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Inflation targets and endogenous wage markups in a New Keynesian model ☆

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ABSTRACT

Empirical contributions show that wage re-negotiations take place while expiring contracts are still in place. This is captured by assuming that nominal wages are pre-determined. As a consequence, wage setters act as Stackelberg leaders, whereas in the typical New Keynesian model the wage-setting rule implies that they play a Nash game. We present a DSGE New Keynesian model with pre-determined wages and money entering the representative household's utility function and show how these assumptions are sufficient to identify an inverse relationship between the inflation target and the wage markup (and thus employment) both in the short and the long run. This is due to the complementary effects that wage claims and the inflation target have on money holdings. Model estimates suggest that a moderate long-run inflation rate generates non-negligible output gains.

1. Introduction

Recent developments in macroeconomics contradict the widely held belief that permanently higher inflation cannot affect output and employment. A long-run relationship between inflation and real activity is obtained in New Keynesian models based on price staggering, where inflation has adverse effects due to relative price dispersion and to the effect of expectations on mark-ups (Goodfriend and King, 1997;Woodford, 2003;Schmitt-Grohé and Uribe, 2004). Other contributions point to the opposite direction. Benigno and Ricci (2011) resurrect the "grease in the wheels" argument, showing that low inflation rates disciplines monopolistic wage setters in case of downward nominal wage rigidity. In Graham and Snower (2008) the combination of staggered nominal wage contracts and hyperbolic discounting leads to a positive long-run effect of inflation on real variables.

We share the view that New Keynesian models may underestimate the beneficial effects of inflation on wage markups, but we highlight a different disciplining channel. According to recent empirical evidence, wage renegotiations take place

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while expiring contracts are still in place (Du Caju et al., 2008), enabling wage setters to internalize the expected consequences of their actions over the life of the future contract. This feature of observed wage-setting practices plays a critical role in our model, because we are able to show that the anticipation of future inflation unambiguously disciplines wage markups.

The key innovation of the paper is that wage setters decisions anticipate the subsequent choices of price setters, consumers and policymakers. This is captured by assuming that nominal wages are pre-determined. As a consequence, in our model wage setters act as Stackelberg leaders, whereas in the typical New Keynesian model the wage-setting rule implies that they play a Nash game. For the model to replicate the degree of nominal wage inertia typically observed over the business cycle, we incorporate the assumption of pre-determined nominal wages into an otherwise standard sticky-wage model, based on Rotemberg (1982) quadratic adjustment cost. Another important feature of our model is that money enters the representative household's utility function. The pre-determined wages and money-in-the-utility-function assumptions are sufficient to identify an inverse relationship between the central bank long-run inflation target and the steady-state wage markup.

The rationale behind this result is simple. Both a positive inflation target and a consumption fall are associated to a higher marginal utility from real money balances (MUM in short). In the paper we show that wage setters internalize the adverse effect of a wage increase on consumption and are therefore induced to moderate their wage claims in order to limit the expected increase in MUM. Since the impact of a consumption fall on MUM grows with the expected inflation rate, we obtain a new justification for the existence of a non-vertical Phillips curve.

In order to assess the empirical relevance of our theoretical results we estimate the model for the US economy using Bayesian estimation techniques. We find a substantial disciplining effect on wage markups over the post-1983 sample, when average inflation has been relatively low. Further, the empirical performance of our model is strictly better than the standard alternative where wages are sticky but the predetermined wages assumption is ruled out.

The rest of the paper is organized as follows. The next section outlines our model. Section 3 discusses the steady state features of our model and, characterizes the wage moderation effect associated to a positive inflation rate. Section 4 takes the model to the data by using Bayesian estimation techniques. Section 5 characterizes our estimated long-run Phillips curve and presents the impulse response functions to an interest rate shock. Section 6 concludes.

2. The model

We consider a simple DSGE model without capital, where inertia is driven by consumption habits and by price and nominal wage rigidities. Monetary policy chooses the long-run inflation target and implements a Taylor rule. In addition, we nest the assumption of pre-determined nominal wages into a standard Rotemberg (1982) wage-setting rule.

2.1. Households

The representative household (i) maximizes a standard, separable money-in-the-utility function[1]:

$$U = \sum_{t=0}^{\infty} \beta^t \left(\ln\left(c_{t,i} - bc_{t-1,i}\right) - \frac{\eta}{1+\phi} l_{t,i}^{1+\phi} + \frac{\Gamma_t}{1-\varepsilon} \left(\frac{M_{t,i}}{P_t}\right)^{1-\varepsilon} \right) \tag{1}$$

where $\beta \in (0,1)$ is the intertemporal discount rate, $c_{t,i}$ is a consumption bundle, b denotes internal habits, $l_{t,i}$ is a differentiated labor type that is supplied to all firms, $M_{t,i}/P_t$ denotes real money holdings, Γ_t is a scale parameter. Following Neiss (1999), we set $\Gamma_t = \xi_m A_t^{\varepsilon-1}$, where A_t defines a non-stationary productivity factor. This guarantees that the model has a balanced growth path along which money velocity is constant even if $\varepsilon \neq 1$. The flow budget constraint is:

$$c_{t,i} + \frac{M_{t,i}}{P_{t,i}} + \frac{B_{t+1,i}}{P_t} = w_{t,i} l_{t,i} + \frac{M_{t-1,i}}{P_t} + \theta_t + \frac{\tau_t}{P_t} + R_t \frac{B_{t,i}}{P_t} \tag{2}$$

where $B_{t,i}$ denotes holdings of one-period bonds, $w_{t,i} = W_{t,i}/P_t$ is the real wage, θ_t denotes firms profits, τ_t is a lump-sum transfer from central bank profits, R_t is the nominal interest rate.

Consumption basket and price index are defined as follows: $c_t = \left(\int_0^1 c_t(j)^\rho di\right)^{\frac{1}{\rho}}$ and $P_t = \left(\int_0^1 P_t(j)^{\frac{\rho}{\rho-1}} dj\right)^{\frac{\rho-1}{\rho}}$, where ρ is a parameter that characterizes standard Dixit-Stiglitz preferences.

The first order conditions for consumption are:

$$c_{t,i}(j) = c_{t,i}\left(\frac{P_t(j)}{P_t}\right)^{\frac{1}{\rho-1}} \tag{3}$$

$$\lambda_t = \frac{1}{c_t - bc_{t-1}} - \frac{\beta b}{c_{t+1} - bc_t} \tag{4}$$

$$\lambda_t = \beta \frac{R_{t+1}}{\pi_{t+1}} \lambda_{t+1} \tag{5}$$

[1] See Neiss (1999), Christiano et al. (2005) and Gali et al. (2007).