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Inflation and Output Dynamics with State-Dependent Nominal Rigidities

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Abstract

The paper shows that in a natural extension of Calvo pricing that endogenizes the degree of nominal rigidities, the pricing scheme delivers a generalized New Keynesian Phillips (NKPC). In the NKPC of the model, current inflation responds to movements of relative prices and to endogenous fluctuations in the average frequency of price adjustment, as well as to the conventional variables: marginal cost and future inflation. I analyze the implications of the extended NKPC on the dynamics of the model.

Keywords: Phillips Curve, State-Dependent Pricing, Nominal Rigidities

JEL classification: E30, E31, E32

Resumen

El documento muestra que en una extensión natural del modelo de fijación de precios de Calvo, la cual endogeneiza el grado de rigideces nominales, se puede derivar una curva neokeynesiana de Phillips generalizada. En la curva de Phillips del modelo la inflación responde a movimientos en los precios relativos y a fluctuaciones en la frecuencia de cambios de precio promedio, así como a las variables convencionales de costo marginal e inflación esperada. Analizo las implicaciones de la curva de Phillips generalizada para la dinámica del modelo.

Palabras clave: Curva de Phillips, precios dependientes del Estado, rigidez nominal

Clasificación JEL: E30, E31, E32

Inflation and Output Dynamics with
State-Dependent Nominal Rigidities

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The paper shows that in a natural extension of Calvo pricing that endogenizes the degree of nominal rigidities, the pricing scheme delivers a generalized New Keynesian Phillips (NKPC). In the NKPC of the model, current inflation responds to movements of relative prices and to endogenous fluctuations in the average frequency of price adjustment, as well as to the conventional variables: marginal cost and future inflation. I analyze the implications of the extended NKPC on the dynamics of the model.

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Resumen

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1. Introduction

The microfounded new Keynesian Phillips curve (NKPC) establishes a link between inflation and a measure of real activity; such link arises from the assumptions about the pricing behavior of firms. In particular, when firms are subject to Calvo (1983) pricing, we can show that around a steady-state equilibrium, deviations of inflation from its steady-state ($\widehat{\Pi}_t$) respond to expected deviations of inflation ($E_t\widehat{\Pi}_{t+1}$), and to deviations of the marginal cost from its steady-state ($\widehat{\psi}_t$). In that framework, the NKPC is

$$\widehat{\Pi}_t = \beta E_t \widehat{\Pi}_{t+1} + S^*_\psi \widehat{\psi}_t, \tag{1}$$

where β and S^*_ψ are given by deep parameters of the model—see for example Woodford (2003). Calvo pricing is a time-dependent pricing in the sense that it assumes that firms adjust prices infrequently and the timing of such price adjustments are not contingent upon the state of the economy; by assumption firms change their prices in a staggered fashion only when they receive an idiosyncratic random signal that arrives with constant probability common to all firms—which I refer to as Calvo probability.

The assumption of time-dependent pricing makes the model very tractable, however it implies that in such economy the degree of nominal rigidities, measured by the average frequency of price changes, is constant and exogenously imposed by the Calvo probability. Moreover, in the NKPC (1) relative prices play no first-order role in shaping the trade-offs between inflation and real activity.

In sharp contrast however, in a class of state-dependent pricing models[2], the

[2]Pricing is state-dependent in the sense that changes in nominal prices happen infrequently and they are triggered by certain states of the economy.

degree of nominal rigidities is determined by the state of the economy and it can fluctuate endogenously along the business cycle; moreover, in that class of models the complete distribution of relative prices is an state variable of the economy and therefore the full distribution of relative prices is a determinant of the trade-offs between inflation and real activity [3]. However, such general class of state-dependent pricing models is intractable because forward-looking optimizing firms would have to forecast not only aggregate variables but also the full distribution of relative prices. Thus, assumptions are made in the literature to reduce the number of state variables and thus make state-dependent pricing models tractable—see for example Caplin and Spulber (1987), Caplin and Leahy (1991, 1997), Dotsey et al. (1997) or Gertler and Leahy (2006).

This paper extends Calvo (1983) pricing to introduce elements of state dependent pricing while preserving its tractability. As in Calvo pricing, the model assumes that there is a continuum of firms that change prices in a staggered fashion only when they receive an idiosyncratic random signal that arrives with probability $(1-\alpha_L)$; such probability is constant in every period of time, independent of the state of the economy. However, different from Calvo (1983) pricing, I assume that when the random signal arrives, firms not only choose the nominal price of their product but also can choose a higher Calvo probability $(1-\alpha_H)$—where $(1-\alpha_H) > (1-\alpha_L)$. Price-setters must pay a lump-sum cost to benefit from faster price revisions; as in Dotsey, King, and Wolman (1999) this lump-sum cost is drawn randomly. An entrepreneur chooses the higher Calvo probability if the cost of doing so is compensated by the associated change in the value of the firm.

The assumptions of the pricing model aim to generate endogenous fluctuations

[3] Caplin and Spulber (1987) is a notable exception of a model with nominal rigidities where such trade-offs are not present; i.e. Caplin and Spulber (1987) model features short-run neutrality of money.

in the degree of nominal rigidities while keeping the model tractable. However, an interpretation of the assumptions in this pricing model follow from the staggered contracts model of Taylor (1980). As pointed out in Calvo (1983), random price changes is a mathematical shortcut to capture the effects of the infrequent and asynchronized price changes in the model of Taylor (1980). That is, in Calvo's model firms do not change prices continuously as if they were constrained by pre-arranged contracts.

Following that interpretation, the assumptions of this paper amount to having firms behaving as if they were constrained by contracts; however different from Calvo pricing, in this model firms behave as if they had an option to sign either a "conventional contract" or a "short contract" by choosing one out two possible Calvo probabilities. Whenever the "current contract" expires—i.e. when a firm receives the random signal to adjust prices—firms choose both, a nominal price and one out of two possible contracts. The model imposes an additional cost to the short contracts—otherwise all firms optimally choose those shorter contracts under all states,—yet under some states of the economy a subset of firms may find optimal to pay such cost and speed up (in expectations) the next price revision [4]. Of course, this interpretation of the pricing assumptions falls short from a detailed microeconomic description of pricing practices pursued in some state-dependent pricing models such as those in Dotsey et al. (1997), Golosov and Lucas (2003) or Gertler and Leahy (2006).

The pricing model of the paper differs from Calvo (1983) pricing in two key characteristics. First, as in state-dependent pricing models, in this model the degree of nominal rigidities is endogenously determined, i.e. the model features state-

[4] Firms can shorten the expected lapse between price revisions by choosing a higher probability associated to the arrival of the random signal to revise prices, $(1 - \alpha_H)$.

dependent nominal rigidities; and second, in this setup, a measure of relative prices and a measure of the average frequency of price changes are endogenous state variables of the model.

The pricing model delivers a generalized New Keynesian Phillips curve with an explicit role for a measure of relative prices ($\widehat{T}_t$) and the average frequency of price revisions $\widehat{F}_t$. The Phillips curve of this model is:

$$\widehat{\Pi}_t = \beta E_t \widehat{\Pi}_{t+1} + S_\psi \widehat{\psi}_t + S_T \widehat{T}_t - S_F \widehat{F}_t, \tag{2}$$

where β is the same parameter as in (1); different from (1), the short-run slope of the Phillips curve (2) in the space of current inflation and marginal cost S_ψ is endogenously determined by the steady-state equilibrium. In steady-state more flexible prices—endogenously induced by lowering the expected lump-sum cost incurred to change prices more often—lead to a steeper Phillips curve. Similarly the coefficients S_T and S_F are endogenously determined by the steady-state equilibrium.

The pricing of the paper contains as special case the standard NKPC (1) of Calvo pricing; that special case is achieved by increasing the average lump-sum cost associated to faster price revision, in the limit, no firm is willing to pay such cost and all firms behave as in the Calvo model. This special case allows to isolate the effects of endogenous fluctuations in the degree of nominal rigidities in simulated experiments.

The rest of the paper is organized as follows. Section 2 presents a dynamic stochastic general equilibrium (DSGE) model; section 3 presents a log-linear version of the supply block of the model and discusses the new features of the Phillips curve; section 4 presents impulse responses of the calibrated model; and section 5 concludes.

2. The Model

The economy is populated by a representative household, a continuum of monopolistic firms indexed by $z \in [0,1]$, a monetary authority, and a fiscal authority.

2.1. The Household

The household's period utility function at t is

$$U(C_t, M_t/P_t, N_t) \equiv \frac{\varphi_{d,t}}{(1-\Gamma)(1-\gamma)} \left[C_t^{1-\gamma} + (M_t/P_t)^{1-\gamma}\right]^{1-\Gamma} + \kappa \varphi_{d,t}^{\iota} \frac{(1-N_t)}{1-\zeta}^{1-\zeta}$$

where $\Gamma \geq 0$, $\gamma > 0$, $\kappa > 0$, $\iota > 0$, and $\zeta \geq 0$. $C_t \equiv \left[\int_0^1 [c_t(z)]^{(\theta-1)/\theta} dz\right]^{\theta/(\theta-1)}$, with $\theta > 1$, is the Dixit-Stiglitz aggregator of consumption over varieties of goods $c_t(z)$. M_t denotes nominal cash balances, P_t is the price index and N_t is time allocated to labor, with the total endowment of time per period normalized to one. $\varphi_{d,t}$ is a preference shock that follows a stationary stochastic process.

The budget constraint is

$$M_{t-1} + A_t + B_{t-1} + W_t N_t + \Delta_t \geq \int_0^1 p_t(z)\, c_t(z) dz + B_t/(1+r_t) + M_t.$$

The sources of funds are nominal cash balances left available in period $t-1$, M_{t-1}, nominal transfers A_t received from the monetary authority, nominal bonds maturing at period t, B_{t-1}, income from working a fraction N_t of the endowed time at a nominal wage rate W_t, and lump-sum transfers equal to the nominal profits from the monopolistic firms, denoted by Δ_t.[5] The uses of funds consist of consumption of the good $c_t(z)$ purchased at the nominal price $p_t(z)$ for $z \in [0, 1]$, bonds purchased at t with nominal value of $B_t/(1+r_t)$, where r_t is the net nominal interest rate between t and $t + 1$, and the money balances M_t carried into $t + 1$.

The household chooses C_t, M_t/P_t, N_t, and B_t/P_t to maximize

$$\sum_{i=0}^{\infty} \beta^i E_t U\left(C_{t+i}, M_{t+i}/P_{t+i}, N_{t+i}\right)$$

subject to the budget constraint. Expenditure minimization yields the demand for the variety $c_t(z)$:

$$c_t(z) = \left[\frac{p_t(z)}{P_t}\right]^{-\theta} C_t\,, \tag{3}$$

where

$$P_t \equiv \left[\int_0^1 [p_t(z)]^{1-\theta}\, dz\right]^{\frac{1}{1-\theta}} \tag{4}$$

is the utility-based price index.

Let χ_t denote the Lagrange multiplier associated to the budget constraint, the first-order conditions for C_t, M_t/P_t, N_t, and B_t/P_t, respectively, imply:

$$\varphi_{d,t}\left[C_t^{1-\gamma} + (M_t/P_t)^{1-\gamma}\right]^{-\Gamma} C_t^{-\gamma} = \chi_t, \tag{5}$$

$$\varphi_{d,t}\left[C_t^{1-\gamma} + (M_t/P_t)^{1-\gamma}\right]^{-\Gamma} (M_t/P_t)^{-\gamma} = \chi_t - \beta E_t \frac{\chi_{t+1}}{\Pi_{t+1}}\,, \tag{6}$$

$$\kappa \varphi_{d,t}^{\iota}\,(1 - N_t)^{-\zeta} = \chi_t w_t, \tag{7}$$

[5] Later it will become clear that this transfers come from two sources. After tax profits from firms and government revenues from taxes on profits. Thus the total transfer equals to the before-taxes-profits, that is $\Delta_t = \int_0^1 \Delta_t(z)dz$, where $\Delta_t(z)$ denotes before-taxes-profits of firm z.

and

$$\chi_t = \beta E_t \frac{\chi_{t+1}\left[1 + r_t\right]}{\Pi_{t+1}}, \tag{8}$$

where $\Pi_t \equiv P_t / P_{t-1}$ is the gross inflation rate, and $w_t \equiv W_t / P_t$ is the real wage.

2.2. The Firms

In every period $t = 0, 1, 2, \ldots$, each firm $z \in [0, 1]$ produces a distinct perishable good indexed with the same index of the producing firm.

The pricing scheme

Extending Calvo (1983) pricing, I assume that the continuum of firms in any period t can be described by two disjoint sets of firms—μ and V—that are subject to a set-specific Calvo probability to reset prices. The set μ, with mass μ_t in period t, contains firms that reset prices subject to the probability $(1 - \alpha_L)$. The set V, with mass V_t in period t, is formed by firms that change prices subject to the probability $(1 - \alpha_H)$; without loss of generality I assume $(1 - \alpha_H) > (1 - \alpha_L)$. It follows that $\mu_t + V_t = 1$ for all t. As described below, the mass of both sets is endogenously determined in every period by the optimal pricing plan of firms (see Figure 1).

A *pricing plan* for a firm resetting prices in period t consists of two objects: a nominal price for its product and a *Calvo probability* $(1 - \alpha_j) \in \left\{(1 - \alpha_L), (1 - \alpha_H)\right\}$. The Calvo probability dictates how often, in average, a firm resets prices; the firm can choose a new price only when it receives a random signal that arrives with probability $(1 - \alpha_j)$.

When a firm receives the random signal of price revisions, as in Dotsey, King and Wolman (1999), it also observes the realization of a random lump-sum cost $\xi \geq 0$, in units of output, that the firm has to pay in order to choose the higher probability of price revisions $(1-\alpha_H)$. [6] If the firm does not pay the random cost, it is subject to the lower probability of price revisions.

A firm that pays the random cost at t will belong to the set V—i.e., is subject to $(1-\alpha_H)$—at least until it receives a new random signal, say at $t+i$; then, the firm will choose at $t+i$ either to pay the random cost again and keep the higher probability of price revisions, or not to pay the random cost and lower its probability of price adjustment to $(1-\alpha_L)$.

Note that the pricing plan (the price *and* the Calvo probability) chosen in period t is in place until the firm receives a new random signal to reset prices. Also note that the random cost ξ is only paid in the period in which the firm is resetting prices and only by those firms that optimally choose the higher Calvo probability. This assumptions greatly simplifies the number of state variables that we need keep track of.

[Figure 1 about here.]

The firm's problem: Value of the firm

The firm chooses a pricing plan—i.e., a price and a Calvo probability—according to the mechanism described above to maximize its value. To save notation, define j as a subindex such that $j \in \{H, L\}$. The value of any firm z can be described using four recursions; two of them associated to its value at t when the firm is setting

[6] In Dotsey et al. (1999), the random lump-sum cost represents units of labor associated to the physical cost (menu cost) of changing prices. In that paper, firms evaluate in every period the convenience of changing prices versus keeping the same price given the physical cost of changing prices. In this paper, firms solve for the optimal pricing plan only when they receive the random signal to reset prices.

a new price at t subject to the probability $(1-\alpha_j)$. I denote the value of such firm with $D_{0j,t}$. The other two recursions are associated to the value of z at $t+i$, with $i=1,2,3\ldots$, when the firm has not changed its price since t and it is subject to the probability $(1-\alpha_j)$. In that case the value of the firm is denoted by $D_{1j,t+i}$. [7] These recursions are described in what follows.

Let $I_t(z)$ be the indicator function equal to 1 if z chooses $(1-\alpha_H)$ in t and zero otherwise. Let $\lambda_t \equiv \Pr[I_t(z)=1]$ be the probability of z choosing $(1-\alpha_H)$ in t. Also let $d(p_{j,t}(z),\cdot)$ be the real profits of the firm z, given the price $p_{j,t}(z)$. Moreover, assume that profits are levied at a tax rate $\tau_j \geq 0$ for firms acting under the probability of price revisions $(1-\alpha_j)$. Note that he model allows for, but does not require, differentiated tax rates. As argued below, for the case of a log-linearized economy around zero steady-state inflation, it will prove useful to assume $\tau_L > 0$ and $\tau_H = 0$. [8]

In period t, the real value of a firm z subject to the Calvo probability $(1-\alpha_j)$ that receives the random signal of price revision, gross of the random cost, is given by the recursion

$$\begin{aligned} D_{0j,t}(S_t) = &\max_{p_{j,t}(z)} \Big\{ (1-\tau_j) d\big(p_{j,t}(z), S_t\big) \\ &+ \beta\alpha_j E_t \frac{\chi_{t+1}}{\chi_t} D_{1j,t+1}\big(p_{j,t}(z), S_{t+1}\big) \\ &+ \beta\,(1-\alpha_j)\, E_t \frac{\chi_{t+1}}{\chi_t} \lambda_{t+1} \left[D_{0H,t+1}\big(S_{t+1}\big) - \Xi_{t+1}\right] \\ &+ \beta\,(1-\alpha_j)\, E_t \frac{\chi_{t+1}}{\chi_t}\,(1-\lambda_{t+1})\, D_{0L,t+1}\big(S_{t+1}\big) \Big\}, \end{aligned} \tag{9}$$

[7] The subindex 0 means that the firm is resetting its price in that period. The subindex 1 means that the firm is not resetting its price in that period. Note that the four recursions account for the possibility of acting under two different probabilities of price revisions and the two possibilities of being allowed to change prices or not.

[8] For example, in Hernandez (2006) I assume $\tau_L = \tau_H = 0$ in a non-linear economy.

where S_t is a vector of variables describing the state of the economy at t, $\beta \frac{\chi_{t+1}}{\chi_t}$ is the stochastic discount factor, and $E_t \Xi_{t+1}$, defined below, is the expected random cost conditional on choosing $(1-\alpha_H)$ at $t+1$ with probability λ_{t+1}.

The recursion (9) has a straightforward interpretation. For example, set $j = H$; it follows from (9) that the value of the firm z at t acting subject to $(1-\alpha_H)$, $D_{0H,t}$, equals the after-tax-profits $(1-\tau_H)d\big(p_{j,t}(z), \cdot\big)$ plus the discounted expected value of the firm at $t+1$. The last three lines in (9) describe the expected value of the firm at $t+1$ under the three possible circumstances.

First, with probability α_H the firm is not allowed to change its price. Thus it is not allowed to choose a different probability of price adjustment. In that case, the value of the firm at $t+1$ is $D_{1H,t+1}(\cdot)$. Second, with probability $(1-\alpha_H)$ the firm receives the random signal of price revision—which is strictly time dependent—and, with expected probability $E_t(1-\alpha_H)\lambda_{t+1}$, the firm decides to pay the random cost. The expected value of the cost paid is $E_t\Xi_{t+1}$—discussed below—, thus, the expected value of the firm is $E_t\big[D_{0H,t+1}(\cdot) - \Xi_{t+1}\big]$. Finally with probability $(1-\alpha_H)$ the firm is allowed to revise its price, and with expected probability $E_t(1-\alpha_H)(1-\lambda_{t+1})$ the firm decides not to pay the random cost. Therefore it will be subject to the probability of price changes $(1-\alpha_L)$. In that case, the expected value of the firm is $E_t D_{0L,t+1}(\cdot)$.

Following the same principle, the value of the firm at $t+i$, with $i = 1, 2, 3, \ldots$, for a firm acting under $(1-\alpha_j)$, if it has not received the signal to reset its price since t, is

$$
\begin{aligned}
D_{1j,t+i}(S_{t+i}) =& (1-\tau_j) d(p_{j,t}(z), S_{t+i}) \\
&+ \beta \alpha_j E_{t+1} \frac{\chi_{t+1+i}}{\chi_{t+i}} D_{1j,t+1+i}(p_{j,t}(z), S_{t+1+i}) \\
&+ \beta (1-\alpha_j) E_{t+1} \frac{\chi_{t+1+i}}{\chi_{t+i}} \lambda_{t+1+i} \left[D_{0H,t+1+i}(S_{t+1+i}) - \Xi_{t+1+i} \right] \\
&+ \beta (1-\alpha_j) E_{t+1} \frac{\chi_{t+1+i}}{\chi_{t+i}} (1-\lambda_{t+1+i}) D_{0L,t+1+i}(S_{t+1+i}).
\end{aligned} \tag{10}
$$

Note that the maximization operator is not present in (10) because the firm cannot revise prices; the only decision made is input demand, which is implicit in the definition of $d(\cdot)$.

Optimal pricing plan I: Optimal Calvo probability

A firm z that receives the random signal of price revisions at t chooses the high probability of price revisions if the value of the firm at t under $(1-\alpha_H)$ exceeds the value of the firm at t under $(1-\alpha_L)$ by at least the lump-sum random cost associated, that is, if

$$
D_{0H,t} - D_{0L,t} \geq \xi. \tag{11}
$$

Before observing the realization of ξ, the probability of z choosing $(1-\alpha_H)$ is $\Pr\left[D_{0H,t} - D_{0L,t} \geq \xi\right] = G\left(D_{0H,t} - D_{0L,t}\right)$, where $G(\cdot)$ is the cumulative density function of the lump-sum random cost ξ. As argued by Dotsey, King and Wolman (1999), the continuity of $G(\cdot)$ and the fact that there is la large number of firms imply that the fraction of firms that chooses $(1-\alpha_H)$, conditional on receiving the random signal of price revisions, is $\lambda_t = G\left(D_{0H,t} - D_{0L,t}\right)$.

For parameterization purposes assume [9] $g(\xi) \equiv b \cdot \exp(-b \cdot \xi)$ if $\xi \geq 0$ and $g(\xi) \equiv 0$

[9]Different from Dotsey et al. (1999) or Burstein (2005), I do not need to impose an upper bound

if $\xi < 0$. Thus, the probability of z choosing $(1-\alpha_H)$ is:

$$\lambda_t = 1 - \exp\Big(-b\big[D_{0H,t} - D_{0L,t}\big]\Big). \quad (12)$$

Moreover, the conditional expected random cost Ξ_t is [10]:

$$E_t\Xi_{t+1} = E_t\frac{1}{\lambda_{t+1}}\left[\frac{1}{b} - \big[1/b + D_{0H,t+1} - D_{0L,t+1}\big]\cdot\exp\Big(-b\big[D_{0H,t+1} - D_{0L,t+1}\big]\Big)\right]. \quad (13)$$

Optimal pricing plan II: Optimal new prices

Any firm z choosing an optimal pricing plan maximizes its expected present value by choosing a Calvo probability—as described in the section above— and a nominal price $p_{j,t}(z)$, subject to: the pricing scheme described, the demand for good z (equation 3) and the technology

$$y_t(z) = \varphi_{T,t}N_t(z), \quad (14)$$

where $y_t(z)$ is the total output produced by the firm, $N_t(z)$ is the amount of labor employed by the firm z, and $\varphi_{T,t}$ is a productivity shock that follows a stationary stochastic process. $y_t(z)$ has two components: output produced to satisfy consumer demand $y_{c,t}(z)$ and output required in pricing activities by firms incurring the random lump-sum cost, $y_{p,t}(z)$, i.e., $y_t(z) \equiv y_{c,t}(z) + y_{p,t}(z)$.

Constant returns to scale together with the market clearing condition $c_t(z) =$

for the random variable ξ. This is because firms have the option of not paying the random cost and still change prices with a lower frequency.

[10]Note that the expected random cost is conditional on ξ satisfying $[D_{0H,t} - D_{0L,t}] \geq \xi \geq 0$. Otherwise, according to (11), the firm chooses not to pay the random cost. To obtain equation (13) compute $1/G\left(D_{0H,t} - D_{0L,t}\right)\cdot\int_0^{[D_{0H,t}-D_{0L,t}]} x\, g(x)dx$, forward the resulting expression one period and take the expected value. Note that the term $1/\lambda_{t+1}$ in (13) is part of the conditional distribution, i.e., $g(\xi|\xi < \xi_0) = g(\xi)/G(\xi_0)$.

$y_{c,t}(z)$ and equation (3) yields the profit function gross of the random lump-sum cost as

$$d\left(p_{j,t}, S_t\right) = \left[\frac{p_{j,t}(z)}{P_t} - \psi_t\right] \left(\frac{p_{j,t}(z)}{P_t}\right)^{-\theta} C_t. \tag{15}$$

where ψ_t is the real marginal cost. Note that the marginal cost is not firm specific because labor is freely mobile and $\varphi_{T,t}$ is common across firms.

Using equations (9), (10) and (15) the optimal new price set at t by *any* firm under the Calvo probability $(1-\alpha_j)$ is [11]

$$p_{j,t}^* = \frac{\theta}{\theta-1} \frac{E_t \sum_{i=0}^{\infty} \left(\beta\alpha_j\right)^i \frac{\chi_{t+i}}{\chi_t} \psi_{t+i} \left(P_{t+i}\right)^{\theta} C_{t+i}}{E_t \sum_{i=0}^{\infty} \left(\beta\alpha_j\right)^i \frac{\chi_{t+i}}{\chi_t} \left(P_{t+i}\right)^{\theta-1} C_{t+i}}, \tag{16}$$

where I dropped the firm-subindex z because the new price $p_{j,t}^*$ is common for all firms subject to the probability $(1-\alpha_j)$.

A recursion for the aggregate degree of nominal rigidities

To aggregate firm-level prices and form a price index we need to keep track of the mass of firms setting prices under each Calvo probability. Recall that μ_t is the mass of firms setting prices subject to the Calvo probability $(1-\alpha_L)$ and V_t is the mass of firms setting prices with the Calvo probability $(1-\alpha_H)$—see Figure 1.

Note that the mass of firms choosing $(1-\alpha_H)$ in period t is given by the difference

[11] From equation (9), the first-order condition for the optimal new price is

$$0 = (1-\tau_j) \frac{\partial d\left(p_{j,t}(z), S_t\right)}{\partial p_{j,t}(z)} + \beta\alpha_j E_t \frac{\chi_{t+1}}{\chi_t} \frac{\partial D_{1j,t+1}\left(p_{j,t}(z), S_{t+1}\right)}{\partial p_{j,t}(z)},$$

where, from equation (10)

$$\frac{\partial D_{1j,t+i}\left(p_{j,t}(z), S_{t+i}\right)}{\partial p_{j,t}(z)} = (1-\tau_j) \frac{\partial d\left(p_{j,t}(z), S_{t+i}\right)}{\partial p_{j,t}(z)} + \beta\alpha_j E_t \frac{\chi_{t+1+i}}{\chi_{t+i}} \frac{\partial D_{1j,t+1+i}\left(p_{j,t}(z), S_{t+1+i}\right)}{\partial p_{j,t}(z)}$$

for $i = 1, 2, 3, \ldots$. To obtain (16), use equation (15) to get $\partial d(\cdot) / \partial p_{j,t}(z)$ and substitute it in the two equations above recursively.

$V_t - V_{t-1}$. It follows that the dynamics of V_t and μ_t can be described with the recursions

$$\begin{aligned} V_t &= V_{t-1} + \lambda_t(1-\alpha_L)\mu_{t-1} - (1-\lambda_t)(1-\alpha_H)V_{t-1}, \\ \mu_t &= 1 - V_t, \\ \mu_0 &= \mu, \text{ and } V_0 = V. \end{aligned} \tag{17}$$

The first recursion in (17) implies that the net mass of firms choosing $(1-\alpha_H)$ at t, that is $V_t - V_{t-1}$, equals the mass of firms that decided to switch from $(1-\alpha_L)$ to $(1-\alpha_H)$ at the beginning of the period —$\lambda_t(1-\alpha_L)\mu_{t-1}$—, minus the mass of firms switching back from the higher probability to the lower probability— $(1-\lambda_t)(1-\alpha_H)V_{t-1}$. The second equation in (17) holds because the mass of firms is constant and equal to one for all $t = 0, 1, 2 \ldots$. The initial conditions are determined by the steady state of the economy.

Note that if we assume that one period represents a quarter, it follows that, in average, firms in the economy change prices

$$F_t \equiv (1-\alpha_L)\mu_t + (1-\alpha_H)(1-\mu_t) \tag{18}$$

times per quarter. Thus, although the expected frequency of price revisions can take only two values at firm level, the average frequency of price revisions at the aggregate level is a double-bounded continuous function with upper and lower bounds $(1-\alpha_H)$ and $(1-\alpha_L)$, respectively.

In that sense the Calvo probabilities in this model can be interpreted as an upper and lower bound to the *aggregate degree of nominal rigidities*, measured by F_t. Moreover, the aggregate degree of nominal rigidities fluctuates with the state of the economy.

The price level

To make explicit the effects of firms optimally choosing a Calvo probability on the evolution of the price level, it is convenient to rewrite the price index (4), in terms of the price sub-indexes $P_{L,t}$ and $P_{H,t}$ as follows

$$P_t \equiv \left[\int_0^1 \left[p_t(z)\right]^{1-\theta} dz\right]^{\frac{1}{1-\theta}} \equiv \left[\delta_t P_{L,t}^{1-\theta} + (1-\delta_t) P_{H,t}^{1-\theta}\right]^{\frac{1}{1-\theta}}, \tag{19}$$

where $P_{L,t} \equiv \left[\frac{1}{\delta_t}\int_0^{\mu_t} [p_t(s)]^{1-\theta} ds\right]^{\frac{1}{1-\theta}}$ and $P_{H,t} \equiv \left[\frac{1}{1-\delta_t}\int_{\mu_t}^1 [p_t(s)]^{1-\theta} ds\right]^{\frac{1}{1-\theta}}$.

With the proper selection of the index $s \in [0,1]$, the integral in the sub-index $P_{j,t}$ aggregates prices of firms subject to the probability $(1-\alpha_j)$. Note that the choice of the weight $\delta_t \in (0,1)$ does not affect the price index definition nor its dynamics. [12] However, it is convenient to define the sub-indexes $P_{j,t}$ with δ_t equal to the steady-state value of μ in order to make explicit the effect of the average frequency of price changes in the Phillips curve. Thus, I assume $\delta_t = \mu$ in what follows.

Recursions for price sub-indexes

As in the standard Calvo (1983)–Yun (1996) setup, the dynamics of the price sub-indexes can be described using a simple recursion. Note that for any firm subject to $(1-\alpha_j)$, the probability of not changing prices is equal to α_j in every period. Thus, in every period the price sub-index $P_{j,t}$ contains a fraction α_j of the prices prevailing in the previous period. Moreover, since all firms setting a new price at

[12] If $\delta_t = \mu_t$, the price sub-indexes $P_{L,t}$ and $P_{H,t}$ are the consumer price sub-indexes of the baskets of goods produced by firms in the sets μ and V, respectively.

t under $(1-\alpha_j)$ choose the same price $p^*_{j,t}$, then:

$$P_{L,t}^{(1-\theta)} = \alpha_L P_{L,t-1}^{(1-\theta)} + \frac{1}{\mu}\left[(1-\alpha_L)\mu_{t-1} - (V_t - V_{t-1})\right] \left(p^*_{L,t}\right)^{(1-\theta)}, \tag{20}$$

and

$$P_{H,t}^{(1-\theta)} = \alpha_H P_{H,t-1}^{(1-\theta)} + \frac{1}{1-\mu}\left[(1-\alpha_H)(1-\mu_{t-1}) + (V_t - V_{t-1})\right] \left(p^*_{H,t}\right)^{(1-\theta)}. \tag{21}$$

Equations (20) and (21) make explicit the effects of firms endogenously choosing to reset prices faster or slower on the dynamics of the price index. The terms $\left[(1-\alpha_L)\mu_{t-1} - (V_t - V_{t-1})\right]$ and $\left[(1-\alpha_H)(1-\mu_{t-1}) + (V_t - V_{t-1})\right]$ in equations (20) and (21) account for the mass of firms setting the new prices $p^*_{L,t}$ and $p^*_{H,t}$ in period t, respectively. [13]

Calvo price index as special case

The price index described by equations (19), (20) and (21) contains as special case the price index obtained from the standard Calvo pricing. To see that, note that if the cost of choosing faster price revisions (ξ) is fully restrictive, then the probability of a generic firm z choosing $(1-\alpha_H)$ is zero; that is $\lambda_t = 0$ for all t. It follows from (17) that $V_t = 0$ and $\mu_t = 1$ for all t, thus the price sub-index (21) vanishes and the price index boils down to $P_t = P_{L,t}$, where from (20):

$$P_{L,t}^{(1-\theta)} = \alpha_L P_{L,t-1}^{(1-\theta)} + (1-\alpha_L)\left(p^*_{L,t}\right)^{(1-\theta)}.$$

[13] In (20), the mass of firms setting the new price $p^*_{L,t}$ is expressed as the mass of firms in the low probability that had the opportunity to revise prices at the beginning of the period t, $(1-\alpha_L)\mu_{t-1}$, minus the net mass of those that decided to choose $(1-\alpha_H)$ at t, $(V_t - V_{t-1})$—see Figure 1. Similarly, in (21), the mass of firms setting the new price $p^*_{H,t}$ is expressed as the mass of firms under the high probability that received the random signal of price changes at the beginning of the period, $(1-\alpha_H)(1-\mu_{t-1})$, plus the net mass of firms choosing $(1-\alpha_H)$ at t, $(V_t - V_{t-1})$.

Note that the price index in the equation above together with the firm's optimal price (16) can also be obtained from a model using Calvo pricing, thus the model contains *as special case* the new Keynesian Phillips curve (1) widely discussed in the literature.

2.3. Monetary Policy

Finally, to close the model, we must specify the monetary policy. I assume that the central bank follows a modified Taylor (1993) rule

$$\widehat{r}_t = \sigma_r \widehat{r}_{t-1} + \sigma_\pi \widehat{\Pi}_{t-1} + \sigma_y \widehat{Y}_{c,t-1} + \varepsilon_{r,t} \,. \tag{22}$$

where $\widehat{x}_t$ denotes log-linear deviations from steady-state for the corresponding variable; $\sigma_r \geq 0$, $\sigma_\pi > 0$ and $\sigma_y \geq 0$ are parameters chosen by the central bank; and $\varepsilon_{r,t}$ is an i.i.d. shock with standard deviation Φ_r.

3. A Generalized Phillips Curve

To analyze the dynamics of the model I use its log-linear version. I denote by $\widehat{x}_t \equiv dx_t/x$ the percentage (logarithmic) deviation of the variable x_t from its steady-state value—which is written without the time subscript.

The Phillips curve of the model is obtained from equations (16)-(21). As shown in Appendix A, defining the ratio of price sub-indexes (20) and (21) as $T_t \equiv P_{L,t}/P_{H,t}$, the model yields the Phillips curve

$$\widehat{\Pi}_t = \beta E_t \widehat{\Pi}_{t+1} + S_\psi \widehat{\psi}_t + S_T \widehat{T}_t - S_F \widehat{F}_t, \tag{23}$$

where all the coefficients are positive, with $S_\psi \equiv [\mu a_L + (1-\mu)a_H]$, $S_T \equiv \mu(1-\mu)(a_H - a_L)$, $S_F \equiv \frac{1}{\theta-1}F\left[(\alpha_H^{-1} - \alpha_L^{-1})/(\alpha_L - \alpha_H) - \beta\right]$, $a_L \equiv (1-\alpha_L)(1-\beta\alpha_L)/\alpha_L$, and $a_H \equiv (1-\alpha_H)(1-\beta\alpha_H)/\alpha_H$.

In the generalized NKPC (23), as in the textbook version of Calvo's (1983) model, inflation is forward looking and responds to fluctuations in marginal cost. Moreover, in the Phillips curve (23), as in Carlstrom, Fuerst, and Ghironi (2005), the relative prices T_t affect current inflation;[14] the relative prices T_t—as shown in appendix B—are governed by the second-order difference equation

$$\beta E_t\widehat{T}_{t+1} - \tau_1\widehat{T}_t + \widehat{T}_{t-1} = (a_H - a_L)\widehat{\psi}_t + \beta\tau_2 E_t\widehat{F}_{t+1} - \tau_3\widehat{F}_t + \tau_2\widehat{F}_{t-1}, \tag{24}$$

where $\tau_1 \equiv [1 + \beta + (1-\mu)a_L + \mu a_H]$, $\tau_2 \equiv \frac{F}{\theta-1}\frac{1}{\alpha_L-\alpha_H}\frac{1}{\mu(1-\mu)}$, and $\tau_3 \equiv \frac{F}{\theta-1}\frac{1}{\alpha_L-\alpha_H}\left[\frac{1}{\mu}(\beta\alpha_L + \alpha_L^{-1}) + \frac{1}{1-\mu}(\beta\alpha_H + \alpha_H^{-1})\right]$.

From the price sub-indexes (20) and (21) it is clear that the dynamics of the mass of firms setting new prices at different intervals of time, play a role in shaping the evolution of the price level. Thus, $\widehat{F}_t$ appears in the Phillips curve to account for the evolution of such mass of firms. [15] The log-linear version of the average frequency of price revisions (18) yield

$$\widehat{F}_t = \nu_1\widehat{F}_{t-1} + \nu_2\widehat{\lambda}_t\,, \tag{25}$$

where $\nu_1 \equiv [1 - (1-\alpha_L)\lambda - (1-\alpha_H)(1-\lambda)]$, thus $\nu_1 \in (0, 1)$, and $\nu_2 \equiv \lambda(\alpha_L - \alpha_H)$.

[14] Carlstrom, Fuerst, and Ghironi (2005) investigate the determinacy properties of a two-sector model with different degrees of nominal rigidity. In Carlstrom et al. (2005) T_t represents the ratio of price sub-indexes for the corresponding sub-baskets. Here, as mentioned above, T_t does not represent the ratio of price sub-indexes, since the weights in the price sub-indexes are fixed (μ, $1-\mu$), while the mass of firms forming the sub-baskets is allowed to change (μ_t, $1-\mu_t$).

[15] Note that using (17) and (18) the mass of firms μ_t and V_t can both be expressed in terms of the average frequency of price revisions.

Finally, to complete the description of the supply block, appendix B shows that log-linear versions of equations (9) and (10) together with the definition of λ_t in (12) yield:

$$\widehat{\lambda}_t = \beta\nu_1 E_t \widehat{\lambda}_{t+1} + (\tau_L - \tau_H) d\widehat{d}_t + \nu_3 E_t (\widehat{\chi}_{t+1} - \widehat{\chi}_t) \tag{26}$$

where $\nu_3 \equiv \frac{1-\lambda}{\lambda} b \left[D_H - D_L - (\tau_L - \tau_H) d\right]$ and $\widehat{d}_t = \widehat{C}_t - (\theta - 1)\widehat{\psi}_t$ is the log-linear profit function (15).

Equations (23)–(26) describe the supply bock of the model. Two comments are worth to mention: first, note that the persistence of the frequency of price changes—measured by ν_1—is a consequence of the time-dependent feature of the model, i.e., because firms are not allowed to vary the probability of price adjustments in every period. Second, note from equation (25) that the driving force behind fluctuations in the frequency of price changes F_t is the probability of choosing faster price revisions, λ_t; moreover, equation (26) shows that such probability is determined by the string of current and future profit-differentials across firms setting prices under each probability, $(\tau_L - \tau_H) d\widehat{d}_t$, and the effect of the discount factor. Hence, if the effect of profit-differentials dominates in (26), we expect the frequency of price changes to co-move with profits.

4. The Full Microfounded DSGE model

Table 1 summarizes the DSGE model described in Section 2 in a system of twelve log-linear equations (27)-(38) describing the dynamics of twelve endogenous variables: $\widehat{\Pi}_t$, $\widehat{r}_t$, $\widehat{F}_t$, $\widehat{T}_t$,$\widehat{\psi}_t$, $\widehat{C}_t$, $\widehat{N}_t$, $\widehat{\lambda}_t$, $\widehat{Y}_{p,t}$, $\widehat{\Xi}_t$, $\widehat{m}_t$ and $\widehat{\chi}_t$. The model also includes three exogenous disturbances: a shock to the Taylor rule, a productivity shock (39), and a preference shock (40).

[Table 1 about here.]

4.1. Calibration

I calibrate the model with parameter values from the literature. Table 2 summarizes the calibration of the model; in particular the parameters in the Taylor rule ensure determinacy. To save space, I'll only discuss the parameters regarding the pricing mechanism.

[Table 2 about here.]

Firms' profits play no role in most monetary models of the business cycle, however in this model, firms' decisions about speeding up future changes in prices are based on the string of current and expected future profits. Thus, the stylized fact of procyclical profits—see Rotemberg and Woodford (1999)—is a key issue for calibration in this model.

Christiano et al. (1996) discuss how the standard new Keynesian model requires a high value of the firm's markup in order to produce procyclical movements in profits. This property is inherited by our model. Here, I do not attempt to find a remedy, but I impose a high markup for the monopolistic firms ($\theta = 3$ implies a 50 percent markup) and an infinite elasticity of labor supply ($\zeta = 0$) to generate procyclicality of profits[16].

The parameters of the pricing mechanism are chosen to stay close to the standard time-dependent model. $(1 - \alpha_L) = 1/5$ implies that firms under the low frequency of price changes revise prices once every five quarters on average;

[16]Rotemberg and Woodford (1999) propose some remedies to Christiano, Eichenbaum and Evans' critique.

$(1 - \alpha_H) = 1/3$ implies that, under the high frequency of price adjustments, firms set new prices prices once every three quarters on average[17].

The parameter b in the distribution of the random cost $G(\cdot)$ is chosen so that the unconditional mean of ξ is the same as in Dotsey et al. (1999), i.e. $E[\xi] = 1/b = 0.006$. Golosov and Lucas' (2003) calibration implies that the random lump-sum cost of price revisions is about 1.9 percent of profits. According to our calibration, the (unconditional) expected cost represents 1.3 percent of profits. The values of differentiated tax rates on profits, $\tau_L = 0.005$ and $\tau_H = 0$, allow for the average frequency of price changes to increase by 17 percent or decrease by 23 percent with respect to its steady state ($F = 0.28$), without hitting the upper or lower bounds.

4.2. Impulse Responses

The special case of the model discussed in page 16, when the price index boils down to the Calvo price index, offers a natural benchmark to analyze the effects of the extended Phillips curve (23). I calculate the impulse responses for the three exogenous shocks of the model—preference shock, technology shock and shock to the Taylor rule—using the techniques described in Uhlig (1999). Then I compare the results with the special case of the model, when the Phillips curve resembles equation (1) with $S_{\psi}^{*} \equiv (1 - \alpha_L)(1 - \beta\alpha_L)/\alpha_L$.

Figure 2, shows the responses of interest rate, inflation, output and the average frequency of price changes to a positive, one standard deviation preference shock.

[17] Note that in the model, the probabilities of price adjustment $(1 - \alpha_L)$ and $(1 - \alpha_H)$ represent two possibilities that one firm can adopt as part of its optimal pricing policy. Values for the frequency of price chances in that range are common in the literature. Also note that this approach is different from the two-sector model with different degrees of nominal rigidity of Carlstrom, Fuerst, and Ghironi (2005) or Bils and Klenow (2004) which capture intersectoral heterogeneity in nominal rigidities.

The response of inflation is stronger in the model of this paper, while the response of output is weaker than those in the time-dependent benchmark. The same property holds also for inflation and output responses to productivity shocks and shocks to the Taylor rule, as shown in Figures 3 and 4. For monetary expansions this result is found also by Dotsey et al. (1997).

Figures 2, 3, and 4 also show that for small shocks the dynamics of output and inflation in the model with elements of state-dependent pricing is well approximated by the time-dependent model. That conclusion is also found by Dotsey et al. (1997), Burstein (2005) or Klenow and Kryvtsov (2004).

Moreover, Figures 2, 3 and 4 show that the frequency of price changes is procyclical. This result follows from the procyclicality of profits. Under zero steady-state inflation, the difference in the value of firms adjusting prices faster versus those adjusting slower is proportional to profits—common for both type of firms. Thus, more firms are willing to cover the costs of additional price revisions in booms, causing upward fluctuations in the average frequency of price changes. Furthermore, procyclical movements in the average frequency of price revisions imply that inflation and the average frequency of price changes move in the same direction after preference shocks or shocks to the Taylor rule, but they move in opposite directions after technology shocks. This result is in line with the conventional wisdom that the frequency of price changes is positive correlated with the inflation rate. For example, such relation is *assumed* in Bakhshi, Burriel-Llombart, Khan, and Rudolf (2005). Moreover, evidence of that correlation is found by Cecchetti (1986) and suggested in Zbaraki et al. (2003).

Figure 5 shows the evolution of the relative price $T_t \equiv P_{L,t}/P_{H,t}$. Figures 2 to 5 show that the impulse responses of the terms T_t and F_t in the Phillips curve (23) are persistent. Those terms can be identified as cost-push shocks by some-one using the standard Calvo (1983) or Rotemberg (1982) pricing model. For example, Ireland (2004), using data for the U.S. economy in the postwar period, finds evidence of systematic deviations in the inflation-output relation predicted by a model with Rotemberg (1982) pricing. In Ireland's (2004) model the cost-push shock is characterized as exogenous stochastic disturbances in the degree of monopolistic power that follow an autoregressive process of order one. Consistently with the prediction of our model, Ireland finds that such shocks are very persistent (with a correlation coefficient of 0.9672) [18].

[Figure 2 about here.]

[Figure 3 about here.]

[Figure 4 about here.]

[Figure 5 about here.]

5. Concluding Remarks

This paper introduced elements of state-dependent pricing in a tractable fashion in a dynamic, stochastic, general equilibrium monetary model. The pricing scheme proposed represents a natural extension of Calvo's (1983) pricing which generates endogenous movements in the average frequency of price revisions.

The pricing mechanism delivers a generalized New Keynesian Phillips curve in the sense that it makes explicit the role of relative prices and the frequency price revisions as additional endogenous variables that affect the inflation-output

[18] Moreover, Ireland (2004) finds that cost-push shocks are more relevant than technology shocks in explaining the behavior of inflation, output and interest rates.

trade-off. The model offers, therefore, a microfounded rationale for systematic deviations in the inflation-output relation predicted by the new Keynesian Phillips curve, i.e. cost-push shocks. Different from Steinsson (2003) or Ireland (2004), who microfound cost-push shocks as exogenous stochastic disturbances to the elasticity of substitution between goods, here, such deviations arise endogenously. Moreover, the model predicts that exogenous shocks would have persistent effects in both terms, relative prices and the frequency price revisions.

Additionally, I see this as a basic setup suited to tackle questions for which endogenous price flexibility is central in a dynamic, stochastic, general equilibrium framework. For example, we know since Ireland (1997b) that we can explain the empirical evidence on disinflationary programs implemented in high and moderate inflation economies found by Gordon (1982) and Sargent (1982) by allowing for endogenous speed of price adjustments. Moreover, Calvo, Celasun, and Kumhof (2003) show that the frequency of price adjustments (exogenously given in their model) plays an important role in measuring welfare costs of disinflation programs. Finally, Hernandez (2006) shows that endogenous fluctuations in the frequency of price changes are key to rationalize the dynamics of consumption and inflation observed in large exchange rate-based disinflation programs—the type of programs implemented in several Latin American economies in the past decades. This suggests that elements of state-dependent pricing are a desirable feature in models of disinflation programs.

A. Appendix: Deriving The Phillips Curve

Log-linearizing the second equation in (17) we obtain

$$\widehat{\mu}_t = -V/\mu\widehat{V}_t\,. \tag{A-1}$$

Log-linearizing the price index (19) yields

$$\widehat{P}_t = \mu\widehat{P}_{L,t} + (1-\mu)\widehat{P}_{H,t}\,. \tag{A-2}$$

From (A-2), defining $\Pi_{j,t} \equiv \frac{P_{j,t}}{P_{j,t-1}}$,

$$\widehat{\Pi}_t = \mu\widehat{\Pi}_{L,t} + (1-\mu)\widehat{\Pi}_{H,t}\,. \tag{A-3}$$

The log-linear version of equation (16) can be written as

$$\widehat{p}^*_{j,t} = (1-\beta\alpha_j)(\widehat{P}_t + \widehat{\psi}_t) + E_t\,\beta\alpha_j\widehat{p}^*_{j,t+1}\,. \tag{A-4}$$

Using (A-1), the log-linear versions of equations (20) and (21) are

$$\widehat{P}_{L,t} = \alpha_L\widehat{P}_{L,t-1} + (1-\alpha_L)\widehat{p}^*_{L,t} + \frac{1}{\theta-1}\frac{V}{\mu}\left[\widehat{V}_t - \alpha_L\widehat{V}_{t-1}\right] \tag{A-5}$$

$$\widehat{P}_{H,t} = \alpha_H\widehat{P}_{H,t-1} + (1-\alpha_H)\widehat{p}^*_{H,t} - \frac{1}{\theta-1}\frac{V}{1-\mu}\left[\widehat{V}_t - \alpha_H\widehat{V}_{t-1}\right]\,. \tag{A-6}$$

Next, let $R_{j,t} \equiv \frac{P_{j,t}}{P_t}$ and recall $T_t \equiv \frac{P_{L,t}}{P_{H,t}}$. Thus, from (A-2), we have

$$\widehat{R}_{L,t} = (1-\mu)\widehat{T}_t \ \text{ and } \widehat{R}_{H,t} = -\mu\widehat{T}_t\,. \tag{A-7}$$

Forwarding (A-5) and solving for $\widehat{p}^*_{L,t+1}$, I obtain

$$(1-\alpha_L)\widehat{p}^*_{L,t+1} = \widehat{\Pi}_{L,t+1} + (1-\alpha_L)\widehat{P}_{L,t} - \frac{1}{\theta-1}\frac{V}{\mu}(\widehat{V}_{t+1} - \alpha_L\widehat{V}_t)\,.$$

Substituting the last equation into the right-hand side of (A-4) for $j = L$, substituting the resulting equation into (A-5), and rearranging yields

$$\begin{aligned}\widehat{\Pi}_{L,t} = \beta E_t \widehat{\Pi}_{L,t+1} + \frac{(1-\alpha_L)(1-\beta\alpha_L)}{\alpha_L}\left[\widehat{\psi}_t - \widehat{R}_{L,t}\right] \\ - \beta\frac{1}{\theta-1}\frac{V}{\mu}E_t\left[\widehat{V}_{t+1} - \alpha_L\widehat{V}_t\right] + \frac{1}{\alpha_L}\frac{1}{\theta-1}\frac{V}{\mu}\left[\widehat{V}_t - \alpha_L\widehat{V}_{t-1}\right]\,.\end{aligned} \tag{A-8}$$

Forwarding (A-6) and solving for $\widehat{p}^*_{H,t+1}$, I obtain

$$(1-\alpha_H)\widehat{p}^*_{H,t+1} = \widehat{\Pi}_{H,t+1} + (1-\alpha_H)\widehat{P}_{H,t} + \frac{1}{\theta-1}\frac{V}{1-\mu}(\widehat{V}_{t+1} - \alpha_H\widehat{V}_t).$$

Substituting the last equation into the right-hand side of (A-4) for $j = H$, substituting the resulting equation into (A-6), and rearranging yields

$$\begin{aligned}\widehat{\Pi}_{H,t} =& \beta E_t \widehat{\Pi}_{H,t+1} + \frac{(1-\alpha_H)(1-\beta\alpha_H)}{\alpha_H}\left[\widehat{\psi}_t - \widehat{R}_{H,t}\right] \\ &+ \beta\frac{1}{\theta-1}\frac{V}{1-\mu}E_t\left[\widehat{V}_{t+1} - \alpha_H\widehat{V}_t\right] - \frac{1}{\alpha_H}\frac{1}{\theta-1}\frac{V}{1-\mu}\left[\widehat{V}_t - \alpha_H\widehat{V}_{t-1}\right]\,.\end{aligned} \tag{A-9}$$

Next, multiplying (A-8) times μ and (A-9) times $(1-\mu)$, substituting the resulting equations into (A-3) and using (A-7) yields

$$\begin{aligned}\widehat{\Pi}_t = \beta E_t \widehat{\Pi}_{t+1} + \left[\mu\,(1-\alpha_L)(1-\beta\alpha_L)/\,\alpha_L + (1-\mu)\,(1-\alpha_H)(1-\beta\alpha_H)/\,\alpha_H\right]\widehat{\psi}_t \\ + \mu(1-\mu)\left[(1-\alpha_H)(1-\beta\alpha_H)/\,\alpha_H - (1-\alpha_L)(1-\beta\alpha_L)/\,\alpha_L\right]\widehat{T}_t \\ - \frac{1}{\theta-1}V\left[\left(\alpha_H^{-1} - \alpha_L^{-1}\right) - \beta(\alpha_L - \alpha_H)\right]\widehat{V}_t\end{aligned} \tag{A-10}$$

Finally, using (25), and the definitions of a_L, a_H and f in the text, we obtain the Phillips curve equation (23).

B. Appendix: Difference equations for T_t and λ_t

First note that log-linearizing equations (17) and (18) we obtain:

$$\widehat{V}_t = \nu_1 \widehat{V}_{t-1} + \lambda[(1-\alpha_H) + \mu(1-\alpha_L)/V]\widehat{\lambda}_t, \tag{B-1}$$

and

$$\widehat{F}_t = (\alpha_L - \alpha_H)\frac{V}{F}\widehat{V}_t \tag{B-2}$$

where, as in the text, $\nu_1 \equiv [1-(1-\alpha_L)\lambda - (1-\alpha_H)(1-\lambda)]$. Substituting B-2 into B-1 we obtain equation (25).

The second-order difference equation for T_t, (24), is obtained as follows. Rewrite (A-5) as

$$\begin{aligned}\beta E_t R_{L,t+1} - \left[1+\beta+(1-\alpha_L)(1-\beta\alpha_L)/\,\alpha_L\right] R_{L,t} + R_{L,t-1} = \\ \Pi_t - \beta E_t \Pi_{t+1} - \left[(1-\alpha_L)(1-\beta\alpha_L)/\,\alpha_L\right]\psi_t \\ -\beta\frac{1}{\theta-1}\frac{V}{\mu}E_t\left[\widehat{V}_{t+1} - \alpha_L\widehat{V}_t\right] + \frac{1}{\alpha_L}\frac{1}{\theta-1}\frac{V}{\mu}\left[\widehat{V}_t - \alpha_L\widehat{V}_{t-1}\right];\end{aligned} \tag{B-3}$$

similarly, rewrite (A-6) as

$$\begin{aligned}\beta E_t R_{H,t+1} - \left[1+\beta+(1-\alpha_H)(1-\beta\alpha_H)/\,\alpha_H\right] R_{H,t} + R_{H,t-1} = \\ \Pi_t - \beta E_t \Pi_{t+1} - \left[(1-\alpha_H)(1-\beta\alpha_H)/\,\alpha_H\right]\psi_t \\ +\beta\frac{1}{\theta-1}\frac{V}{1-\mu}E_t\left[\widehat{V}_{t+1} - \alpha_H\widehat{V}_t\right] - \frac{1}{\alpha_H}\frac{1}{\theta-1}\frac{V}{1-\mu}\left[\widehat{V}_t - \alpha_H\widehat{V}_{t-1}\right].\end{aligned} \tag{B-4}$$

Finally, to obtain equation (24) use (A-7) to express (B-3) and (B-4) in terms of T_t; subtract (B-4) from (B-3) and collect common terms; in the expression obtained, use equation (B-2) to substitute V_t for F_t; and use the definitions of τ_1, τ_2 and τ_3 in the text.

To derive equation (26), first note that in steady-state $D_{0H} = D_{1H}$; alsot note that log-linear versions of (9) and (10)—evaluating this dunctions at the optimal prices—imply $\widehat{D}_{0j,t} = \widehat{D}_{1j,t}$. Thus, denote with $\widehat{D}_{j,t}$ the value of the firm acting under $(1-\alpha_j)$.

Next, log-linearize equation (12) to obtain

$$\widehat{\lambda}_t = \frac{1-\lambda}{\lambda} b \left[D_H \widehat{D}_{H,t} - D_L \widehat{D}_{L,t} \right]. \tag{B-5}$$

Equation (9) for $j = H$ implies

$$\begin{aligned} D_H \widehat{D}_{H,t} = {} & (1-\tau_H) d\, \widehat{d}_t + \left[\beta\alpha_H + \beta\lambda(1-\alpha_H)\right] D_H E_t \widehat{D}_{H,t+1} \\ & + \beta(1-\alpha_H)(1-\lambda) D_L E_t \widehat{D}_{L,t+1} + \left[D_H - (1-\tau_H)d\right] E_t \left(\widehat{\chi}_{t+1} - \widehat{\chi}_t\right) \end{aligned} \tag{B-6}$$

and for $j = L$ it implies

$$\begin{aligned} D_L \widehat{D}_{L,t} = {} & (1-\tau_L) d\, \widehat{d}_t + \beta\lambda(1-\alpha_L) D_H E_t \widehat{D}_{H,t+1} \\ & + \left[\beta - \beta\lambda(1-\alpha_L)\right] D_L E_t \widehat{D}_{L,t+1} + \left[D_L - (1-\tau_L)d\right] E_t \left(\widehat{\chi}_{t+1} - \widehat{\chi}_t\right). \end{aligned} \tag{B-7}$$

Subtract $\beta(1-\alpha_H)(1-\lambda) D_H E_t \widehat{D}_{H,t+1}$ from both sides of equation (B-6) to obtain

$$\begin{aligned} & D_H \widehat{D}_{H,t} - \beta(1-\alpha_H)(1-\lambda) D_H E_t \widehat{D}_{H,t+1} = \\ & \quad (1-\tau_H) d\, \widehat{d}_t + \left[\beta\alpha_H + \beta\lambda(1-\alpha_H)\right] D_H E_t \widehat{D}_{H,t+1} \\ & \quad + \beta(1-\alpha_H)(1-\lambda) E_t \left[D_L \widehat{D}_{L,t+1} - D_H \widehat{D}_{H,t+1} \right] + \left[D_H - (1-\tau_H)d\right] E_t \left(\widehat{\chi}_{t+1} - \widehat{\chi}_t\right). \end{aligned}$$

Use (B-5) in the last expression and simplify to find

$$\begin{aligned} D_H\widehat{D}_{H,t} &= \beta D_H E_t \widehat{D}_{H,t+1} + (1-\tau_H) d\,\widehat{d}_t - \beta \frac{\lambda}{1-\lambda}\frac{1}{b}(1-\lambda)(1-\alpha_H) E_t \widehat{\lambda}_{t+1} \\ &\quad + \left[D_H - (1-\tau_H)d\right] E_t\left(\widehat{\chi}_{t+1} - \widehat{\chi}_t\right) \end{aligned} \tag{B-8}$$

Subtract $\beta\lambda(1-\alpha_L)D_L E_t \widehat{D}_{L,t+1}$ from both sides of equation (B-7), use (B-5), and simplify to obtain

$$\begin{aligned} D_L\widehat{D}_{L,t} &= \beta D_L E_t \widehat{D}_{L,t+1} + (1-\tau_L) d\,\widehat{d}_t + \beta \frac{\lambda}{1-\lambda}\frac{1}{b}\lambda(1-\alpha_L) E_t \widehat{\lambda}_{t+1} \\ &\quad + \left[D_L - (1-\tau_L)d\right] E_t\left(\widehat{\chi}_{t+1} - \widehat{\chi}_t\right) \end{aligned} \tag{B-9}$$

Next, subtract (B-9) from (B-8) and use (B-5) to obtain equation (26).

References

Bakhshi, Hasan, Pablo Burriel-Llombart, Hashmat Khan, and Barbara Rudolf. "The New Keynesyan Phillips Curve Under Trend Inflation and Strategic Complementarity." *Journal of Macroeconomics* .

Bils, Mark, and Peter J. Klenow. "Some Evidence on the Importance of Sticky Prices." *Journal of Political Economy* 112, 5: (2004) 947–985.

Burstein, Ariel. "Inflation and Output Dynamics with State Dependent Pricing Decisions." *Journal of Monetary Economics* .

Calvo, Guillermo A. "Staggered Prices in a Utility-Maximizing Framework." *Journal of Monetary Economics* 12: (1983) 383–398.

Calvo, Guillermo A., Oya Celasun, and Michael Kumhof. "Nominal Exchange Rate Anchoring Under Inflation Inertia." manuscript, Stanford University, 2003.

Caplin, Andrew S., and Daniel F. Spulber. "Menu Costs and the Neutrality of Money." *Quarterly Journal of Economics* 102: (1987) 703–725.

Carlstrom, Charles, Timothy Fuerst, and Fabio Ghironi. "Does it Matter (for Equilibrium Determinacy) What Price Index the Central Bank Targets?" *Journal of Economic Theory* .

Cecchetti, Steven. "The Frequency of Price Adjustment: A Study of the Newsstand Prices od Magazines, 1953 to 1979." *Journal of Econometrics* 31: (1986) 255–274.

Christiano, Lawrence J., Martin Eichenbaum, and Charles L. Evans. "Sticky Price and Limited Participation Models of Money: A Comparison." NBER Working Paper 5804, 1996.

Dotsey, Michael, Robert G. King, and Alexander L. Wolman. "State-Dependent Pricing and the Dynamics of Business Cycles." Federal Reserve Bank of Richmond Working Paper 97-2, 1997.

———. "State-Dependent Pricing and the General Equilibrium Dynamics of Money and Output." *Quarterly Journal of Economics* 114: (1999) 655–690.

Gertler, Mark, and John Leahy. "A Phillips Curve with an Ss Foundation." NBER Working Paper 11971, 2006.

Golosov, Mikhail, and Robert E. Lucas. "Menu Costs and Phillips Curves." NBER Working Paper 10187, 2003.

Gordon, Robert J. "Why Stopping Inflation May Be Costly: Evidence from Fourteen Historical Episodes." In *Inflation: Causes and Effects*, edited by Robert E. Hall, Chicago: University of Chicago press, 1982, 11–40.

Hernandez, Kolver. "State-Dependent Nominal Rigidities & Disinflation Programs in Small Open Economies." University of Delaware Working Paper 2006-13, 2006.

Ireland, Peter N. "A Small, Structural, Quarterly Model for Monetary Policy Evaluation ." *Carnegie-Rochester Conference Series on Public Policy* 47: (1997a) 83–108.

———. "Stopping Inflations, Big and Small." *Journal of Money, Credit and Banking* 29: (1997b) 759–777.

———. “Technology Shocks in the New Keynesian Model.” *The Review of Economics and Statistics* 86, 4: (2004) 923–936.

Klenow, Peter J., and Oleksity Kryvtsov. “State-Dependent or Time-Dependent Pricing: Does It Matter for Recent U.S. Inflation?” manuscript, Federal Reserve Bank of Minneapolis, 2004.

McCallum, Bennett T., and Edward Nelson. “An Optimizing IS-LM Specification For Monetary Policy and Business Cycle Analysis.” *Journal of Money, Credit and Banking* 31: (1999) 296–316.

Rotemberg, Julio J. “Monopolistic Price Adjustment and Aggregate Output.” *Review of Economic Studies* 49, 4: (1982) 517–531.

Rotemberg, Julio J., and Michael Woodford. “The Cyclical Behavior of Prices and Costs.” In *Handbook of Macroeconomics*, edited by John B. Taylor, and Michael Woodford, North-Holland, 1999.

Sargent, Thomas J. “The End of Four Big Inflations.” In *Inflation: Causes and Effects*, edited by Robert E. Hall, Chicago: University of Chicago press, 1982, 41–97.

Steinsson, Jón. “Optimal Monetary Policy in an Economy with Inflation Persistence.” *Journal of Monetary Economics* 50: (2003) 1425–1456.

Taylor, John B. “Aggregate Dynamics and Staggered Contracts.” *Journal of Political Economy* 88: (1980) 1–23.

———. “Discretion Versus Policy Rules in Practice.” *Carnegie-Rochester Conference Series on Public Policy* 39: (1993) 195–214.

Uhlig, Harald. “A Toolkit for Analyzing Nonlinear Dynamic Stochastic Models Easily.” In *Computational Methods for the Study of Dynamic Economies*, edited by Marimon R., and A. Scott, Oxford: Oxford University Press, 1999.

Woodford, Michael. *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton: Princeton University press, 2003.

Yun, Tack. “Nominal Price Rigidity, Money Supply Endogeneity, and Business Cycles.” *Journal of Monetary Economics* 37: (1996) 345–370.

Zbaraki, Mark J., Mark Ritson, Daniel Levy, Shantanu Dutta, and Mark Bergen. “The Managerial and Customer Dimensions of Price Adjustment: Direct Evidence from Industrial Markets.” manuscript, University of Pennsylvania, 2003.

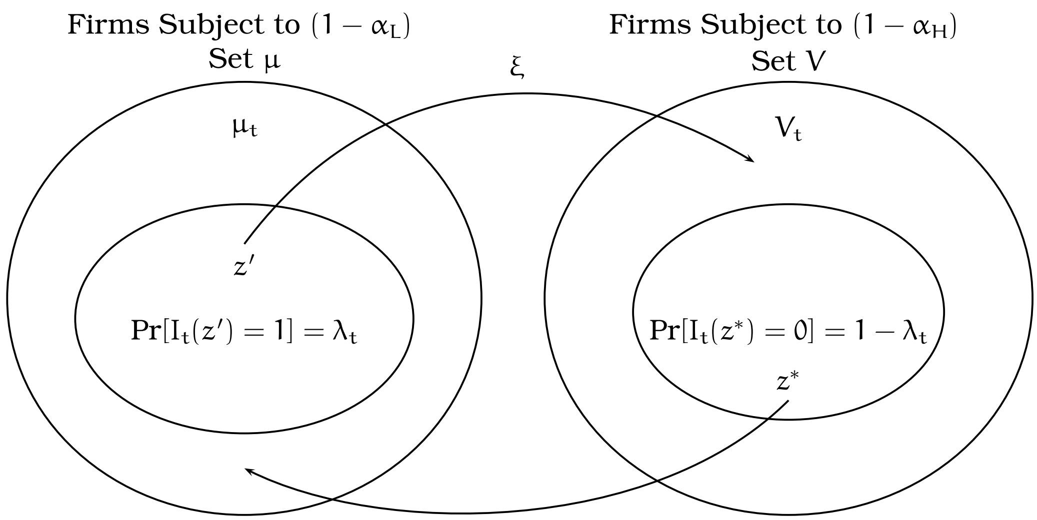

Figure 1: Pricing Mechanism

The firm z' setting a new pricing plan at t can optimally increase its Calvo probability from $(1-\alpha_L)$ to $(1-\alpha_H)$ by paying the random lump-sum cost ξ. The firm z^* resetting prices at t can optimally decide not to pay the random cost, in which case it will be subject to the Calvo probability $(1-\alpha_L)$. The set μ with mass μ_t in period t accounts for all firms acting subject to $(1-\alpha_L)$. The set V with mass V_t in t accounts for all firms subject to $(1-\alpha_H)$ in that period. A fraction λ_t of firms in the set μ—at the beginning of the period—resetting prices at t will switch to the set V at t. Similarly, a fraction $1-\lambda_t$ of firms in the set V—at the beginning of the period—resetting prices at t will switch to the set μ at t.

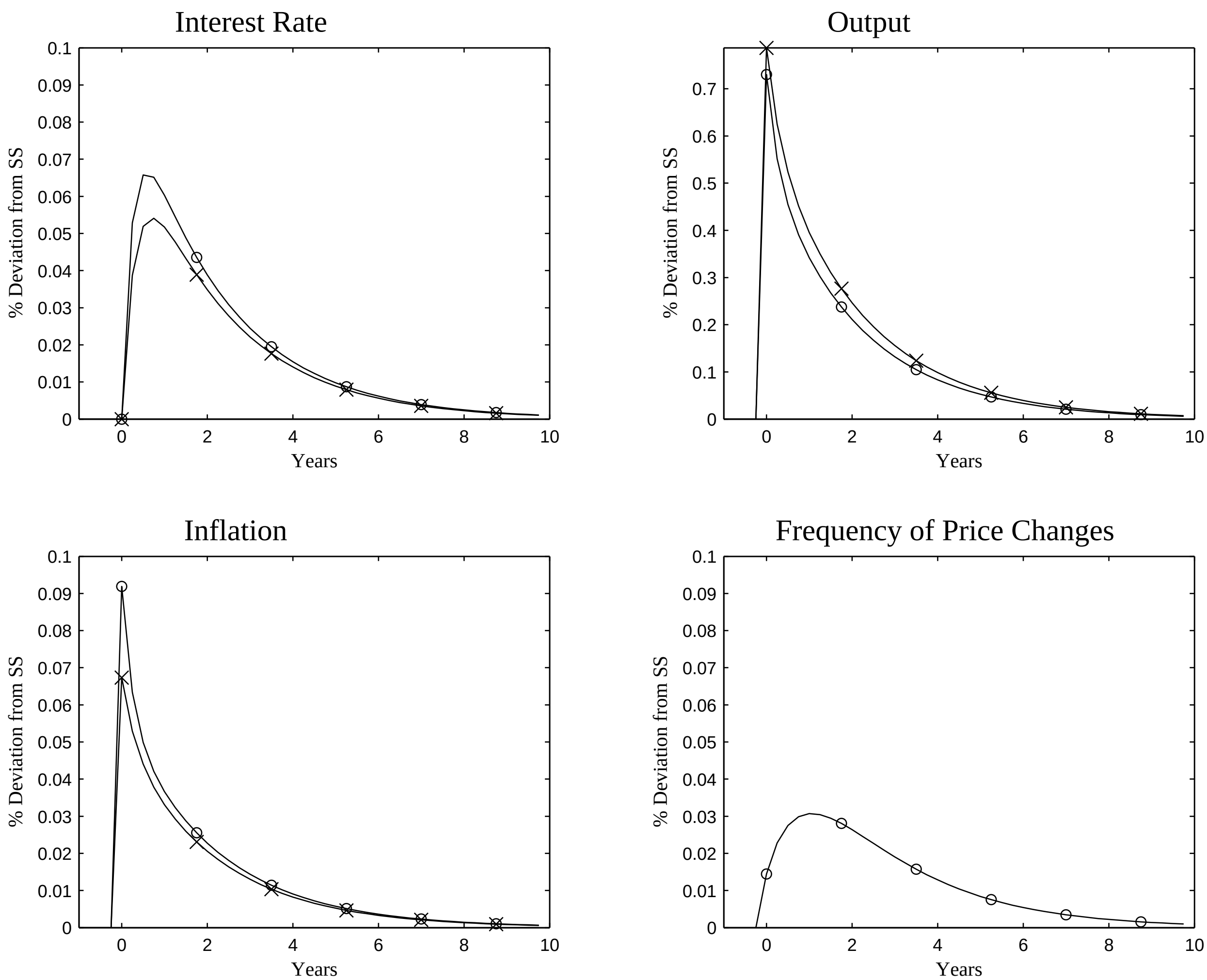

Figure 2: Response to a Preference Shock

$-o-$ Model with State $-$ Dependent Frequency of Price Changes, $\;-\times-$ Time $-$ Dependent Model

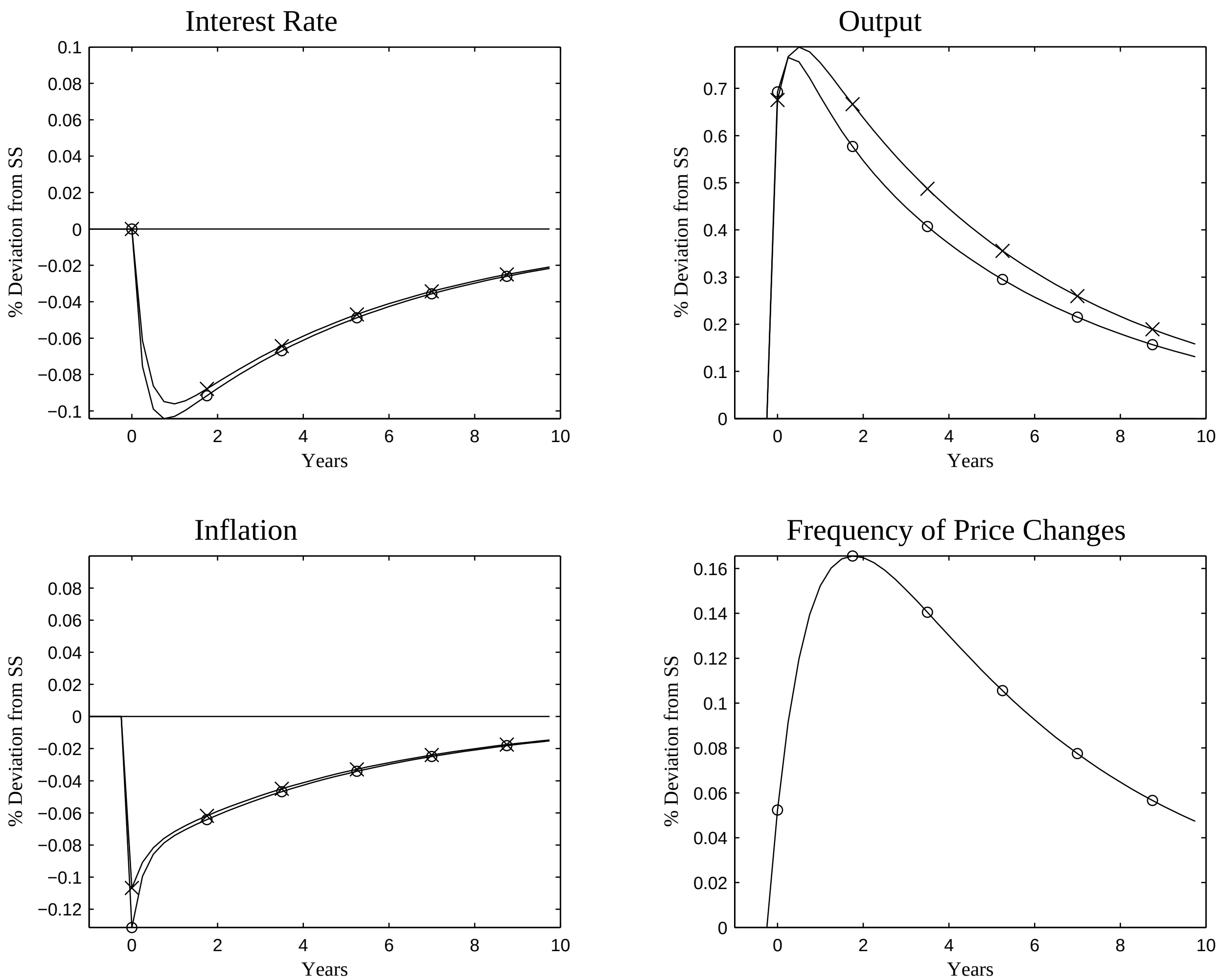

Figure 3: Response to a Productivity Shock

$-o-$ Model with State $-$ Dependent Frequency of Price Changes, $-\times-$ Time $-$ Dependent Model

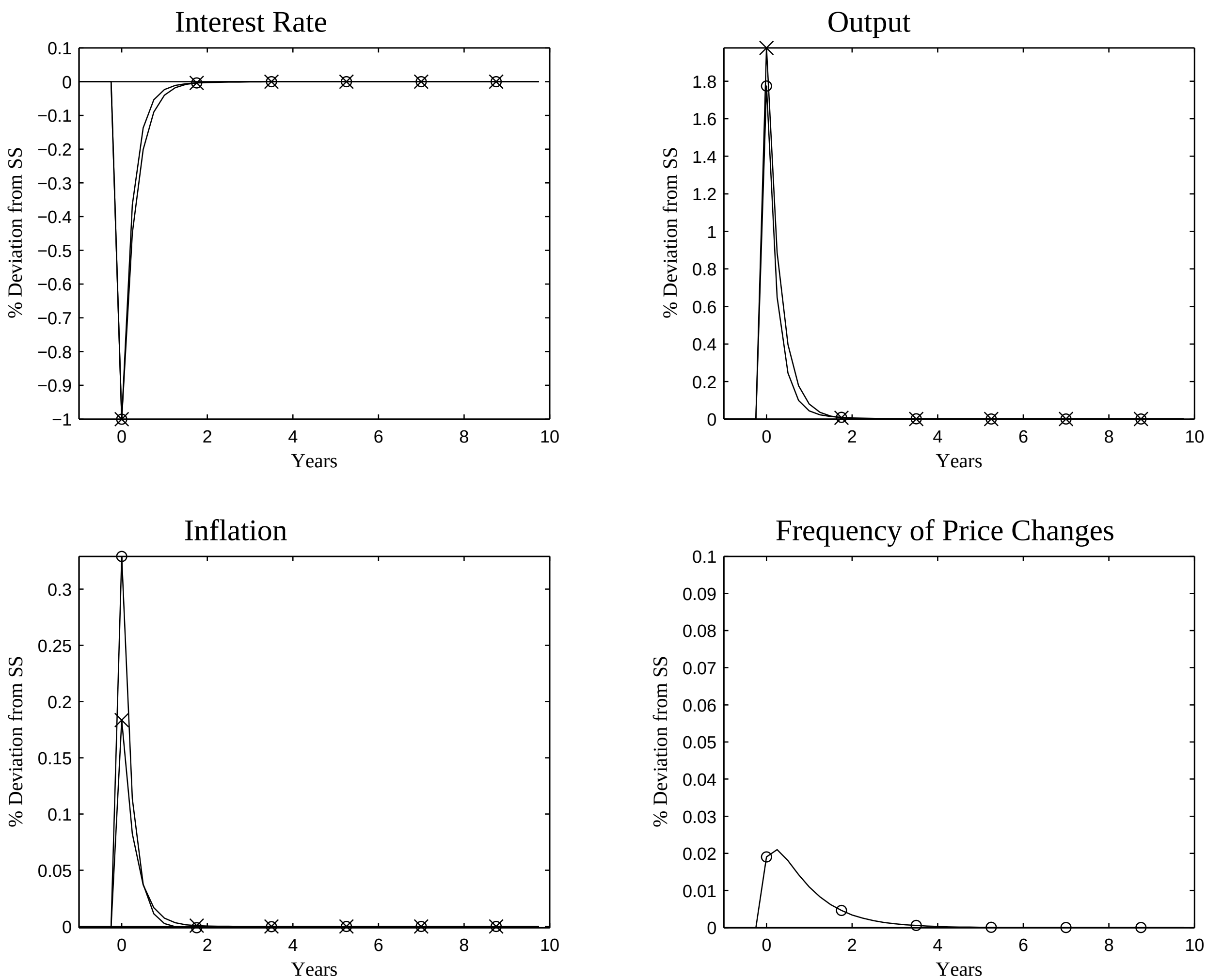

Figure 4: Response to a Expansionary Taylor Rule Shock

$-o-$ Model with State – Dependent Frequency of Price Changes, $-\times-$ Time – Dependent Model

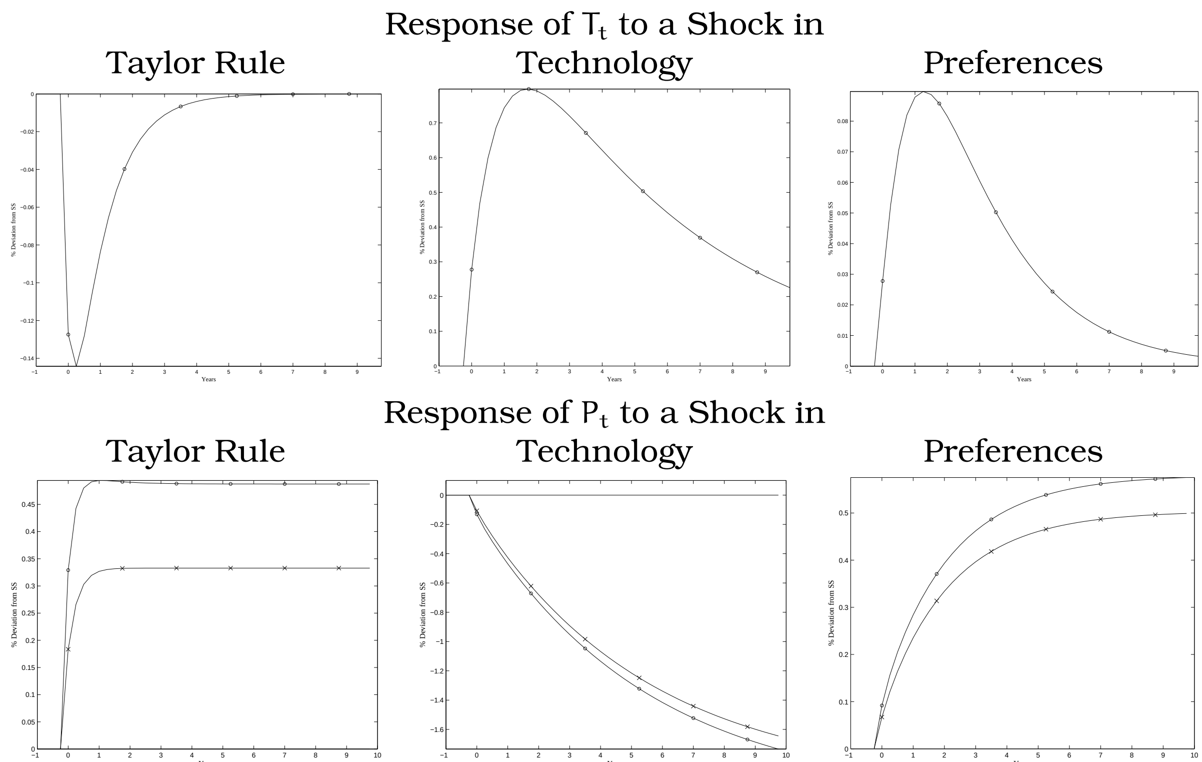

Figure 5: Response of the Relative Price T_t and the Price Index P_t

–o–Model with State-Dependent Frequency of Price Changes,–×– Time-Dependent Model

Households

$$\widehat{\chi}_t = \left[(\gamma-1)\nu C^{1-\gamma}-\gamma\right]\widehat{C}_t + \nu m^{1-\gamma}[\gamma-1]\widehat{m}_t + \widehat{\varphi}_{d,t} \tag{27}$$

$$\widehat{\chi}_t = E_t\left[\widehat{\chi}_{t+1} + \widehat{r}_t - \widehat{\Pi}_{t+1}\right] \tag{28}$$

$$\widehat{m}_t \approx \widehat{C}_t - \frac{1}{\gamma}\widehat{r}_t, \tag{29}$$

Supply Block

$$\widehat{\Pi}_t = \beta E_t\widehat{\Pi}_{t+1} + S_\psi\widehat{\psi}_t + S_T\widehat{T}_t - S_F\widehat{F}_t \tag{30}$$

$$\beta E_t\widehat{T}_{t+1} - \tau_1\widehat{T}_t + \widehat{T}_{t-1} = (a_H - a_L)\widehat{\psi}_t + E_t\beta\tau_2\widehat{F}_{t+1} - \tau_3\widehat{F}_t + \tau_2\widehat{F}_{t-1} \tag{31}$$

$$\widehat{F}_t = \nu_1\widehat{F}_{t-1} + \nu_2\widehat{\lambda}_t\,, \tag{32}$$

$$\widehat{\lambda}_t = \beta\nu_1 E_t\widehat{\lambda}_{t+1} + (\tau_L - \tau_H)d\left[\widehat{C}_t - (\theta-1)\widehat{\psi}_t\right] + \nu_3 E_t\left(\widehat{\chi}_{t+1} - \widehat{\chi}_t\right) \tag{33}$$

Pricing Activities

$$\widehat{\Xi}_t = \frac{1}{\Xi}\left[D_H - D_L - \Xi\right]\widehat{\lambda}_t\,. \tag{34}$$

$$\widehat{Y}_{p,t} = \frac{\Xi\lambda F}{Y_p}\widehat{F}_{t-1} + \widehat{\lambda}_t + \widehat{\Xi}_t\,. \tag{35}$$

Market Clearing

$$C\widehat{C}_t \approx Y\left[\widehat{N}_t + \widehat{\varphi}_{T,t}\right] - Y_p\widehat{Y}_{p,t} \tag{36}$$

$$\widehat{\psi}_t = \frac{\zeta N}{1-N}\frac{1}{Y}\left[C\widehat{C}_t + Y_p\widehat{Y}_{p,t}\right] - \left[1 + \zeta N/(1-N)\right]\widehat{\varphi}_{T,t} - \widehat{\chi}_t + \iota\widehat{\varphi}_{d,t} \tag{37}$$

Monetary Policy

$$\widehat{r}_t = \sigma_r\widehat{r}_{t-1} + \sigma_\pi\widehat{\Pi}_{t-1} + \sigma_c\widehat{C}_{t-1} + \varepsilon_{r,t}\,. \tag{38}$$

Exogenous Shocks

$$\widehat{\varphi}_{T,t} = \rho_T\widehat{\varphi}_{T,t-1} + \varepsilon_{T,t} \tag{39}$$

$$\widehat{\varphi}_{d,t} = \rho_d\,\widehat{\varphi}_{d,t-1} + \varepsilon_{d,t} \tag{40}$$

Table 1: Log-linear version of the model

Notes:
In equation (5) $\nu \equiv \Gamma\left[C^{1-\gamma} + m^{1-\gamma}\right]^{-1}$
Equation (29) uses the approximation $1/(1+r_t) \approx 1 - r_t$
Equation (36) uses the relations $Y_t = A\varphi_{T,t}N_t$, where $Y_t \equiv Y_{c,t} + Y_{p,t}$, $Y_{c,t} \equiv \int_0^1 y_{c,t}(z)dz$, $Y_{p,t} \equiv \int_0^1 y_{p,t}(z)dz$ and $N_t \equiv \int_0^1 N_t(z)dz$.
Equation (35) is calculated multiplying the conditional average random cost (13) times the total mass of firms paying the random cost, that is: $Y_{p,t} = \lambda_t\left[(1-\alpha_H)V_{t-1} + (1-\alpha_L)\mu_{t-1}\right]\Xi_t$.

Parameter Value	Description
	Preferences
$\beta = .99$	subjective discount factor
$1/\gamma = 0.12$	interest rate elasticity of money demand—see Ireland (1997a)
$(\theta - 1)/\theta = 0.5$	steady-state markup above marginal cost
$\zeta = 0$	implies infinite elasticity of labor supply
$\Gamma = 1$	non-separable logarithmic utility in C_t and M_t/P_t
$\iota = 1/2$	preference parameters
	Pricing mechanism
$(1 - \alpha_L) = 1/5$	lower bound for average frequency of price revisions (F_t)
$(1 - \alpha_H) = 1/3$	upper bound for average frequency of price revisions (F_t)
$1/b = 0.006$	unconditional expected random cost in units of output
$\tau_L = 0.005$, $\tau_H = 0$	tax rates on profits
	Monetary Policy
$\sigma_r = 0.55$, $\sigma_{pi} = 0.57$,	
$\sigma_c = 0$, $\Phi_r = 0.0025$	augmented Taylor rule
	Exogenous shocks
$\rho_\tau = 0.95$, $\Phi_\tau = 0.007$	productivity shock
$\rho_d = 0.9$, $\Phi_d = 0.035$	preference shock

Table 2: Baseline Calibration

Notes:

I set ι to 1/2, so the preference shock $\varphi_{d,t}$ has qualitatively the same effect on inflation and output as McCallum and Nelson's (1999) IS shock. However, this reduces the volatility of marginal cost in the presence of preference shocks.

The parameter values for the Taylor rule are in line with Ireland's (2004) estimates.

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