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Why Do Central Banks Push for Structural Reforms? The Case of a Reform in the Labor Market

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Abstract

In spite of being mainly concerned with stabilization policies, central banks in many developed countries often advocate the necessity of structural reforms. In turn, demand-side policies - such as monetary policy - can often help improving the political support of reforms (two-handed-approach). By arguing that labor market reforms influence the effectiveness of monetary policy, we assess if central banks have incentives to help promoting such reforms.

In order to identify the channels through which the effects of the reform impinge on the effectiveness of monetary policy, we add stylized features of the labor market to a standard New Keynesian model for monetary policy analysis. In this framework, a labor market reform is modeled as a structural change inducing a permanent shift in the flexible prices unemployment and output levels. The reform-induced adjustments, under different sources of macroeconomic and reform implementation inertias, are then compared across different monetary policy rules.

We find that, in general, labor market reform increases the effectiveness of monetary policy as a demand-management instrument. However, conditional to the presence of different inertias, the reform process can bring about transition stabilization costs, depending on the monetary policy rule. Choosing a particular monetary policy rule, as well as the business cycle timing of the reform, are means to reduce such costs.

Keywords: Monetary policy effectiveness; Monetary policy rules; Labor market reform; New-Keynesian models.

JEL Classification Codes: E24; E52; E58.

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1 Introduction

In spite of being mainly concerned with stabilization policies, central banks in many developed countries often advocate the necessity of reforms in the labor market. In fact, in addition to the more direct gains in macroeconomic efficiency, structural reforms like those in the labor market may also affect the effectiveness of monetary policy. From monetary policy literature we learn that independent and optimizing central banks do not care about the reform's impact on potential output, as Loss functions reflect only price and output stabilization goals. Therefore, the transition and permanent effects of the reform can affect monetary policymaking only to the extent of their impact on the stabilization role of the monetary authorities. In turn, the implementation of a labor market reform, as any structural reform, can be jeopardized because it often lacks political support. Demand-side policies, such as monetary policy, can often help to improve its political sustainability (Aguiar and Ribeiro, 2007).

In this context, our aim is to quantitatively evaluate the impact of a labor market reform on the effectiveness of the monetary policy and thus, check if central banks have incentives to conduct monetary policies to lend a helping hand to the reform's political support. Monetary policy effectiveness refers to the central bank's ability to achieve its stabilization goals. Improvements in effectiveness can occur due to changes in the economic structure, that reduce the cost at which stabilization goals are achieved or, in other words, that improve the stabilization trade off. These gains can occur even when monetary policy is inefficient – *i.e.*, even under non-optimal rules.

As a starting point, in section 2 we describe an economy by using a macro model which combines the main features of the standard New-Keynesian rational-expectations models, widely used in monetary policy analysis, with some specific labor market features. In particular, by including a right-to-manage process of collective bargaining over nominal gross wages, the model yields a flexible-prices equilibrium without labor-market clearing.

Having included some labor market institutions in the model, it is possible to identify instruments of labor market reform. In particular, in section 3, we consider the reduction of the unemployment-benefit replacement ratio as a stylized labor market reform, that can be pre-announced – one-shot or gradually implemented – or unexpected.

In section 4, we first establish the criteria for measurement of the effects of the reform on stabilization costs, and then proceed with its computation, for different macroeconomic and reform implementation scenarios, across different monetary policy rules. In regards to the latter, we allow four alternative hypotheses: optimal monetary policy, under commitment and under discretion, and the Taylor rule, with and without interest-rate smoothing. On the one hand, impacts on stabilization costs may arise during the adjustment periods following reform implementation – reform induced transition costs. On the other hand, by affecting the unemployment-inflation trade off once the economy has fully adjusted, the reform may improve the effectiveness of monetary policy in stabilizing the economy in face of shocks – permanent effects. Evaluation of these impacts is carried out by computing the central bank's Loss function, in face of reform implementation and in face of demand-side, technology or cost-push shocks.

Final remarks are presented in section 5. We find that, in general, labor market reform reduces the costs of monetary policy as a demand-management device. However, conditional on the presence of different sources of inertia, produced either by the functioning of the goods market or by the reform implementation process, the reform can bring about transition stabilization costs, depending on the monetary policy rule. Choosing a particular monetary policy rule, as well as the business cycle timing of the reform, are means to reduce such costs.

2 A Macroeconomic Model with Labor Market Frictions

In this section we proceed with the description of a model designed to capture the interactions between labor market reform and monetary policy. The model is exhaustively presented in Aguiar and Ribeiro (2007) and thus, is only briefly described here. In particular, we follow the standard New-Keynesian framework modified to include non-clearing labor-market features. The latter affect the non-efficient flexible-price output level, the feasible output level towards which demand-side management policies, namely monetary policy, should be targeted at.

2.1 Households

Consider an infinitely-lived risk-averse individual (*i.e.*, household), representative of the consumers' behavior in the economy. Enjoying utility from consumption and leisure, the representative household aims at

$$\underset{C_{t+j},GB_{i+j+1}}{Max} \quad E_t \sum_{j=0}^{\infty} \beta^{t+j} \left(Log\left[C_t(i) - hC_{t-1}(i)\right] \exp(g_t) - \frac{N_t^{(1+\varphi)}}{1+\varphi} \right)$$

$$s.t. \quad C_{t+j} = \frac{\Pi_{t+j}}{P_{t+j}} + \frac{W_{t+j}}{P_{t+j}}(1-u_{t+j}) - GB_{t+j+1}\frac{1}{(1+rr_{t+j})} + GB_{t+j}. \qquad (1)$$

In the utility function, based on Christiano *et al*'s (2005), C stands for *per capita* consumption of a composite final good, N for the hours worked by the representative individual, g defines a shock to preferences and β $(0 < \beta < 1)$ is the discount factor. Either being employed or unemployed, the individual supplies a fixed amount of labor, normalized to 1. Effective *per capita* hours of work, N, are taken as given by the individual, as they are determined by the demand for labor; assuming $N \leq 1$, the unemployment rate is $u = 1 - N$. The index of habit persistence, $h \geq 0$, captures the consumers' wish to smooth both the level and the change in consumption, slowly changing habits, and confers the utility function an appealing form for fitting the data (see, for instance, Smets and Wouters, 2003).

The inter-temporal budget constraint results from a weighted average of the constraints facing the employed and the unemployed and limits real consumption per period to the real income raised during current production activity plus the changes in holdings of real risk-free government bonds (GB). Production output is distributed either under the form of labor-related incomes or as profit earnings, Π. As for the former, the representative agent is "homogenized" as if he were partially employed and partially unemployed with probabilities $(1-u)$ and u, respectively.[1] Thus, the representative agent receives the net of taxes real wage rate, $\frac{W}{P}(1-\tau_t)$, over $(1-u)$, and the real unemployment benefit rate, $\frac{bW}{P}$, over u. Given that unemployment benefits are fully tax-financed (a pure Bismarckian system) by the employed, *i.e.* $\tau = \frac{bu}{1-u}$, so as to keep the government budget permanently balanced, average real labor-related income simplifies to $\frac{W}{P}(1-u)$ in (1).

Solving problem (1) we get the following Euler equation for consumption (*i.e.*, the IS function), mimicking the economy's aggregate demand dynamics.

$$\begin{aligned}(1+\beta h^2)E_t\Delta y_{t+1} = \; & h\Delta y_t + \beta h E_t \Delta y_{t+2} + \\ & +(1-\beta h)(1-h)(r_t - E_t\pi_{t+1} - \rho) - \\ & -(1-h)(v_t - \beta h E_t v_{t+1}). \end{aligned} \tag{2}$$

Where Δy_t is the change in the (log) of output, defined as $(y_t - y_{t-1})$, $r_t - E_t\pi_{t+1}$ defines the real interest rate (rr_t), and $v_t = -E_t\Delta g_{t+1}$ is a demand-side disturbance.[2] The constant $\rho = -\log\beta$ is the time discount rate and corresponds to the steady-state equilibrium real interest rate in the absence of secular growth (see, below, equation 13, in 3.2).

2.2 Firms

In what concerns the production side, we assume a standard New-Keynesian optimizing setup including inflation inertia.

As in Aguiar and Ribeiro (2007), there is a continuum of differentiated intermediate-goods, Y_i, $i \in [0,1]$, aggregated into a composite final good, Y. The corresponding flexible general price index is a constant markup, μ, over nominal marginal costs.

Inflation inertia, which is essential to account for the observed inflation persistence and to avoid counterfactual dynamics (see, for instance, Estrella and Fuhrer, 2002), is obtained by combining a discrete version of Calvo's (1983) price adjustment mechanism as proposed in Galí (2003) with Amato and Laubach's (2003) non-optimizing price setters. The argument is based on costly re-optimization, which incentives agents to use simple rules of thumb, occasionally, as an alternative to price optimization. In this context, the representative firm faces a constant probability of adjusting its prices in each period, $(1-\theta)$, independently of when prices were last adjusted; however, only a fraction $(1-\omega)$ of price-resetting firms optimize in a forward looking manner, while the remaining ones (fraction ω) follow a backward-looking rule of thumb.

[1] Once distributional issues are not of concern, this weighted average is the simplest way of taking into account heterogeneous agents within a homogeneous representative agent framework.

[2] Hereafter, lowercase variables refer to logs of the correspondent uppercase variables.

The resulting price dynamics - following, among others, Goodfriend and King (1997) and Galí *et al* (2001) - can be expressed in the approximate log form:

$$\frac{\theta+\omega(1-\theta)}{(1-\theta)(1-\omega)}\pi_t - \frac{\omega}{(1-\theta)(1-\omega)}\pi_{t-1} = \tag{3}$$

$$= \frac{\alpha}{\alpha+\varepsilon(1-\alpha)}\log\mu + (1-\theta\beta)\frac{\alpha}{\alpha+\varepsilon(1-\alpha)}\sum_{j=0}^{\infty}(\theta\beta)^j E_t mc_{t+j} + \sum_{j=1}^{\infty}(\theta\beta)^j E_t\pi_{t+j},$$

with $E_t mc_{t+j}$ and $E_t\pi_{t+j}$ standing, respectively, for the log of expected real marginal costs and the expected inflation rate for period $t+j$, conditional on the information available at time t.

2.3 Labor Market - Collective Bargaining

The need for reforming the labor market arises from the existence of institutional arrangements that prevent full employment. We model, as in Aguiar and Ribeiro (2007), an imperfectly competitive labor market characterized by Labor Turnover Costs (LTCs) associated with insider-outsider turnover and which might explain why firms do not substitute outsiders for insiders at lower wages (Lindbeck and Snower, 1988).[3]

In particular, we consider that workers of a given firm (insiders, with bargaining power arising from LTCs) form a labor union to negotiate over wages alone.[4] Firm and union bargain over gross nominal wages, W_i, according to the following Nash bargaining problem:

$$\begin{aligned}
&\underset{W_{it}}{Max} \quad [P_{it}Y_{it} - W_{it}N_{it}]^{(1-\Gamma)}[W_{it} - Wout_t]^{\Gamma}[S_{it}(W_{it})]^{\Gamma} \\
&s.t. \\
&\text{(production function) } Y_{it} = A_t(N_{it})^{\alpha}, \quad \alpha < 1 \\
&\text{(outside option) } Wout_t = F_{it}W_t + (1-F_{it})bW_t = (1-u_t+u_tb)W_t.
\end{aligned} \tag{4}$$

where Γ represents the union's bargaining power; $S_i(W_i)$ stands for the probability of insiders' survival in the firm, capturing the adverse effects of wage claims on the firm's competitiveness and thus, directly on exposure to unemployment (Calmfors and Driffill, 1988).

The utility of each bargaining party is derived from the rent of effective income over the respective "fallback" (*i.e.*, the income each party gets if agreement fails). The first term within square brackets captures the instantaneous utility for the firm, while

[3] The existence of LTCs underlying the insider-outsider theory provides a foundation for insiders' market power, instead of the *ad hoc* definition as imperfect competition in wage setting (as, for instance, in Galí, 2003).

[4] We simplify the functional form of the union's utility by assuming risk neutrality. This does not conflict with the household's risk aversion, since the essential feature is that both the union's and the household's utility increase with wages.

the remaining terms in the maximand refer to the union's instantaneous utility.[5] The union's "fallback", $Wout$, represents the insiders' outside-option earnings: an average of the wage and the unemployment benefit average rates (W, bW), weighted, respectively, by the probability of finding a job outside the i^{th} firm (F_i) and the probability of not finding a job elsewhere $(1-F_i)$. As in Bovenberg *et al* (2000), we take the unemployment rate, u, as a good *proxy* for $(1 - F_i)$.

Assuming symmetry across firms, the optimal solution to problem (4) leads to the following aggregate wage offer curve:

$$\frac{W_t}{P_t} = \left[1 + \frac{1}{\frac{\Gamma}{(1-\Gamma)}\left[\frac{1}{(1-b)u_t} - \varepsilon_{SN}(1-\frac{\alpha}{\mu})^{-1}\right]}\right]^{-1} A_t\,(N_t)^{(\alpha-1)}\,. \quad (5)$$

where ε_{SN} stands for the, constant, elasticity of the survival probability with respect to employment.

Equation 5 shows that real wages depend, among others, on labor market-specific institutional features – the unemployment-benefit ratio, b, and the workers' bargaining power, Γ, which are potential policy instruments for a reform.

In each period, following the bargaining outcome, the firm chooses the employment level, taking wages as given, *i.e.*, we assume the right-to-manage approach to wage formation.[6]

2.4 Flexible-Price Equilibrium

The flexible-price (FP) equilibrium output refers to the output level that would be achieved under no price rigidity, given the above defined structure of the labor and the goods markets. Thus, the FP-equilibrium output (as well as the corresponding FP-equilibrium unemployment rate) would clear a labor market characterized by the wage offer curve (equation 5) and by the labor demand that would result if all firms could freely adjust prices at any period.

$$\bar{u}_t = \overline{u} = \frac{(\mu-\alpha)\Gamma}{\left[\alpha(1-\Gamma)+\Gamma\epsilon_{SN}\mu\right](1-b)}; \quad (6)$$

$$\bar{y}_t = -\alpha\bar{u} + a_t. \quad (7)$$

Where the dashed variables, $\bar{u}_t$ and $\bar{y}_t$ refer to values at the respective FP-equilibrium levels.[7]

The FP-equilibrium unemployment rate increases with the unemployment-benefit replacement ratio (b), the relative power of the union in wage bargaining (Γ), and the degree of monopolistic competition in the market for intermediate goods (μ). Thus, a

[5] For a detailed exposition of the derivation of the Nash bargaining, see Belot and van Ours (2004).

[6] We assume that bargaining occurs in every period, so that nominal wage stickiness is absent.

[7] Hereafter, dashed variables with time subscript refer to FP equilibrium levels, while dashed variables without time subscript stand for their respective steady-state levels.

supply-side policy - for instance, a labor market reform that reduces b - pushes the FP output level closer to its efficient level, $y_t^e = a_t$.

The aggregate supply (AS), however, needs to account for actual firm's pricing behavior (*i.e.*, under price and inflation inertia, equation 3). Using (3) together with the definition of real marginal cost deviations from its FP level ($\widetilde{mc}_t = mc_t - \overline{mc}_t$), the inflation dynamics (AS) equation follows:[8]

$$\begin{aligned}
\pi_t &= \gamma^f E_t\{\pi_{t+1}\} + \gamma^b \pi_{t-1} + k_1 \widetilde{y}_t + \mathtt{u}_t, \quad \mathtt{u}_t = \lambda(d_1 \Delta\Gamma_t + d_3 \Delta b_t + \mathtt{u}'_t) \quad (8)\\
\textit{where} \quad \widetilde{y}_t &\equiv y_t - \overline{y}_t\\
d_1 &\equiv \left[\frac{1}{(\overline{q}+1)}\frac{1}{(1-\Gamma)\Gamma}\right];\\
d_2 &\equiv \left[\frac{1}{(\overline{q}^2+\overline{q})}\frac{\Gamma}{(1-\Gamma)}\frac{1}{(1-b)\bar{u}^2}\right];\\
d_3 &\equiv \left[\frac{1}{(\overline{q}^2+\overline{q})}\frac{\Gamma}{(1-\Gamma)}\frac{1}{(1-b)^2\bar{u}}\right];\\
k_1 &\equiv \lambda\frac{d_2}{\alpha};\\
\lambda &\equiv \frac{(1-\theta)(1-\beta\theta)(1-\omega)\alpha}{\{\theta+\omega[1-\theta(1-\beta)]\}[\alpha+\varepsilon(1-\alpha)]};\\
\gamma^b &\equiv \frac{\omega}{\theta+\omega[1-\theta(1-\beta)]}; \quad \gamma^f \equiv \frac{\beta\theta}{\theta+\omega[1-\theta(1-\beta)]} \quad \textit{and}\\
\bar{q} &= q(\Gamma, b, \bar{u}).
\end{aligned}$$

Unless an unexpected reform affecting either of the parameters occurs, $\Delta b_t = \Delta\Gamma_t = 0$: unexpected changes in the unemployment-benefit ratio or in the relative wage bargaining power of the parties affect inflation in a similar way to the cost-push shock ($\mathtt{u}'_t$).[9]

We can now sum up the model in regard to the structure describing the economy: (i) the aggregate demand function derived from the households' behavior (equation 2); (ii) the aggregate supply function (equation 8); and (iii) the flexible-price output dynamics (equation 7).

To close the model we need next to account for the behavior of authorities in charge of monetary policy. This enables the use of the model to analyze the interaction between a demand-side stabilization policy and a structural, supply-side, policy.

[8] The presence of habit persistence ($h > 0$) usually affects the aggregate-supply function as Amato and Laubach (2004) show. However, this does not apply to our case due to the assumption of constant labor supply (see 2.1., above).

[9] More generaly, unexpected components of structural reforms provide aditional theoretical foundation for the presence of cost-push shocks in the New-Keynesian Phillips curve.

2.5 Monetary Policy

We assume that monetary policy is the only demand-side management policy available and that the policy maker is an independent central bank (CB).[10]

Theoretically, the policy maker would behave optimally in a way to maximize the utility of the representative agent. However, the literature on monetary policy conducting shows a widespread consensus that central banks follow simple rules instead (see, for instance, Taylor, 1999 and Galí, 2003). Nonetheless, optimal policy performs a useful role in benchmarking simple rules. For instance (and for our purposes), optimal policies provide results on welfare costs that are useful for the evaluation of non-optimal rules.

Optimal monetary policy (OMP) Following the demonstration by Amato and Laubach (2003) and under inflation inertia, the optimal monetary policy (OMP) solutions are obtained by solving the problem faced by the monetary authorities:

$$\underset{\pi_{t+j},\quad \widetilde{y}_{t+j}}{Min} L = E_t \sum_{j=0}^{\infty} \beta^j \left[\pi_{t+j}^2 + \omega_{\widetilde{y}} \widetilde{y}_{t+j}^2 + \omega_{\pi} (\pi_{t+j} - \pi_{t+j-1})^2 \right] \tag{9}$$

$$s.t.$$

$$\pi_t = \gamma^f E_t \{\pi_{t+1}\} + \gamma^b \pi_{t-1} + k_1 \widetilde{y}_t + \mathrm{u}_t, \qquad k_1 > 0$$

$$with \quad \omega_{\widetilde{y}} \equiv \frac{(1+\varphi)\lambda_L}{\varepsilon\alpha}, \quad \omega_{\pi} \equiv \frac{\omega}{(1-\omega)\theta} \quad and \quad \lambda_L = \frac{(1-\beta\theta)(1-\theta)}{\theta},$$

where the constraint refers to the AS function derived in 2.4, above; it captures the inflation - output-gap stabilization trade-off faced by the central banks when responding to cost-push shocks (u_t).

Following Clarida *et al* (1999), the discretionary solution under inflation inertia cannot be analytically determined, except in the case of fully backward looking inflation indexation. It is possible, however, to illustrate the discretionary behavior (OMP-D) if we assume a specific backward-looking rule for private-sector expectations about inflation. Under this assumption, optimization of the intertemporal Loss yields

$$\widetilde{y}_t = -\frac{k_1}{w_{\widetilde{y}}(1-a_{\pi}\beta)} \pi_t - \frac{k_1}{w_{\widetilde{y}}} w_{\pi} (\pi_t - \pi_{t-1}) \tag{10}$$

$$with$$

$$\pi_t = a_{\pi} \pi_{t-1} + a_u \mathrm{u}_t, \qquad 0 \leq a_{\pi} < 1$$

where today's monetary policy affects current and future time path of inflation. Thus, the policy responds not only to current but also to forecasts of inflation into the indefinite future (Clarida *et al*, 1999). The a_{π} parameter is obtained by using the method of undetermined coefficients.

[10] The government is assumed to be neutral, with a passive role exclusively related with income distribution: it collects taxes to pay for the unemployment benefits, constrained to keeping a balanced budget (recall τ, above, in 2.1.).

If, however, the central bank can commit to a plan and thus influences, with credibility, the private sector expectations, optimization, respecting the "timeless perspective" commitment (OMP-C), leads to

$$\pi_t + \omega_\pi(\pi_t - \pi_{t-1}) - \beta\omega_\pi(E_t\{\pi_{t+1}\} - \pi_t) = -\frac{\omega_{\widetilde{y}}}{k_1}\left(\widetilde{y}_t - \frac{\gamma^f}{\beta}\widetilde{y}_{t-1} - \beta\gamma^b E_t\{\widetilde{y}_{t+1}\}\right). \quad (11)$$

Taylor Rule (TR) Regarding non-optimal policies, several authors have proposed a variety of simple rules as a guideline for monetary policy conducting and for assessing its performance across different models. These simple rules can, in general, be summarized in the following instrument rule (*e.g.*, McCallum, 2001):

$$r_t = (1 - \rho_r)\left[\rho + \phi_\pi \pi_t + \phi_y(y_t - \overline{y}_t)\right] + \rho_r r_{t-1} \qquad \phi_\pi, \phi_y > 0, \quad \rho_r \in (0, 1), \quad (12)$$

where r_t stands for the nominal interest rate, π_t for the inflation rate (assuming a zero-inflation target), ρ is the constant steady-state real interest rate, and ρ_r stands for the nominal interest rate smoothing parameter.[11]

3 Effects of a Labor Market Reform on Monetary Policy Effectiveness

In this section we aim at evaluating the impact of a labor market reform on the stabilization role of monetary policy. On the one hand, active stabilization is warranted to optimize the adjustment of the economy induced by the implementation of the reform (transition stabilization costs). On the other hand, the reform changes the structure of the economy including the propagation of shocks and, thus, the effectiveness of monetary policy as a stabilization device (permanent effects). In order to measure these effects, it is necessary to define, first, a stylized labor-market reform.

3.1 A Stylized Labor Market Reform - The Case of Unemployment Benefits

Labor market reforms have two major positive macroeconomic effects: by increasing real wage flexibility, (i) reforms improve stabilization of cost-push shocks and (ii) reduce equilibrium unemployment, thus, increasing the flexible-price output. Saint-Paul and Bentolila (2001) refer to these as the "increasing the economy's adjustment potential" and the "increasing the economy's average performance" effects, respectively. While the latter is a required outcome for a successful labor market reform, the first effect is crucial to affect the effectiveness of monetary policy as a macroeconomic stabilization tool.

[11] Interest rate smoothing draws strong empirical support from the practice of central banks, even if it still lacks a robust theoretical formalization. For an exhaustive review on interest rate smoothing see, for example, Sack and Wieland (2000).

Labor market reforms often refer to a comprehensive set of measures aimed at changing labor market institutions (see, for example, OECD, 2006). We take, for simplification, a reduction in unemployment benefits as a relevant stylized reform: apart from the role of the benefits as a state-provided insurance device, its reduction improves competition in the labor market, thereby increasing real wage flexibility which, in turn, is key to deliver both macroeconomic effects. Through wage formation, unemployment benefits also affect equilibrium unemployment: lower unemployment benefits reduce the outside option for the employed, thus lowering the bargained wage and equilibrium unemployment. This is unambiguously captured in our model's definition of equilibrium unemployment (equation 6, above), in line with both theoretical and empirical studies.[12]

In this context, we model, as a baseline, a stylized reform process consisting of an one-shot pre-announced reduction in the unemployment benefit ratio (b). As in Aguiar and Ribeiro (2007), we also consider two additional cases: a gradual implementation process and an unexpected one-shot reform. While the gradual implementation process adds more generality to the analysis, the unexpected case is a simple way of introducing uncertainty regarding the extent of the reform.

The proposed scenarios for the economic structure and reform processes, as well as the corresponding calibration (described in the Appendix), are used next to compute the impact of the reform on the effectiveness of monetary policy as a macroeconomic stabilization tool.

3.2 Transition Stabilization Costs

The evaluation of transition costs considers the impact that the adjustments exclusively induced by reform implementation have on stabilization costs.

We explore the adjustments to a reduction by 10 percentage points in the unemployment-benefit replacement ratio (from 0.7 to 0.6), for the three reform processes as exposed just above. Also, the adjustments are studied under different assumptions for monetary policy conducting: following OMP rules, either through discretionary or commitment behavior, or following the Taylor rule. In regards to OMP conducting we assume, as default, $\omega_{\widetilde{y}} = 0.01$, which translates into a 3.8% annualized weight put on output gap stabilization, corresponding to a more inflation averse central bank. When results are expected to be sensible to the relative weight put on price stabilization, we also consider outcomes under the extreme opposite case - $\omega_{\widetilde{y}} = 1$, a 80% annualized weight put on output gap stabilization, corresponding to a less inflation averse central bank.

Table 1 shows the evaluation of the stabilization costs implied by the adjustments to the reform, with values referring to the Loss times 10^5. The arguments of the Loss functions are calculated through reform-induced impulse responses, computed up until

[12] See the assessment by Aguiar and Ribeiro (2007), concluding that, in contrast with other labor market reforms, a reduction in the unemployment benefits unambiguously reduces equilibrium unemployment.

full adjustment is achieved. In lines 1 and 6 the underlying economic structure is characterized by no-habit persistence and no-inflation inertia. In particular, line 1 depicts the baseline scenario: one-shot pre-announced reform implemented in the inertia-free economic structure. The scenarios in lines 2 through 5 refer to the one-shot pre-announced reform under various inertias in the economic structure.

	Scenarios	weight of output stabilization ω_y	change in Loss (Loss 10^5)			
			OMP		TR	
			C	D	No smoothing	Smoothing
1	**Baseline**	0.01 and 1	0	0	0	0
2	**Habit formation (h=0.7)**	0.01	0	0	0.697	0.430
		1	*0*	*0*	*20.433*	*18.700*
3	**Inflation inertia**	0.01 and 1	0	0	0	0
4	**Habit formation (h=0.7) and inflation inertia (γ^b=0.5)**	0.01	0	0	0.335	0.254
		1	*0*	*0*	*20.200*	*19.982*
5	**Habit formation (h=0.7) and lower inflation inertia (γ^b=0.27)**	0.01	0	0	0.599	0.370
		1	*0*	*0*	*19.996*	*18.723*
6	**Unexpected Reform**	0.01	0.251	0.232	0.328	0.332
		1	*30.753*	*30.748*	*27.582*	*28.552*

OMP - C: Optimal Monetary Policy under Commitment
OMP - D: Optimal Monetary Policy under Discretion
TR: Taylor Rule

Table 1: Transition Stabilization Costs caused by the Reform

In the case of the pre-announced reform processes, reform implementation leads to short-run adjustments similar to those implied by a negative demand-side shock – this view of reform as a recession is also noted by Saint-Paul (2006). The announced reduction in b directs expectations to a higher FP output level, thus increasing the output gap, and leads to price reduction due to a fall in nominal bargained wages caused by the unemployment-benefit reduction. Unexpected reforms, in contrast, exhibit patterns of cost-push shock adjustments.

Next we analyze in detail the adjustments under each case.

Adjustments to a pre-announced reforms The announcement of the reform leads agents to expect b to take the new value, immediately, such that $\Delta b_t = 0$ in equation 8. Because a pre-announced reform leads to short-run effects on the macroeconomic variables similar to those of a negative demand-side shock, there is no trade off between inflation and output gap stabilization constraining the implementation of OMP. Either under commitment or discretion, with private agents fully internalizing the monetary authorities stabilization objectives ($\pi_t = \widetilde{y}_t = 0$), OMP ensures full short-run stabilization and, thus, reform brings about no transition costs (lines 1 to 5, Table 1).

In contrast, if the economic structure is characterized by habit persistence in consumption and/or in the presence of gradual reform implementation, Taylor rules, which are non-optimal, fail to deliver full macroeconomic stabilization of the short-run reform effects.

The main implication of macroeconomic inertias derives from the presence of consumption smoothing ($h > 0$, recall equation 2): private demand impulse is not sufficient to immediately promote the new $\overline{y}$. From equation 2, as FP unemployment rate falls – given the fall in b –, $\overline{y}_t$ increases and long-run real interest rate ($\overline{rr}$) decreases in the period of reform implementation,

$$\begin{aligned} \overline{rr}_t &= \rho + h_1 E_t\{\Delta\overline{y}_{t+1}\} + h_2 E_t\{\Delta\overline{y}_{t+2}\} + \\ &\quad + h_3\{\Delta\overline{y}_t\} + \frac{1}{(1-\beta h)}[v_t - \beta h E_t\{v_{t+1}\}], \qquad (13) \\ where \quad h_1 &\equiv \frac{(1+\beta h^2)}{(1-\beta h)(1-h)}; h_2 \equiv -\frac{\beta h}{(1-\beta h)(1-h)}; h_3 \equiv -\frac{h}{(1-\beta h)(1-h)}; \\ &\quad h_1 + h_2 + h_3 = 1. \end{aligned}$$

with $\Delta\overline{y}_t > 0$ and $E_t\Delta\overline{y}_{t+1} = E_t\Delta\overline{y}_{t+2} = 0$, because reform is one-shot. The change in $\overline{rr}$ keeps current real interest rate above the FP equilibrium level, refraining consumption and causing a negative output gap which warrants an active expansionary monetary policy alongside with the reform.

Under OMP, the expansionary policy lowers nominal interest rate (exactly matching the fall in the long-run equilibrium real interest rate) immediately pushing demand to the new $\overline{y}$. Just as in the inertia-free scenario, OMP ensures immediate equilibrium with $\pi_t = \widetilde{y}_t = 0$ and, thus, no stabilization costs occur (Table 1, line 2).

Under TR, adjustment of the effective output to the new, higher, $\overline{y}$, is sluggish, as the effective interest rate adjusts only partially, in each period, to the new, lower, $\overline{rr}$. Therefore, firms do not expect policy to immediately push demand to the new $\overline{y}$, thereby laying the ground for inertia effects to operate. Real wages remain lower than the new FP level because employment pressure is only gradual whereas unemployment benefits reduction is immediate. Therefore, actual and expected marginal costs are lower and prices follow. Since the adjustment is gradual, the expansionary monetary policy involves transition stabilization costs, which are lower if the TR includes smoothing (Table 1, line 2). Moreover, stabilization costs move directly with the degree of habit formation (result not reported in Table 1).

If inflation sluggishness is the only source of macroeconomic inertia, any policy rule that penalizes deviations of inflation and/or output from targets drives demand to fully adjust to the new $\overline{y}$ and firms have no incentive for changing prices: immediate stabilization occurs. However, the mix of inflation inertia, habit persistence and non-optimal policy produces differences in adjustment costs. Figure 1 shows the effects of combining both inertias: with the addition of inflation inertia, deflation effects and the fall in the nominal interest rate are smaller, output overshoots, but adjustment takes longer. Therefore, even though inflation inertia *per se* does not influence stabilization costs (line 3 in Table 1), it can actually lower stabilization costs, when combined with habit formation, namely if the central bank is inflation averse ($\omega_{\widetilde{y}} = 0.01$, in lines 4 and 5).[13]

[13] Inflation is less sensible to the output gap when inflation inertia is strong, thus lowering inflation variability.

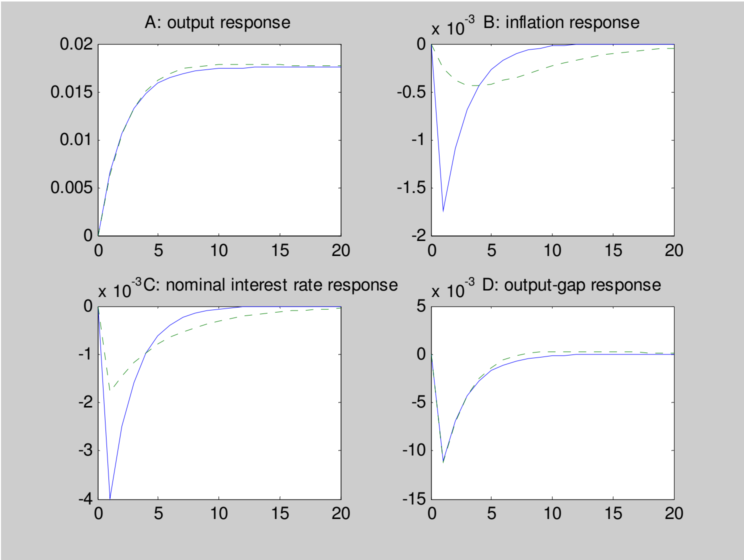

Figure 1: Adjustments to a one-shot pre-announced reform, TR - habit formation (dashed) *vs* habit formation with inflation inertia (solid), $h = 0.7$ and $\gamma^b = 0.5$

A more general version of the pre-announced reform is to consider that implementation is gradual. Following the specification in Aguiar and Ribeiro (2007), where a gradual reduction in b leads to a gradual increase in $\overline{y}$, we have also run simulations with different degrees of inertia in reform implementation. Given that a gradual reform process generates, in each period, expectations of future increases in FP output (due to pre-announcement), a restrictive policy is warranted. In results, not reported in Table 1, OMP delivers, as in the previous cases, full adjustment to each new $\overline{y}$, while under TR the response to the rise in the long-run real interest rate is not as restrictive, therefore accommodating some inflation, with output temporarily above the FP-equilibrium level. These stabilization costs increase with the length of the implementation process and interest rate smoothing, when the CB is more inflation averse, is less painful.

Adjustments to an unexpected reform An unexpected reform – a surprise in the first period and fully perceived from then on – can be interpreted as an extreme case of uncertainty regarding the extent of the reform. In contrast with the pre-announced one, it works as a positive cost-push shock that, unexpectedly, reduces marginal costs from the implementation period onwards. In this context, differences in adjustments to reform arise not only between optimal and non-optimal monetary policy, but also between optimal discretionary (OMP-D) and optimal with commitment (OMP-C).

Line 6 of Table 1 shows OMP-D delivering lower stabilization costs than OMP-C. This seemingly odd result stems from the fact that the monetary authority, to whom the reform is also unexpected, responds, in the first period, to the output gap relative to the pre-reform FP-output level; while the evaluation of stabilization costs refers to the new

FP level.

Compared with OMP, TR implies lower stabilization costs, if the CB cares primarily about output-gap stabilization. The reason behind this dominance is related, again, to the reform being unexpected to the monetary authority. The effect of responding to the output gap relative to the pre-reform FP output level, is amplified when more weight is attached to output-gap stabilization.

Line 6 also shows that, in contrast with the previous cases, interest rate smoothing increases stabilization costs. In a context where the more expansionary the policy is, the faster is the recovery to the new FP equilibrium, smoothing dampens the magnitude of the policy response in the first period; since active policy does not extend to the following periods in the absence of inertias in the economic structure, smoothing is unambiguously less expansionary.

3.3 Permanent Effects on the Costs of Stabilization Policy

Over the long run, the reform yields the target inflation rate with higher output. Since the level of the latter is not an apparent concern for the CB, the case for a reform is seemingly irrelevant for the monetary authority. However, the labor market reform, by improving real wage flexibility and the inflation - output gap trade-off, also permanently impacts on the effectiveness of monetary policy as a demand-management device.

In what follows, we compute the stabilization costs faced by the CB, in order to assess if they are reduced or amplified once the reform takes full effect. Assuming that economies are hit by three types of shocks, we evaluate stabilization costs across alternative scenarios and under different monetary policy rules.

Unlike transition stabilization costs of the adjustments to the reform, to evaluate the permanent effects on stabilization costs we need to evaluate the infinite horizon intertemporal Loss function for given properties of the shocks. For this purpose we re-scaled the Loss function, as proposed in Rudebusch and Svensson (1999). With $\beta \to 1$,

$$\lim_{\beta \to 1}(1-\beta)(L) = E(L_t) = var(\pi_t) + \omega_{\widetilde{y}} var(\widetilde{y}_t) + \omega_\pi \left[var(\pi_t - \pi_{t-1})\right]. \qquad (14)$$

Where L_t stands for the period Loss function, $L_t = \pi_t^2 + \omega_{\widetilde{y}}\widetilde{y}_t^2 + \omega_\pi(\pi_t - \pi_{t-1})^2$, and $L = E_0\left[\sum_{t=0}^{\infty}\beta^t(L_t)\right]$.

In order to evaluate $E(L_t)$, output-gap and inflation variability must be determined conditional upon the variability of shocks. We follow the standard practice, by considering three types of shocks: (i) demand-side (v_t) and (ii) cost-push ($\mathtt{u}_t$) shocks (recall equations 2 and 8, respectively), assumed to follow a white-noise process with zero mean and standard-deviations of σ_v and $\sigma_{\mathtt{u}}$, respectively; and (iii) a temporary technological shock , a_t (equation 7), modeled as a first order autoregressive process, with innovation characterized by a zero mean and standard-deviation of σ_a (see, for instance, McCallum and Nelson, 1999 and 2004).[14] The values for the parameters characterizing these

[14]The temporary nature of the technology shock is appropriate in the context of macroeconomic

processes are taken from McCallum and Nelson (2004), and they respect to a model close to our calibration. Values for σ_v and σ_u are set at 0.02 and 0.005, respectively, while the autocorrelation parameter and the standard deviations of the technology shock innovation are set at 0.95 and 0.007, respectively.

To compute Losses, we have analytically determined the second moments of the endogenous variables, applying the asymptotic formulas presented in Hamilton (1994, pp. 264-6). The methodology requires the definition of the endogenous variables as a function of the predetermined and the exogenous ones, that is, the standard form of the solution to rational expectations models. Table 2, shows the stabilization costs of the simple combination of the three types of shocks, under different rules of monetary policy, comparing the steady state with ($b = 0.6$) and without ($b = 0.7$) reform.

In general, the reform improves the effectiveness of monetary policy – most of the changes in Loss in Table 2 are welfare improving. The patterns in Table 2, though, show that the magnitude (in terms of percentual change in Loss), and sometimes the sign of the permanent effects of the reform on stabilization costs, depend not only on the policy rule and on the relative weight that the CB puts on price stabilization, but also on the scenarios for economic structure inertia.[15] In addition, the nature of each shock also influence the results. A more detailed view of the reform effects, including the analysis of each type of shock is, thus, in order. In what follows, we proceed, comparing the impacts under optimal monetary policy with those under the Taylor rule.[16]

Optimal monetary policy (OMP) Under optimal plans, either with discretionary or commitment behavior, the labor market reform has positive effects across all the scenarios. These gains, related exclusively to the adjustments to cost-push shocks, arise from the improved trade-off between inflation and output-gap stabilization.

Table 2 shows that, as expected - since cost-push are the only relevant shocks under OMP - the discretionary solution delivers always higher stabilization costs than those under commitment. Across all scenarios, reform stabilization gains increase with the relative weight put on price stabilization – *i.e.*, the improvement in the trade-off is sharper when the CB is more inflation averse, as inflation control comes at lower output stabilization costs. In general, reform induces higher gains under OMP-D than under commitment, if more weight is put on inflation stabilization.

Gains from reform do not depend on the degree of habit-formation, but they change with inflation inertia. The reason is straightforward – OMP fully insures against demand-side inertia and, thus, the CB's optimal response is independent of the degree of habit-formation; however, because inflation inertia directly affects the CB's restriction, policy responses to cost-push shocks depend on the degree of AS inertia. For example, if the CB is inflation averse, inflation inertia increases gains under commitment (from 9.8% to 10.3%) while lowering gains under discretion (from 12.3% to 10.8%).

stabilization.

[15] In addition to the scenarios reported in Table 2, we have also considered other (lower) degrees of habit formation and inflation inertia, with coherent results.

[16] From here on, gains/costs of reform refer to percentual change in Loss.

Scenarios / Policy Rules		Stabilization Costs											
		without reform (b=0.7)					with reform (b=0.6)					change in Loss	% change in Loss
		sd(π)	sd(ygap)	sd($\Delta\pi$)	sd(r)	Loss 10^5	sd(π)	sd(ygap)	sd($\Delta\pi$)	sd(r)	Loss 10^5		
Baseline													
OMP-C													
	ω_y=0.01	0.004	0.019		0.021	157.8	0.003	0.020		0.021	142.4	-15.4	-9.78
	ω_y=1	0.005	0.001		0.020	246.5	0.005	0.001		0.020	238.5	-8.0	-3.25
OMP-D													
	ω_y=0.01	0.004	0.019		0.027	211.4	0.004	0.022		0.030	185.3	-26.1	-12.33
	ω_y=1	0.005	0.000		0.020	249.5	0.005	0.000		0.020	249.1	-0.4	-0.16
TR													
No smoothing	ω_y=0.01	0.005	0.018		0.007	262.4	0.005	0.018		0.007	257.4	-5.0	-1.92
	ω_y=1					3434.5					3328.0	-106.5	-3.10
TR													
Smoothing	ω_y=0.01	0.005	0.019		0.002	238.2	0.005	0.019		0.002	237.1	-1.1	-0.47
	ω_y=1					3774.6					3662.1	-112.5	-2.98
Habit persistence (h=0.7)													
OMP-C													
	ω_y=0.01	0.004	0.019		0.195	157.8	0.003	0.020		0.236	142.4	-15.4	-9.78
	ω_y=1	0.005	0.001		0.101	246.5	0.005	0.001		0.101	238.5	-8.0	-3.25
OMP-D													
	ω_y=0.01	0.004	0.019		0.476	211.4	0.004	0.022		0.558	185.3	-26.1	-12.33
	ω_y=1	0.005	0.000		0.101	249.5	0.005	0.000		0.102	249.1	-0.4	-0.16
TR													
No smoothing	ω_y=0.01	0.005	0.009		0.008	267.8	0.005	0.009		0.008	273.9	6.1	2.26
	ω_y=1					1034.5					1010.0	-24.5	-2.37
TR													
Smoothing	ω_y=0.01	0.005	0.009		0.002	238.7	0.005	0.009		0.002	238.3	-0.4	-0.15
	ω_y=1					1058.5					1022.5	-36.0	-3.40
Inflation inertia (γ^b=0.5)													
OMP-C													
	ω_y=0.01	0.011	0.102	0.008	0.027	5874.7	0.009	0.103	0.008	0.030	5272.2	-602.5	-10.26
	ω_y=1	0.020	0.010	0.010	0.030	11428.3	0.020	0.010	0.010	0.030	10613.7	-814.7	-7.13
OMP-D													
	ω_y=0.01	0.020	0.060	0.010	0.040	7358.0	0.010	0.060	0.010	0.050	6560.6	-797.5	-10.84
	ω_y=1	0.030	0.000	0.010	0.040	14726.0	0.030	0.000	0.010	0.030	14042.0	-684.0	-4.64
TR													
No smoothing	ω_y=0.01	0.020	0.050	0.010	0.020	7519.7	0.020	0.040	0.010	0.020	6996.9	-522.8	-6.95
	ω_y=1					27575.6					23899.9	-3675.6	-13.33
TR													
Smoothing	ω_y=0.01	0.010	0.050	0.010	0.010	6901.5	0.010	0.040	0.010	0.010	6441.6	-459.9	-6.66
	ω_y=1					30195.7					25866.7	-4329.0	-14.34
Habit persistence (h=0.7) Inflation inertia (γ^b=0.5)													
OMP-C													
	ω_y=0.01	0.011	0.102	0.008	0.027	5874.7	0.009	0.103	0.008	0.030	5272.2	-602.5	-10.26
	ω_y=1	0.020	0.010	0.010	0.030	11428.3	0.020	0.010	0.010	0.030	10613.7	-814.7	-7.13
OMP-D													
	ω_y=0.01	0.020	0.060	0.010	0.040	7358.0	0.010	0.060	0.010	0.050	6560.6	-797.5	-10.84
	ω_y=1	0.030	0.000	0.010	0.040	14726.0	0.030	0.000	0.010	0.030	14042.0	-684.0	-4.64
TR													
No smoothing	ω_y=0.01	0.020	0.030	0.010	0.020	7970.1	0.017	0.027	0.009	0.023	7530.3	-439.9	-5.52
	ω_y=1					17087.8					14694.9	-2392.9	-14.00
TR													
Smoothing	ω_y=0.01	0.016	0.040	0.009	0.013	7155.2	0.015	0.035	0.009	0.012	6744.7	-410.5	-5.74
	ω_y=1					22617.6					18963.5	-3654.1	-16.16

OMP - C: Optimal Monetary Policy under Commitment   sd: standard deviation

OMP - D: Optimal Monetary Policy under Discretion

TR: Taylor Rule

Table 2: Permanent Effects of a Reform on Stabilization Costs caused by a combination of Cost-push, Demand-side and Technology Shocks

Demand-side shocks	without reform (b=0.7)				with reform (b=0.6)				permanent effects of the reform			
	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)
Baseline	0.0008	0.0168		33.8	0.0010	0.0165		36.8	0.0002	-0.0003		3.0
Habit persistence (h=0.7)	0.0008	0.0070		0.0	0.0011	0.0069		16.7	0.0003	-0.0001		16.7
Inflation inertia (γ^b=0.5)	0.0002	0.0175	0.0001	32.1	0.0003	0.0174	0.0002	32.8	0.0001	-0.0001	0.0000	0.7
Combined inertias (h=0.7, γ^b=0.5)	0.0005	0.0070	0.0001	8.0	0.0006	0.0069	0.0001	9.4	0.0001	-0.0001	0.0000	1.4

Technology Shocks	without reform (b=0.7)				with reform (b=0.6)				permanent effects of the reform			
	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)
Baseline	0.0004	0.0006		2.0	0.0005	0.0005		2.4	0.0001	-0.0001		0.3
Habit persistence (h=0.7)	0.0010	0.0052		0.0	0.0012	0.0051		16.7	0.0002	-0.0001		16.7
Inflation inertia (γ^b=0.5)	0.0001	0.0014	0.0001	0.6	0.0001	0.0013	0.0003	0.7	0.0000	-0.0001	0.0002	0.1
Combined inertias (h=0.7, γ^b=0.5)	0.0002	0.0054	0.0001	4.2	0.0002	0.0054	0.0002	4.9	0.0000	0.0000	0.0001	0.7

Cost-push Shocks	without reform (b=0.7)				with reform (b=0.6)				permanent effects of the reform			
	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)	sd(**π**)	sd(ygap)	sd(**Δπ**)	Loss 10^5 (ω_y=0.01)
Baseline	0.0047	0.0063		226.5	0.0046	0.0062		218.3	-0.0001	-0.0001		-8.3
Habit persistence (h=0.7)	0.0049	0.0008		0.0	0.0049	0.0008		240.4	0.0000	0.0000		240.4
Inflation inertia (γ^b=0.5)	0.0171	0.0415	0.0090	7487.0	0.0160	0.0037	0.0088	6963.4	-0.0011	-0.0377	-0.0001	-523.6
Combined inertias (h=0.7, γ^b=0.5)	0.0180	0.0290	0.0092	7957.9	0.0170	0.0254	0.0091	7516.0	-0.0010	-0.0036	-0.0001	-441.9

sd: standard deviation

Table 3: Permanent Effects of the Reform on Stabilization Costs caused by each type of Shock, under the Taylor Rule

Taylor Rule (TR) Under TR, the reform affects stabilization costs arising from the three types of shocks, not necessarily with uniform impacts. Table 3 decomposes the effects of the combined shocks reported in Table 2 for the non-smoothed TR, by assuming that the economies are hit only by each type of shock.

In general, in face of demand-side or technology shocks, the reform produces ambiguous permanent effects on stabilization costs: in both cases, reform improves output gap variability and worsens inflation variability. As for cost-push shocks, the reform impacts are unambiguously positive: both inflation and output gap variability are, broadly, reduced. Combining the three shocks, in the baseline scenario, losses may occur for a CB that attaches a large weight to price stabilization, or if demand and(or) technology shocks dominate.

Regarding the other scenarios, in Table 2, the degree of habit formation reduces, while the inflation inertia amplifies, the gains of the reform. For sufficiently high IS inertia and large weight put on price stabilization, the reform may even increase costs – as in the case of $h = 0.7$ and $\omega_{\tilde{y}} = 0.01$ in the table, with a 2.3% increase in Loss; adding inflation inertia reverts this loss – reform gains of 5.5% in the last panel of the table.

By inspection of Table 3, habit formation both dampens the gains and increases the costs of stabilization induced by the labor market reform: on the one hand, the higher the inertia, output variability gains are lower while inflation variability is higher in face of demand-side and technology shocks; on the other hand, the higher the inertia, the smaller the reform stabilization gains in the adjustment to cost-push shocks. We can also conclude that (larger) losses (than in the inertia-free scenario) may occur for a strongly inflation averse CB, or if demand and(or) technology shocks dominate.

As for the higher stabilization gains in the inflation inertia scenario (relative to baseline), they result from lower stabilization costs of demand and technology shocks and higher gains in face of costs-push shocks (Table 3); while, in absolute terms, the gains unambiguously outweigh the costs.[17]

Regarding smoothed TR, Table 2 shows that, across all scenarios, interest rate smoothing not only reduces interest rate volatility – as expected – but also improves stabilization when the CB is strongly inflation averse (compare the levels of Loss with and without smoothing). As for the permanent effects with smoothing, reform always improves demand-side management, unlike some cases with the non-smoothed TR (compare the changes in Loss with and without smoothing).

Finally, it is worthwhile to compare the generally positive permanent effects with the transition costs of reform (compare the changes in Loss in Table 2 with the ones in Table 1). The latter are clearly outweighed by the former, indicating that, over time, reform yields net positive gains for the stabilization role of the CB, even when transition costs occur.

4 Final Remarks

Using a reduction in the unemployment benefit replacement ratio as a stylized labor market reform, we find that, in general, once adjustment is completed, it permanently increases the effectiveness of monetary policy, *i.e.*, it permanently improves the stabilization policy trade off. However, reform implementation may generate transition stabilization costs. We show that the impacts of the reform on stabilization costs are sensible to the inertias characterizing aggregate demand and supply, the reform processes, the monetary policy rule and to the relative weight central banks put on price stabilization. These results provide insight for the interactions between demand-side stabilization policies and structural reforms.

Unless the reform is unexpected, following an optimal policy rule avoids transition costs. However, transition costs arise under the Taylor-type rule, which is non-optimal. These stabilization costs rise with (i) the time it takes for reform implementation, (ii) the degree of uncertainty about the extent of the reform, and (iii) the importance of habit persistence in consumption; while decreasing with the degree of inflation inertia for an inflation averse central bank.

Considering, in turn, the permanent effects on stabilization costs, we conclude that, in general, central banks gain with the reform. Under optimal policies, the highest gains arise when the central bank exhibits strong preferences for price stabilization. Therefore, independent (optimizing) and inflation averse central banks are expected to strongly advocate the necessity of structural reforms.

When transition costs are present – under non optimal rules –, they are likely to be outweighed by permanent gains, in general (with the exception of a high degree of habit

[17]Notice that the dominance of gains with inflation inertia still holds even when combined with habit formation. From the results in Table 3, losses would only occur if cost-push shocks accounted for less than 0.5% of the shocks hitting the economy.

formation coupled with a highly inflation averse central bank). In our simulations, this balance is maximized when:

(i) the non-optimal rule includes smoothing,

(iia) the central bank is strongly inflation averse and inflation inertia is high, or

(iib) the central bank is strongly inflation prone and both habit persistence and inflation inertia are high.

Still regarding non optimal rules, our results also uncover three additional motivations for smoothing interest rates: (i) under inflation averse central bank preferences, it reduces the Loss, even when it is not an objective *de per se*; (ii) smoothing reduces transition stabilization costs of the announced, one-shot, reform; and, (iii) smoothing dominates the simple Taylor rule in what respects the permanent monetary policy effectiveness gains from reform.

Although we conclude that, in general, reform induces net positive stabilization gains, some notes are in order.

First, the balance between permanent effects and transition costs depends on the magnitude and the frequency of the different types of shocks hitting the economy as well as on the magnitude of the reform – which has not been systematically scrutinized yet. Saint-Paul and Bentolila (2001), for instance, argue that reforms are often of a larger magnitude than the shocks hitting the economy.

Second, in addition to improving monetary policy as a demand-side management device, reform permanently improves macroeconomic efficiency as well, even though this is not explicitly considered in central banks' objectives.

In any case, transition stabilization costs can be dampened through transitory changes in monetary policy rules and by choosing the right phase of the cycle to implement reform. For instance, moving closer to optimal rules lowers, in general, stabilization costs; and the most favorable phase of the cycle occurs when stabilization effects of the shocks hitting the economy are opposite to the ones arising from reform implementation.

We conclude that, as it improves monetary policy effectiveness, central banks are expected to push for labor market reform. Moreover, from a political economy perspective, it is less costly for a more effective central bank to sustain policy independence.

Appendix: Model Calibration

The values for the set of parameters are chosen with a view to the Euro area. We start by combining the calibration proposed in Moyen and Sahuc (2005) with Galí (2003), and then use other additional sources. Table 4 presents the values.

For the labor market specific parameters, we set an indicative European after-reform replacement ratio of 60% and also a value of 0.4 for the elasticity of survival with respect to the expected number of insiders - based on Layard *et al* (1991), pages 514 and 105, respectively. Labor intensity and the relative power of firms in the bargaining process are chosen as to get a reasonable equilibrium unemployment rate – $\overline{u}$ in equation (6) –, around 6%. The low value for Γ is supported by the low and decreasing degree of

Description	Parameter	Value
Price elasticity of demand	ε	11
Quarterly discount factor	β	0.99
Probability of firms not changing prices in a given period	θ	0.83
Unemployment-benefit replacement ratio	b	0.6
Elasticity of the survival probability with respect to employment	ε_{SN}	0.4
Labor intensity	α	0.9
Technology index	A	1
Union's bargaining power	Γ	0.1
Low/High habit formation	h	0.5 / 0.7
Low/High inflation inertia	γ^b	0.27 / 0.5
Low/High relative weight on output stabilization in the Loss function	ω_y	0.01 / 1
Inflation feedback parameter	ϕ_π	0.5
Output-gap feedback parameter	ϕ_y	0.125
Interest rate smoothing parameter	ρ_r	0.8

Table 4: Baseline Parameter Calibration

unionism in European countries (see, for instance, Blanchard, 2004, p. 26).[18] As for α, instead of the more commonly used value of 1, we set it slightly below, since we need a decreasing marginal productivity of labor for wage bargaining to exhibit a trade-off between real wage and employment level.

As for the scenarios including habit formation, the evidence in Christiano *et al* (2001) and in Fuhrer (2000) clearly point to a high degree of persistence. Our values have been chosen closer to Christiano *et al*'s (2001), given that we adopt their theoretical formulation.

For the calibration of the inflation inertia, the lower value of the AS coefficient in Table 4 has been chosen in coherence with Galí *et al*'s (2001, p. 1257) value of $\omega = 0.3$, which, according to the authors, ensures a good replication of the European inflation dynamics. Whereas the higher value, implying $\omega = 0.82$, follows Fuhrer and Moore (1995).

In respect to monetary policy, we consider two types of central banks: an inflation averse CB, that attaches a high value to price stabilization, and an inflation prone CB, that mostly cares about output stabilization. These values are taken from McCallum and Nelson (2004). For the non-optimal interest rate rule we chose the original Taylor's feedback parameters, while taking the interest rate smoothing parameter from McCallum

[18] Cahuc *et al.* (2002) estimate a bargaining power of about 0.2 in France, a result consistent with others using Canadian and British datasets. Note, however, that the average unemployment rate was, during the estimation period, around 10% in France (see, for instance, Nickell and Layard, 1999).

and Nelson (1999; 2004).

References

Aguiar, Álvaro and Ana Paula Ribeiro (2007), "Monetary Policy and the Political Support for a Labor Market Reform", FEP WP N^o 237, February 2007

Amato, J. D. and T. Laubach (2004), "Implications of Habit Formation for Optimal Monetary Policy", *Journal of Monetary Economics*, Vol. 51, N^o 2, March, pp.305-325

Amato, J. D. and T. Laubach (2003), "Rule of Thumb Behaviour and Monetary Policy", *European Economic Review*, vol. 47, n^o 5, October, pp. 791-831

Belot, M. and J. C. van Ours (2004), "Does the Recent Success of Some OECD Countries in Lowering Their Unemployment Rates Lie in the Clever Design of Their Labor Market Reforms?", *Oxford Economic Papers*, Vol. 56, N^o 4, October, pp. 621-642

Blanchard, O. J. (2004), "The Economic Future of Europe", *Journal of Economic Perspectives*, Vol. 18, N^o 4, Fall, pp. 3-26

Bovenberg, A., Johan J. Graafland and Ruud A. Moij (2000), "Tax reform and the Dutch labor market: an applied general equilibrium approach", *Journal of Public Economics*, vol. 78, n^o 1-2, pp. 193-214, October

Cahuc, P., C. Gianella, D. Goux and A. Zylberberg (2002), "Equalizing Wage Differences and Bargaining Power: Evidence From a Panel of French Firms", CEPR Discussion Papers, DP n^o 3510, CEPR

Calmfors L. and J. Driffil (1988), "Bargaining Structure, Corporatism and Macroeconomic Performance", *Economic Policy*, 6, pp. 13-62

Calvo, G.A. (1983), "Staggered Prices in an Utility-Maximizing Framework", *Journal of Monetary Economics*, 12, pp. 383-398

Christiano, L., M. Eichenbaum and C. Evans (2005), "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy", *Journal of Political Economy*, February, Vol. 113, N^o 1, pp. 1-45

Clarida, R., J. Galí and M. Gertler (1999), "The Science of Monetary Policy: A New Keynesian Perspective", *Journal of Economic Literature*, Vol. XXXVII, December, pp. 1661-1707

Estrella, A. and J. C. Fuhrer (2002), "Dynamic Inconsistencies: Counterfactual Implications of a Class of Rational-Expectations Models", American Economic Review, vol. 92, n^o 4, pp. 1013-1028

Fuhrer, J. (2000), "Habit Formation in Consumption and its Implications for Monetary-Policy Models", *The American Economic Review*, vol. 90, n^o 3, pp. 367-390

Fuhrer, J. and G. Moore (1995), "Inflation Persistence", *Quarterly Journal of Economics*, 110, pp. 127-159

Galí, J. (2003), "New Perspectives on Monetary Policy, Inflation, and the Business Cycle", in *Advances in Economic Theory*, L. Hansen and S. Turnovsky (eds.), Vol. III, pp. 151-197, Cambridge Uiversity Press

Galí, J., M. Gertler and J. D. López-Salido (2001), "European Inflation Dynamics", *European Economic Review*, 45, pp. 1237-1270

Goodfriend, M. and R. G. King (1997), "The New Neoclassical Synthesis and the Role of Monetary Policy" in Rotemberg and Woodford (eds.), *Macroeconomics Annual* 1997, pp. 231-295

Hamilton, J. D. (1994), *Time Series Analysis*, Princeton, p. 257-266

Layard, R., S. Nickell and R. Jackman (1991), *Unemployment*, Oxford University Press, Oxford

Lindbeck, A. and D. Snower (1988), "Cooperation, Harassment, and Involuntary Unemployment: an Insider-Outsider Approach", *American Economic Review*, Vol. 78, pp. 167-188

McCallum, B. (2001), "Should Monetary Policy Respond strongly to Output Gaps?", *American Economic Review*, 91 (2), May, pp. 258-262

McCallum, B. and E. Nelson (1999), "Performance of Operational Policy Rules in an Estimated Semiclassical Structural Model", in *Monetary Policy Rules*, J. B. Taylor (ed.), pp. 15-45, NBER

McCallum, B. and E. Nelson (2004), "Timeless Perspective vs. Discretionary Monetary Policy in Forward-Looking Models", *Review of the Federal Reserve Bank of San Francisco*, March, pp. 43-56

Moyen, Stéphane and Jean-Guillaume Sahuc (2005), "Incorporating Labour Market Frictions into an Optimizing-Based Monetary Policy Model", *Economic Modelling*, Vol. 22, N^o 1, pp. 159-186

Nickell, S. and R. Layard (1999), "Labor Market Institutions and Economic Performance", *in* Ashenfelter O. and D. Card, *Handbook of Labor Economics*, Vol. 3C, pp. 3029-3084

OECD (2006), *Economic Policy Reforms: Going for Growth*, Part I - Chapter 1, "Progress in Responding to the 2005 Policy Priorities: Overview"

Rudebusch, G. D. and L. E.O. Svensson (1999), "Policy Rules for Inflation Targeting", *in* J. B. Taylor (ed.), *Monetary Policy Rules*, NBER, pp. 203-262

Sack, B. and V. Wieland (2000), "Interest Rate Smoothing and Optimal Monetary Policy: a Review of Recent Empirical Evidence", *Journal of Economics and Business*, Vol. 52, N^o 1-2, January-April, pp. 205-228

Saint-Paul, G. (2006), "Macroeconomic fluctuations and the timing of labor market reform", in *Structural Reforms and Economic Growth in Europe*, S. Eijffinger *et al* (eds.), European Summer Institute and CEPR, September

Saint-Paul, G. and S. Bentolila (2001), "Will EMU increase Eurosclerosis?", in *The impact of EMU on Europe and the Developing Countries*, Charles Wyplosz (ed.), WIDER, Oxford U. Press, pp. 128-168

Smets, F. and R. Wouters (2003), "An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area", *Journal of the European Economic Association*, Vol. 1, N^o 5, September, pp. 1123-1175

Taylor, J.B (1999) (ed.), *Monetary Policy Rules*, University of Chicago Press and NBER, 442 p

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