households that are able to adjust the portfolios.

At first sight one could think that different degrees of monetary transmission can impose costs on a common monetary policy that responds optimally to aggregate shocks, as is commonly claimed in the literature on optimal currency areas. In this paper we show that this is not the case. The strength of the monetary transmission mechanism is irrelevant for the conduct of the optimal monetary policy.

The paper proceeds as follows: In the next section we identify the allocations in an economy where prices are perfectly flexible and there are no portfolio restrictions. We show that there are monetary policies such that either prices or portfolio choices are pre-determined, in the sense that they do not change with contemporaneous information. Thus, with adequate monetary policy it is possible to replicate the behavior of the economy with either one of these restrictions. In sections 3 and 4, we state the main results. These results entail that there are optimal response common monetary policies which are independent of the degree of price or portfolio stickiness. In Section 5, we provide the intuition for the results and discuss policy implications. Section 6 contains concluding remarks.

2. An economy with flexible prices 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 indexed by $i \in [0,1]$, financial intermediaries and a government or central bank. Each firm produces a distinct, perishable consumption good, indexed by i.

The government makes a lump-sum monetary transfer $X_t = (G_t - 1)M^s_{t-1}$ to the representative financial intermediary at each date $t = 0, 1, 2, ..,$ where M^s_{t-1} represents the money supply per household at date $t-1$. The money supply evolves according to $M^s_t = G_t M^s_{t-1}$. If M_{t+1} denotes the money carried by the household into period $t+1$, market clearing requires that $M^s_t = M_{t+1}$, for all $t = 0, 1, 2, ...$

The financial intermediaries receive loans L_t from the households and lend them out to the firms. The gross nominal interest rate on both the deposits and the loans is R_t. The financial intermediaries receive from the monetary authority the transfer of money X_t, that is also lent out to the firms.

2.1. The households

The households start period t with outstanding money balances, M_t, and decide to lend out L_t in the credit market to the financial intermediaries. They receive the labor income, $W_t N_t$ where W_t is the nominal wage rate, that can be used to purchase consumption in the same period. The purchases of consumption goods have to be made with $M_t - L_t + W_t N_t$, so,

$$\int_0^1 P_t(i) c_t(i) di \leq M_t - L_t + W_t N_t \tag{2.1}$$

At the end of the period, the households receive the gross returns on the loans $R_t L_t$ as well as the profits from the financial intermediaries, $R_t X_t$, and from the firms $\Pi_t = \int_0^1 \Pi_t(i) di$.

The preferences are described by the expected utility function:

$$U = E\left\{\sum_{t=0}^{\infty} \beta^t u\left(C_t, 1 - N_t\right)\right\}$$

where β is a discount factor and the composite consumption C_t is

$$C_t = \left[\int_0^1 c_t(i)^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}, \theta > 1.$$

The households face the budget constraints

$$M_{t+1} = \left[W_t N_t + M_t - L_t - \int_0^1 P_t(i) c_t(i) di\right] + R_t\left[L_t + X_t\right] + \Pi_t \tag{2.2}$$

Let $P_t = \left[\int P_t(i)^{1-\theta} di\right]^{\frac{1}{1-\theta}}$. We obtain the following marginal conditions:

$$\frac{c_t(i)}{C_t} = \left(\frac{P_t(i)}{P_t}\right)^{-\theta} \tag{2.3}$$

$$\frac{U_{1-Nt}}{U_{ct}} = \frac{W_t}{P_t} \tag{2.4}$$

$$\frac{U_{ct}}{P_t} = R_t E_t\left[\frac{\beta U_{ct+1}}{P_{t+1}}\right] \tag{2.5}$$

Condition (2.3) defines the demand for each of the intermediate goods i and condition (2.4) sets the intratemporal marginal rate of substitution between consumption and leisure equal to the real wage. Since the households can use the labor income to consume the good in the same period the nominal interest rate does not appear in condition (2.4).

Condition (2.5) is a requirement for the optimal savings decision. One additional unit of deposits, L_t, implies the marginal cost of $\frac{U_{ct}}{P_t}$, and the benefit of $R_t E_t \left[\frac{\beta U_{ct+1}}{P_{t+1}}\right]$, since the returns can only be used for consumption in the following period.

2.2. Firms

The firms need to borrow the wage bill from the financial intermediaries. $B_t(i)$ is the demand for loans by firm i. The problem of the firm is to choose the price in order to maximize profits:

$$\Pi_t(i) = P_t(i)y_t(i) - W_t n_t(i) - (R_t - 1)B_t(i)$$

satisfying the demand function (2.3),

$$\frac{y_t(i)}{C_t} = \left(\frac{P_t(i)}{P_t}\right)^{-\theta}, \tag{2.6}$$

obtained from the households problem, the production function,

$$y_t(i) \leq s_t n_t(i),$$

where s_t is the level of technology, and the cash-in-advance restriction,

$$W_t n_t(i) \leq B_t(i).$$

If the production function and the cash-in-advance restrictions are both satisfied with equality, the profits can be written as

$$\Pi_t(i) = P_t(i)y_t(i) - R_t W_t \frac{y_t(i)}{s_t}$$

where $P_t(i)$ is determined by the demand function (2.6). The first order condition of this problem is

$$P_t(i)\left[1 + \frac{d\ln P_t(i)}{d\ln y_t(i)}\right] - \frac{R_t W_t}{s_t} = 0$$

where $\frac{d \ln P_t(i)}{d \ln y_t(i)} = -\frac{1}{\theta}$, so that θ is the demand elasticity. Therefore, it must be that

$$P_t = P_t(i) = \frac{\theta}{\theta - 1} \frac{W_t R_t}{s_t}$$

The firms set a common price, a constant mark-up over marginal cost. As the elasticity of demand θ gets larger, the mark-up converges down to 1.

Let $w_t = \frac{W_t}{P_t}$. Then we have

$$w_t R_t = \frac{(\theta - 1) s_t}{\theta} \tag{2.7}$$

2.3. Market clearing:

$$L_t + X_t = B_t$$

where $B_t = \int_0^1 B_t(i) di$

$$c_t(i) = y_t(i)$$

$$N_t = \int_0^1 n_t(i) \ di$$

2.4. Equilibrium allocations:

The equilibrium allocations in this environment with flexible prices and portfolios decisions can be summarized by the following equations that determine in every period $C^*(s_t, R_t)$, $N^*(s_t, R_t)$ and $\frac{W_t}{P_t}^*(s_t, R_t)$:

$$\frac{U_{1-N}(C_t, 1 - N_t)}{U_c(C_t, 1 - N_t)} = \frac{W_t}{P_t} \tag{2.8}$$

$$C_t = s_t N_t \tag{2.9}$$

and (2.7).

What is the effect of an increase in the real wage in this economy? From (2.8) and (2.9), we obtain

$$\frac{dN_t}{d\frac{P_t}{W_t}} = \frac{1}{D_{C_t} s_t - D_{1-N_t}} \tag{2.10}$$

Assuming that both leisure and consumption are normal goods, so that $D_{ct} \leq 0$ (with GHH preferences $D_{ct} = 0$) and $D_{1-Nt} > 0$ respectively, then

$$\frac{dN_t}{d\frac{P_t}{W_t}} < 0 \tag{2.11}$$

With an increase in the real wage (possibly caused by a cut in the interest rate), employment and consumption go up.

The allocations in this environment can be supported by a large set of money supply processes. Monetary policy affects equilibrium allocations exclusively through the implied path of the nominal interest rate. This economy with flexible prices and no portfolio restrictions displays money neutrality, in the sense that a change in the money supply that does not affect the path of the nominal interest rate, has no real effects and is transmitted exclusively to the price levels and the nominal value of the loans by the household to the financial intermediaries. The economy is neutral but is not superneutral. In Adão, Correia and Teles (1999) we characterize the conditions under which the flexible prices allocation is the optimal allocation in an environment with sticky prices. We show that when the path of interest rates is state independent the flexible prices allocation is optimal for preferences that are aggregable and compatible with balanced growth.

What are the sequences of price levels, private credit and money supplies that support this allocation? These paths will have to satisfy:

$$U_{ct}C_t = R_t E_t \left[\beta U_{ct+1} C_{t+1} \frac{M^s_{t+1}}{M^s_t}\right] \tag{2.12}$$

obtained from (2.5), as well as the households and firms cash-in-advance constraints, and market clearing, for

$$P_t C_t \leq M_t - L_t + W_t N_t = M_t - L_t + B_t = M_t + X_t = M^s_t \tag{2.13}$$

In this set of money supply policies there is a policy such that the prices are pre-determined, in the sense that they are not revised with the contemporaneous information. Let s^t be the history of shocks, the proposition follows,

Proposition 2.1. *There is a sequence of pre-determined prices (set at time t using the information available at time $t-1$), $\{_{t-1}P^*_t(s^t)\}$, and one associated sequence of money supplies, $\{X^*_t(s^t)\}$ that are consistent with the equilibrium allocations described by (2.5), (2.7), (2.8), and (2.9).*

Proof. Let the money supply, $M_t^{s*}(s^t) = M_t(s^{t-1}) + X_t^*(s^t)$, be given by

$$M_t(s^{t-1}) + X_t^*(s^t) =_{t-1} P_t^*(s^t)C_t^*(s^t) \tag{2.14}$$

so that the resulting price will not change with the information at time t. This policy is consistent with the equations (2.7), (2.8) and (2.9). It remains to be shown that it is also consistent with (2.5). When prices for period $t+1$ are chosen with the information at t, $\frac{P_{t+1}}{P_t}$ is known in t. Then, given the allocations $\{C_t^*, N_t^*, R_t\}$ the sequence of pre-determined prices satisfies

$$\frac{1}{R_t} = \frac{P_t}{P_{t+1}} E_t \left[\frac{\beta U_{ct+1}}{U_{ct}} \right]$$

■

The equilibrium allocation is supported by a money supply that reacts contemporaneously to the state of the economy, so that the prices will not have to adjust to the new information. A similar result, stated in the following proposition, is obtained for pre-determined loans.

Proposition 2.2. *There is a sequence of pre-determined loans (set at time t using the information available at time $t-1$), $\{_{t-1}L_t^*(s^t)\}$, and one associated sequence of money supplies, $\{X_t^*(s^t)\}$ that are consistent with the equilibrium allocations described by (2.5), (2.7), (2.8), and (2.9).*

Proof. Let the money supply, $M_t^{s*}(s^t) \equiv M_t(s^{t-1}) + X_t^*(s^t)$, be given by

$$M_t(s^{t-1}) + X_t^*(s^t) = P_t^*(s^t)C_t^*(s^t) \tag{2.15}$$

and

$$_{t-1}L_t(s^t) + X_t^*(s^t) = W_t^*(s^t)N_t^*(s^t) \tag{2.16}$$

so that the households lending decisions at time t do not depend on the contemporaneous information. This policy is consistent with the equations (2.7), (2.8) and (2.9). It is also consistent with (2.5), since there are many ratios of price levels consistent with sequences of pre-determined lending decisions that would deliver the same allocations. Also notice that

$$\frac{_{t-1}L_t(s^t) + X_t^*(s^t)}{M_t(s^t) + X_t^*(s^t)} = \frac{W_t^*(s^t)}{P_t^*(s^t)s_t} = \frac{(\theta - 1)}{\theta R_t} \tag{2.17}$$

so that, at each date, $X_t^*(s^t)$ depends on the shock at time t only through R_t. ■

3. When prices are set in advance

We consider now an environment where a set of firms of measure α set the prices one period in advance and commit to sell the output on demand in period t at the previously chosen price. These prices are $P_t^S(i)$. The remaining $1-\alpha$ firms set prices for period t in that same period, $P_t^F(i)$.

When firm i sets prices one period in advance it solves the problem of choosing the price $P_t(i)$ that maximizes

$$E_{t-1}\left[\frac{U_c(t+1)}{P_{t+1}}y_t(i)\left(P_t(i)-\frac{R_tW_t}{s_t}\right)\right] \tag{3.1}$$

where MU_{t+1} is the marginal valuation of consumption at period $t+1$,when the profits can be used for consumption, in units of consumption at t . Expression (3.1) can be rewritten as

$$E_{t-1}\left[\frac{U_c(t+1)}{P_{t+1}}C_t\left(\frac{P_t(i)}{P_t}\right)^{-\theta}\left(\frac{P_t(i)}{P_t}-\frac{R_tW_t}{s_tP_t}\right)\right].$$

The first order conditions are

$$E_{t-1}\left[\frac{U_c(t+1)}{P_{t+1}}\frac{C_t(1-\theta)}{P_t^{-\theta}}+\frac{U_c(t+1)}{P_{t+1}}C_t\theta\frac{P_t(i)^{-1}}{P_t^{-\theta}}\frac{R_tW_t}{s_t}\right]=0,$$

so that the solution is given by

$$P_t(i)^S=\frac{\theta E_{t-1}\left[\frac{U_c(t+1)}{P_{t+1}}C_tP_t^{\theta}\frac{R_tW_t}{s_t}\right]}{(\theta-1)E_{t-1}\left[\frac{U_c(t+1)}{P_{t+1}}C_tP_t^{\theta}\right]},$$

which can be written as

$$P_t(i)^S=P_t^S=\frac{\theta}{(\theta-1)}E_{t-1}\left[\upsilon_t\frac{R_tW_t}{s_t}\right]$$

where $\upsilon_t=\frac{\frac{u_{Ct+1}}{P_{t+1}}C_t}{E_{t-1}\left[\frac{u_{Ct+1}}{P_{t+1}}C_t\right]}$.

The price level in this economy is given by the appropriate average of two prices,

$$P_t=\left[\alpha P_t^{S(1-\theta)}+(1-\alpha)P_t^{F(1-\theta)}\right]^{\frac{1}{1-\theta}}$$

where $P_t^F = \frac{\theta}{(\theta-1)} \frac{R_t W_t}{s_t}$, as in the economy with flexible prices only.

In this economy, when there is an unanticipated monetary injection, because some prices are set in advance, prices will not increase fully in order to compensate the additional money supply; consumption and employment will also increase. This increase in activity raises the real wage, from (2.4). Marginal costs increase, so that the ex-post mark up will be lower than $\frac{\theta}{(\theta-1)}$. This reduction in the mark-up is in itself beneficial. However, there will also be a relative price distortion, because the flexible prices will adjust in order to partially absorb the shock. Even if the gains compensate the losses, this policy cannot obviously be used systematically. A stochastic monetary policy, independent of the state of the economy, is only destabilizing.

In the presence of this price stickiness, exogenous shocks on preferences or technology, will also have undesirable effects on ex-post mark-ups and relative prices, moving the economy away from the potential level of activity. Monetary policy can, in response to these shocks, neutralize those effects, and keep the economy operating at its full potential. Even if the optimal response to a positive technological shock, or a shock in public expenditures, is to increase the money supply, so that the optimal policy is procyclical, still one could say that this neutral policy is in some sense stabilizing.

When the money supply is given by the X_t^* characterized in the proof of Proposition 2.1, flexible prices are not revised with new information. Then,

$$P_t^F(i) =_{t-1} P_t^* = P_t(i)^S$$

This means that when monetary policy is conducted under the conditions in Proposition 2.1, following the path of transfers $\{X_t^*\}$, the restriction of prices being set in advance is not binding. This result is stated in the following lemma,

Lemma 3.1. *For a money supply sequence given by $\left\{M_t^{S*}\right\}$, the equilibrium allocations and prices when a fraction of firms set the prices in advance, coincides with the equilibrium with flexible prices.*

The intuition is that while some firms will be setting prices one period in advance, there exists a monetary policy such that the firms choosing prices at t for period t will choose a price level identical to the one chosen by the firms that chose prices in advance. This monetary policy is the one described in Proposition 2.1. This policy is optimal, as money reacts to the shocks in period t, neutralizing the effects of the frictions in the economy. The sequence of flexible prices

${}_{t-1}P_t^*$ corresponds to one sequence of money supplies, which is independent of the *strength* of the monetary transmission mechanism (i.e. of the fraction of firms that set prices in advance, α).

The following corollary states the main policy conclusion of this paper, that differing monetary transmission mechanisms do not impose a cost on a single policy in a monetary union.

Corollary 3.2. *Economies with different αs, i.e. with differing monetary transmission mechanism, share the same optimal policy in response to aggregate shocks. Thus, in a monetary union hit by a common shock the single monetary policy is identical to the national monetary policies.*

4. When portfolios are set in advance

When households are restricted on their portfolio decisions, the environment is the version proposed by Christiano, Eichenbaum and Evans (1997) of the model with market segmentation of Lucas (1990), Fuerst (1992), Christiano and Eichenbaum (1992, 1995). In these models, there are real effects of unanticipated monetary injections.

These effects include a liquidity effect that may dominate the anticipated inflation effect, and provoke, with a money injection, a reduction in interest rates. This is clear when we use the equilibrium conditions

$$P_t C_t \leq M_t + X_t,$$

$$W_t N_t \leq L_t + X_t,$$

the resources constraint, $C_t = s_t N_t$ and the marginal condition for optimal price setting by the firms $P_t = \frac{\theta R_t W_t}{(\theta-1)s_t}$. If the constraints are satisfied with equality, then

$$\frac{L_t + X_t}{M_t + X_t} = \frac{W_t}{P_t s_t} = \frac{(\theta - 1)}{\theta R_t}$$

When L_t is set one period in advance and there is an unanticipated increase in X_t, then, because $L_t < M_t$, the real wage goes up, and the nominal interest rate goes down. The increase in the real wage induces an increase in employment and consumption.

When a household chooses the portfolio before the shocks then the savings decision must satisfy the following condition, that replaces (2.5):

$$E_{t-1}\left(\frac{U_c(t)}{P_t}\right) = E_{t-1}\left(\beta R_t \frac{U_c(t+1)}{P_{t+1}}\right) \tag{4.1}$$

As in Fuerst (1992), this condition can be written as

$$\begin{aligned} \Lambda_t &= \frac{U_c(t)}{P_t} - \beta R_t \frac{U_c(t+1)}{P_{t+1}} \\ &\text{and} \\ E_{t-1}(\Lambda_t) &= 0 \end{aligned}$$

Λ_t is the difference at date t between the value of money in the goods market and its value in the credit market. This value would have to be zero if the households could choose the portfolios contemporaneously. Here it is zero only in expected value. We can write

$$R_t = \frac{\frac{U_c(t)}{P_t} - \Lambda_t}{\beta \frac{U_c(t+1)}{P_{t+1}}}$$

so that a positive money shock (injected through the credit market) reduces the value of money in the credit market. As a result Λ_t is positive and would reduce the nominal interest rate. This effect is compensated by the anticipated inflation effect.

The real impact of monetary policy is larger the larger is the fraction α of households that are restricted from participating in the financial markets, at any point in time. This gives the measure of the monetary transmission mechanism.

In this environment, optimal monetary policy equates the shadow prices of money in the different markets, setting Λ_t to zero, and easing the portfolio adjustment constraint. We show that optimal monetary policy does not depend on the strength of monetary transmission. This is stated in the following lemma, which is analogous to lemma 1 in the last section.

Lemma 4.1. *For a money supply sequence given by $\{X_t^*\}$ described in Proposition 2, the equilibrium where a fraction of households choose their portfolios before the shock, coincides with the equilibrium with flexible portfolios.*

Since monetary policy is such that the optimal decisions with flexible portfolios are determined using the information at time $t-1$, this constraint that portfolios are determined before the shock is not binding. All the households will make the

same portfolio decisions and the allocation coincides with the one with flexible portfolios.

As before we get the following corollary:

Corollary 4.2. *: Economies with different αs, i.e. with differing monetary transmission mechanisms, share the same optimal policy in response to aggregate shocks. Thus in a monetary union the single monetary policy is identical to the national monetary policies.*

5. Explaining the results

In the monetary economies with frictions analyzed in this paper, money shocks will have very different effects depending on the type and strength of the monetary transmission mechanism. For this reason a common monetary policy in countries with very different mechanisms can be costly and provoke disagreement. If monetary policy is conducted with a stochastic component that does not react to the state of the economy this is indeed the case. However, this is not the way monetary policy is ran. Monetary policy is useful because it can react to the state of the economy, easing constraints that would otherwise prevent the economy from operating to its full potential, in good or bad times. Using old language, what monetary policy should do is to close gaps, which are the result of the frictions that were analyzed here.

The role of monetary policy in a sticky prices environment is precisely to ease the constraint of price stickiness. If prices cannot adjust to new information, then monetary policy should be such that they would not need to change, even if they could. In this model with sticky prices, a positive technological shock, like a cut in the price of oil, should induce higher activity and employment, as well as consumption. If monetary policy does not react to this, then it will not allow economic agents to take full advantage of the temporary favorable conditions. What should monetary policy be? Money should be sufficiently abundant, so that the economy operates fully, and the gap to the potential level of economy activity can be closed.

Can monetary policy have this neutralizing role, in an economy where different sectors or regions, or countries, are characterized by different types or strength of monetary transmission? The answer is to some extent, yes. In economies with different degrees of price rigidity, the impact of a technological, preferences or fiscal shock, is of different degree depending on the degree of stickiness. In an

economy where prices are very flexible, the effects will be small. In this economy in order to close this small gap, a relatively large monetary shock (relative to the size of the gap) will be necessary. On the other hand, in an economy where prices are very sticky, the effect of the original shock is very high, but the monetary shock will have to be relatively small in order to obtain the desired results.

When monetary policy is more effective, it is also more necessary. A monetary shock will have a big impact, when a big impact is necessary. The monetary policy is not at all effective in a world with no frictions, case in which it is absolutely not necessary. The effectiveness and necessity of the monetary policy are higher the larger is the strength of the monetary transmission.

We have shown that what has to be done in a simple environment with sticky prices does not depend on the degree of the friction. This is also true if the friction is the result of restrictions on portfolio adjustments. However, the monetary policy is not the same for the two types of frictions. Monetary policy cannot undo the effects of more than one source of frictions. This is true for a single economy as it is for a group of countries. What must be done in an economy with portfolio stickiness and in one with price stickiness is different. In this sense the monetary transmission mechanism is relevant for monetary 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? It could be that the empirically identified channels are simply the result of different reduced forms of the one model, where one fundamental friction drives all the empirical deviations from the Quantity Theory of money.

Different shocks require different replies of monetary policy. What then if shocks to a group of countries are asymmetric when these countries must follow a common policy? In these environments, we conjecture that the optimal response to asymmetric shocks is the same, unless these shocks affect the aggregate. In the sticky prices model, it is the aggregate cash-in-advance constraint that is relevant. If money flows freely from one country to another, then money will go to where it is necessary and the frictions will have no effect on the economy, unless of course, there is an aggregate shock as well. If instead, money does not flow freely, that in itself has implications on how to run monetary policy, for it would not be adequate to run it centrally through open market operations. There would have to be local management of monetary policy that would resemble banking policy. The same irrelevance of asymmetric shocks seems to hold in the model with market segmentation, as long as all the firms are connected to the same central market, where monetary policy is conducted.

Our analysis has abstracted from an important point, that in the context of these models the optimal long run, from a Ramsey (1927) perspective[3], as well as the optimal short run policy, is to follow the Friedman rule, of setting the nominal interest rate equal to zero. When this is the case, the cash in advance constraints will no longer be binding which means that the frictions will have no effect on economic activity[4].

6. Concluding remarks

> ...So much of barbarism, however, still remains in the transactions of most civilised nations, that almost all independent countries choose to assert their nationality by having to their own inconvenience and that of their neighbours, a peculiar currency of their own.

John Stuart Mill (1894), cited in Mundell (1961)'s optimal currency areas work.

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