Does Wage Indexing Matter?

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Abstract: The Rogoff (1985) proposition that it is socially optimal to delegate monetary policy to a conservative central banker has been challenged by a literature that argues that if there is an inflation-averse monopoly union in the economy, it is optimal to delegate monetary policy to an "ultra-liberal" central banker, that is, a central banker that is interested only in stabilizing output. In this paper, we examine whether introducing wage indexing into the later models has any effect on the optimal degree of central bank conservativeness.

JEL classification: E24, E52, E58, J51

1 Introduction

Rogoff (1985) showed that the inflationary bias of monetary policy that arises in the Barro-Gordon (1983) framework could be reduced, or even eliminated, if the government delegates monetary policy to an independent and "conservative"[2] central banker. Extending the Rogoff framework, a series of authors have embedded wage indexing into the relevant literature of time inconsistency in monetary policy. Mourmouras (1997) shows that wage indexation is inflationary in the sense that it weakens the will of government to fight inflation and delegates monetary policy to a central banker that is less inflation-averse than in the original Rogoff model. Similar results have been found by many authors (e.g. Hutchison and Walsh, 1998).

The Rogoff approach has been questioned and is often reversed when unions are assumed non-atomistic, in the sense that their target functions include not only an employment target, but also the costs of inflation. This union "inflation-averseness" has been justified on the grounds that a monopoly union encompasses most of society, which in itself is inflation-averse[3]. In particular, if there is one

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[2] "Conservative" in the sense that the central banker dislikes inflation more than society.

[3] Berger et al. (2002) provide a formal model that shows that the union will be inflation-averse if its outside options

monopoly inflation-averse union it is often found optimal to delegate monetary policy to an "ultra-liberal" central banker, that is, to a central banker that cares only about employment and is inflation indifferent, which is the opposite of Rogoff's proposition (e.g. Cubitt, 1995, Skott, 1997, Lawler, 2000).

The intuition behind this result is that the trade union recognizes that increasing its wage mark-up leads to under-employment. This in turn gives an increasing incentive to the central bank to create surprise inflation. An inflation-indifferent central banker will produce very high inflation for even the slightest positive mark-up and this is costly for the union. Recognizing this outcome, the union moderates its wage claims and the central banker simply looses interest in creating surprise inflation as employment reaches its equilibrium level, while inflation and the wage premium are zero.

Cubitt (1995), Skott (1997), and Cukierman and Lippi (2001) examine only a deterministic environment. Lawler (2000) extends this framework to include stochastic shocks in the production function and finds that the "ultra-liberal" result is offset. In particular, Lawler finds that if stochastic shocks are present, it is optimal to delegate monetary policy to a central banker who shares the same preferences with the rest of society (or the government).

This paper examines the effects of wage indexing on central bank conservativeness when there is a monopoly "inflation-averse" union in the economy and only some of the wage contracts are indexed.

2 The Model

The model is built around Lawler (2000) and extended to allow for indexed wage contracts as in Gray (1976) and Fischer (1983). Production is described by the following Cobb-Douglas function:

$$y = al + \theta \tag{1}$$

where y is output, l is employment, a is the elasticity of output with respect to employment, and θ is a white noise productivity shock $[\theta \sim WN(0, \sigma_\theta^2)]$[4]. Profit-maximization behavior leads to the following

are not indexed.

[4] Time scripts have been eliminated to reduce clutter.

labour demand:

$$l^d = -\beta(w - p - \theta) \tag{2}$$

where $\beta = (1-\alpha)^{-1}$ and the constant is ignored. Assuming that labour supply is fixed and normalized to zero ($l^s = 0$) we derive the competitive Warlasian equilibrium for labour as:

$$\tilde{w} = p + \theta \tag{3}$$

We assume that some of the wage contracts are indexed and for those that are not unions set a mark-up (φ) over the expected market-clearing wage. Therefore, the real nominal wage is determined by (4) below:

$$w = E\tilde{w} + \zeta(p - p^e) + \varphi \tag{4}$$

where ζ is the wage indexing parameter.[5] Taking expectations for (3) and combining with (4):

$$w = p^e + \zeta(p - p^e) + \varphi \tag{5}$$

The government's loss function entails two components: deviations of employment and deviations from inflation and is described by below:

$$\Omega = (l - \bar{l})^2 + \lambda(\pi - \bar{\pi})^2 \tag{6}$$

where π is inflation, $\bar{l}$ is the government's target for employment, and λ is the relative weight attached to inflation. The inflation target ($\bar{\pi}$) is assumed zero. The central banker's loss function is described by the following equation:

$$\Omega^I = (l - \bar{l})^2 + (\lambda + \epsilon)(\pi - \bar{\pi})^2 \tag{7}$$

where ϵ is the extra weight on inflation vis-à-vis the government. Throughout this paper we will refer to ϵ as the degree of central bank conservitaveness (hereafter CBC). Equation (8) describes the union's objective function:

$$\Omega^u = (1 + \delta)(l - l^u)^2 + \lambda\pi^2 \tag{8}$$

[5] The wage indexing rule used here (first two components of the equation) is very common in the literature (e.g. Gray, 1976; Fischer, 1983; Mourmouras, 1997).

where l^u is the union's target level of employment which is less than society's, and $\delta \geqslant 0$ reflects the union members' preferences and is taken exogenously. The latter term in the equation reflects the inflation averseness of the monopoly union.

3 Equilibrium

The game is solved via backward induction.

3.1 The central banker's choice of inflation

We derive equilibrium employment by substituting (4) into (2), using the fact that $p - p^e = \pi - \pi^e$, and imposing the condition that employment is demand-driven:

$$l = F(\pi - \pi^e) + \beta(\theta - \phi) \tag{9}$$

where $F = \beta(1 - \zeta)$.To find the central bank's choice of inflation, first we substitute (9) into (7), minimize and solve for π:

$$\pi = \frac{F[\pi^e + \beta\varphi + F\bar{l}]}{A + F^2} - \frac{\beta\theta}{A + F^2} \tag{10}$$

where $A = \lambda + \epsilon$. The second term of the above equation (10) captures the central banker's effort to offset the productivity shock We now substitute π and π^e into l to find the final expression for labour:

$$l = -\beta\varphi + \frac{\beta A}{A + F^2}\theta \tag{11}$$

3.2 The union's choice of the mark-up

To derive the union's optimal choice for the mark-up (φ) we substitute π and l into the union's loss function (8) and take expectations for Ω^u. After taking the first order condition we derive φ as:

$$\varphi = \frac{\lambda F^2\bar{l} - (1 + \delta)A^2 l^u}{\beta[(1 + \delta)(\epsilon + \lambda)^2 + \lambda F^2]^2} \tag{12}$$

It is clear from the above equation that the mark-up is dependent on ϵ. Differentiating the expression with respect to ϵ:

$$\frac{\vartheta\varphi}{\vartheta\epsilon} = \frac{(1 + \delta)\lambda(\epsilon + \lambda)F^2(\bar{l} + l^u)}{\beta[(1 + \delta)(\epsilon + \lambda)^2 + \lambda F^2]^2} > 0 \tag{13}$$

Equation (13) shows us that the greater weight the central banker places on inflation, that is, the more inflation-averse ("conservative") the central banker is, the less costly it is for the union to increase its mark-up, which in turn produces inflation and under-employment. Extending the model for multiple unions does not change the qualitative results.

3.3 The government's choice of the central banker

The government derives the level of CBC that minimizes its loss function. We substitute the expressions we found for φ, π, and l into the government's loss function, take expectations, minimize and solve for ϵ. After finding the first order condition we separate the result into two components: i) Deterministic and ii) Stochastic.

3.3.1 Deterministic case

The first order condition is:

$$\frac{(1+\delta)^2(\epsilon+\lambda)^2[(1-\zeta)^2\beta^2\lambda+(\epsilon+\lambda)^2](l^u-\bar{l})}{[(1-\zeta)^2\beta^2\lambda+(1+\delta)(\epsilon+\lambda)^2]^2}=0 \tag{14}$$

From the above it is clear to see that the government's loss function is minimized when $\epsilon=-\lambda$. This is the case for the "ultra-liberal" central banker.[6] Contrary to the case where unions were considered "atomistic" (indifferent to inflation), wage indexing does not have any effect on the optimal degree of central bank conservativeness.[7] We can also see this result diagrammatically (Fiqure 1).

[insert figure 1 somewhere here]

3.3.2 Stochastic case

The first order condition is:

$$\frac{\epsilon\beta^2[(1-\zeta)^2\beta^2\lambda+(\epsilon+\lambda)^2]}{[(1-\zeta)^2\beta^2+\epsilon+\lambda]}\sigma_\theta^2=0 \tag{15}$$

[6] This is the exact result of Lawler's (2000) model, which does not have wage indexing nor employment targets for the government and the central banker.

[7] The loss function is also minimized when there is full indexing ($\zeta=1$). However, in this extreme case the Phillips curve is vertical and the model collapses.

In the stochastic case the optimal degree of CBC is zero ($\epsilon = 0$). This is shown in Figure 2.

[**insert figure 2 somewhere here**]

With stochastic productivity shocks the "ultra-liberal" result is offset and it is optimal to delegate monetary policy to a central banker that shares the same preferences with the rest of society. However, wage indexing does not have any impact on the optimal CBC and the result remains anti-Rogoff. The discrepancy between the deterministic and stochastic case is due to the fact that in the latter case the central banker offsets the shock. In equilibrium, employment is at its equilibrium level while inflation and the wage mark-up are zero.

4 Some Extensions

Having found that wage indexing has no effect on the optimal degree of CBC when unions are inflation averse, we now turn to the case where the government enforces an *ala* Walsh (1995) linear inflation contract upon the central banker. In particular, the central banker's loss function is now:

$$\Omega^I = (l - \bar{l})^2 + (\lambda + \epsilon)(\pi - \bar{\pi})^2 + 2\gamma\pi \tag{16}$$

where γ is the additional cost of inflation imposed on the central banker via the inflation contract. The model is solved as before with the difference that the government now also chooses the optimal γ. The central banker's choice of inflation is:

$$\pi = \frac{-\gamma A - \beta A\theta F - \gamma F^2 + \beta AF\varphi + \beta\varphi F^3 + F\bar{l}}{A(A + F^2)} \tag{17}$$

The equilibrium level of employment remains the same with equation (9). Solving the union's choice for the mark-up (φ) we find:

$$\varphi = \frac{-(1+\delta)A^2 l^u - \lambda F(-\gamma + F\bar{l})}{\beta[(1+\delta)A^2 + \lambda F^2]} \tag{18}$$

Once again φ is increasing in ϵ. Solving the government's choice for γ we find:

$$\gamma = \frac{-\delta(1+\delta)A^2F(l^u - \bar{l})}{(1+\delta)^2A^2 + \lambda F^2} \tag{19}$$

We now proceed to find the government's choice for the central banker using the values for π, l, φ and γ that were derived above. In the deterministic context the first order condition is:

$$\frac{(1+\delta)^2(\epsilon+\lambda)^2(l^u-\bar{l})^2}{(1-\zeta)^2\beta^2\lambda+(1+\delta)^2(\epsilon+\lambda)^2}=0 \tag{20}$$

As previously the optimal degree of central bank conservativeness is $\epsilon=-\lambda$. This implies that the optimal choice of the contract parameter is $\gamma=0$. Therefore existence of the contract is indifferent in this model. Similar results also hold in the stochastic context:

$$\frac{\beta^2[\epsilon^2+2\epsilon\lambda+\lambda((\zeta-1)^2\beta^2+\lambda)]\epsilon}{[(\zeta-1)^2\beta^2+\epsilon+\lambda]^2}\sigma_\theta^2=0 \tag{21}$$

where the resulting optimal values are $\epsilon=0$ and $\gamma=0$.

Assuming that the government and the central banker do not have employment targets[8] yields the exact same results as previously. The above results also hold if the government imposes a linear inflation target on the central banker.

5 Conclusions

In conclusion, contrary to the Rogoff-type models, when the union(s) in the economy are inflation-averse, wage indexing has no effect on the optimal degree of CBC. We must point out that the result(s) depend crucially on the assumption that the union(s) are (even slightly) inflation-averse ($0<\delta<1$). As δ exceeds unity, Rogoff's conservative central banker is restored as the union(s) cares less about inflation vis-à-vis employment.

[8]This is similar to Lawler's (2000) model. The lack of employment targets for the central banker is conserdered more realistic for Europe as the ECB claims that it does not have an employment target.

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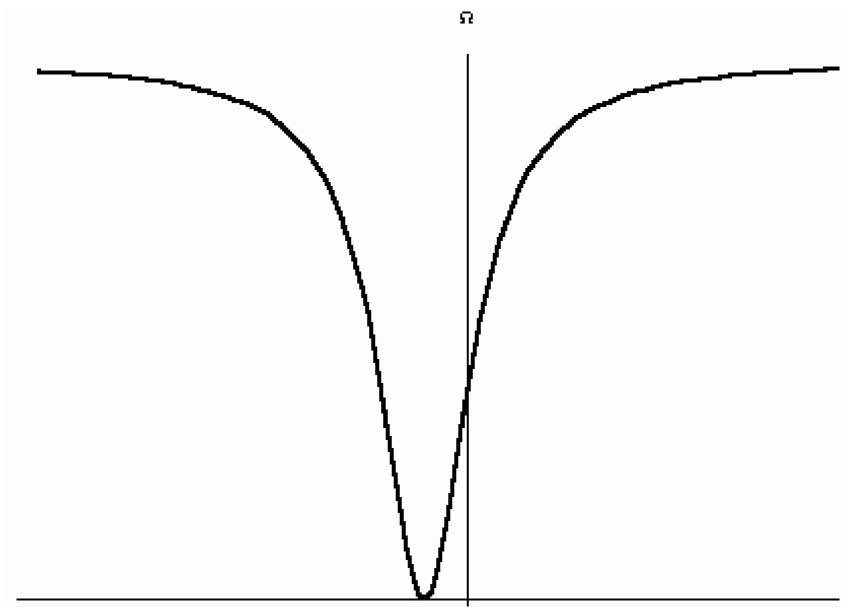

Figure 1: Deterministic case with employment targets

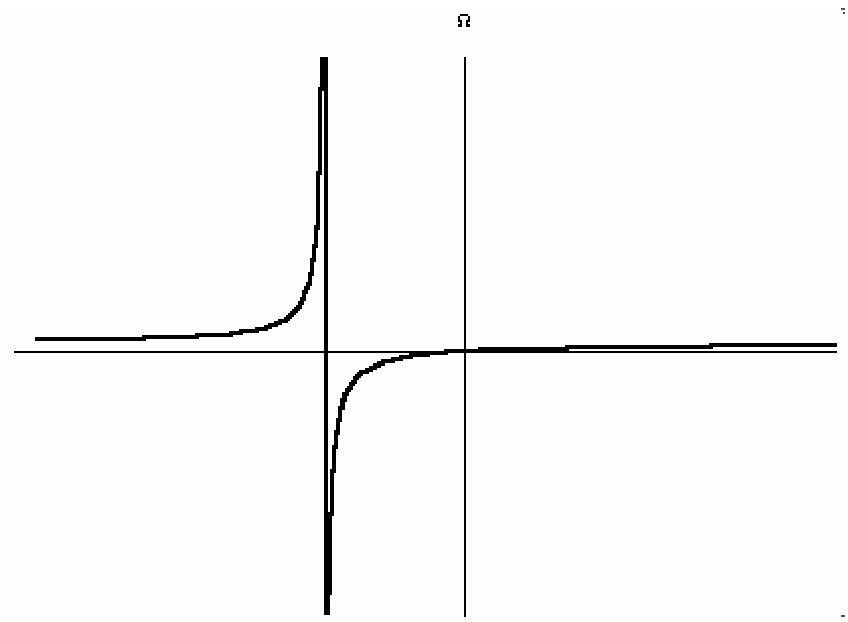

Figure 2: Stochastic case with employment targets