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Comment on 'Market discipline and monetary policy' by Carl Walsh

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This paper shows that the results Walsh (2000, Market discipline and monetary policy, *Oxford Economic Papers*, **52**, 249–71) obtains are highly sensitive to the assumption that different wage contracts are based on different information sets even though they are negotiated simultaneously. In particular, the power of future expectations to discipline an opportunistic central banker is much weaker when homogeneous information sets are used.

1. Introduction

In a recent article in this journal, Carl E. Walsh (2000) extends the monetary game theoretic model in Cukierman and Liviatan (1991) to show that the mix of short- and long-term wage contracts in an economy that features a Lucas-type supply function has effects on optimal inflation choices that are not captured in uniform wage setting models. Walsh shows that in an incomplete information context where some central bankers can commit but others cannot, the introduction of forward-looking inflation expectations acts as a disciplinary device, reducing the inflationary bias[1] and forcing the weaker type to postpone inflationary surprises. In this framework, strong types make inflation choices so as to accommodate adverse expectations and in some cases they manage to prevent the economy from undergoing recession, a result that was firstly due to Cukierman and Liviatan (1991).

Several results highlighted in Walsh are sensitive to an implicit assumption that different sectors in the economy have different information sets. In his model, wage setters who negotiate short-term nominal contracts base their

[1] This result was also obtained in Goodhart and Huang (1998) with a model that assumed real output persistence, overlapping multi-period wage contracts and monetary policy lags.

decisions on past expectations of current inflation, following Barro and Gordon (1983). On the other hand, wage setters negotiating long-term contracts know current inflation and thus base their contracts on current expectations of future inflation, following Taylor (1979) and Calvo (1983).

Under homogenous information sets, the inflationary bias is higher. Inflation persistence endogenously affects the output gap, in spite of the assumption that expectations are forward looking, and past expectations of current inflation are still more important than future expectations. As a result, the channel for the market to discipline the central banker predicted in Walsh (2000) will generally not operate.

The predictions for economic growth under discretion or commitment are also different. Under commitment, for instance, a strong type central banker is sometimes able to generate economic expansion in the second period of a pooling equilibrium.

The paper is organized as follows. Section 2 discusses the expectations setting in Walsh and proposes an alternative framework. Section 3 presents the new optimal choices of inflation and the predictions for the output gap under the separating and pooling equilibria. Finally, the last section concludes the paper.

2. Changing the expectations setting

The reader is referred to Walsh (2000) for the basic set up. There are two types of contracts. Contracts of type A are signed every period. Type B long-term contracts are signed every other period, and are divided into types B1 and B2, differing only on the time they are negotiated. As in Walsh (2000), at the beginning of period t, type A contracts are negotiated based on past expectations of current inflation, and, hence their information set is $[I_{t-1}]$. Type B1 contracts are also negotiated at the beginning of period t, but distinctly from Walsh we assume that they are based on past expectations of current and future inflation. Therefore, the present value of the expected real wage in logs, in sector $B1$, yields $w_t^{B1} - E_{t-1}p_t + \rho(w_t^{B1} - E_{t-1}p_{t+1}) = 0$, and the actual real wage in sector B1 is:

$$w_t^{B1} - p_t = E_{t-1}\pi_t - \pi_t + \frac{\rho}{1+\rho}E_{t-1}\pi_{t+1} \qquad (14')$$

This latter equation differs from the one that appears after eq. (14) in Walsh (2000) as he implicitly assumed that B1-type contracts were based on the information set $[I_t]$, i.e., based on information available at the end of period t. Sector B1 would thus have better information than sector A, although both signed contracts at the same time.

It does not seem natural to argue that some sectors are able to observe inflation rates before others, as inflation rates are usually public.[2] Even under the assumption that simultaneously signed contracts may have heterogeneous information sets, the choice of which sector should have better information is highly arbitrary. In fact, if Walsh had chosen sector A to have better information than sector B1, there would be no surprise at all in sector A and contracts would display perfect foresight. But then, sector A would not affect the equilibrium of the monetary policy game and should have been removed.

Therefore, in order to make the informational structure homogeneous among sectors that sign contracts at the same time, and also nontrivial, we assume that both sectors A and B1 have access to the same information set $[I_{t-1}]$ when they sign their wage contracts.

From (14′) the output gap in logs in sector B1 at t is $y_t^{B1} = a_L/(1-a_L)\times [(\pi_t - E_{t-1}\pi_t) - (\rho/(1+\rho))E_{t-1}\pi_{t+1}]$. Sector B2 negotiates two period contracts at the end of period $t-2$. In Walsh the information set of wage setters in this sector is $[I_{t-1}]$. Thus, the same argument used above on comparing the expectations setting in sectors A and B1 applies here. Assuming that the information set in B2 is $[I_{t-2}]$, the real wage and the output gap in sector B2 are respectively $w_{t-1}^{B2} - p_t = (E_{t-2}\pi_{t-1} - \pi_{t-1}) + ((\rho/(1+\rho))E_{t-2}\pi_t - \pi_t)$ and $y_t^{B2} = a_L/(1-a_L)[(\pi_{t-1} - E_{t-2}\pi_{t-1}) + \pi_t - (\rho/(1+\rho))E_{t-2}\pi_t]$. Hence, the output gap in the economy at time t is[3]:

$$y_t = \bar{a}\left[\frac{1-\gamma}{2}(\pi_{t-1} - E_{t-2}\pi_{t-1}) + \pi_t - \frac{1+\gamma}{2}E_{t-1}\pi_t - \frac{1-\gamma}{2}\bar{\rho}E_{t-2}\pi_t - \frac{1-\gamma}{2}\bar{\rho}E_{t-1}\pi_{t+1}\right] \tag{16′}$$

where $\bar{a} = a_L/(1-a_L)$ and $\bar{\rho} = \rho/(1+\rho)$. This equation differs from eq. (16) in Walsh mainly due to the persistence of inflation (if not perfectly anticipated) affecting the current output gap. That result is consistent with the inheritance of rigidity from past wage negotiations. In addition, the parameter $\bar{a}$, which impacts multiplicatively the output deviation from its equilibrium level in

[2] A counter argument to this point could follow Woodford (2002), who argues that decision-makers may not be fully aware of all information that is made public, which could result in heterogeneous information sets. However, distinctly from Walsh (2000), in Woodford decision-makers act strategically, and high order expectations matter for optimal pricing policy. In that environment, the assumption of limited capacity to filter information generates more sluggish responses of the expectations to shocks, which in turn may cause more persistence of real effects of nominal shocks. In contrast, the heterogeneity of information sets in Walsh (2000) causes less persistence to inflation surprises in the model.

[3] All derivations can be obtained from the authors upon request.

both periods, does not depend on the share of sector A, γ, in the total number of firms.

Walsh draws important conclusions from the output gap equation. Some of these conclusions, however, do not hold when contracts that are signed at the same time are based on the same information sets. For instance, Walsh argues that, when all contracts last for two periods (i.e. $\gamma = 0$), 'expectations of future inflation and past expectations of current inflation will be equally important'. With homogeneous information sets, past expectations of current inflation are almost three times more important than future expectations.[4] Therefore, one might expect that the channel for the market to discipline the central banker will not work as well as described in Walsh (2000). We turn to that point next.

3. New equlibrium results

We replicate Walsh's (2000) strategic interaction between society and the central bank. By using the new output gap equations, we find that the optimal inflation rates, the corresponding sizes of the output gap, and the influence of the heterogeneity of contracts in central bank's decisions are quite different. Although some of the differences follow from the presence of an inertial component in the output gap equation that does not exist in Walsh's model, others alter what we consider to be the core of that paper: how the expectations channel can discipline an opportunistic central banker.

Table 1 compares the optimal inflation rates and the influence of the heterogeneity of contracts in the optimal decisions. The main differences are briefly discussed below.

3.1 The impact of multi-period contracts in discretionary inflation rates

The heterogeneity of contracts is expressed in the model by the variable γ: a higher γ implies a higher share of short-term contracts in the economy. Walsh (2000) argues that 'a smaller γ reduces the incentives to inflate and lowers the inflationary bias under discretion'. This result suggests that an economy with longer-term contracts would systematically exhibit lower inflation rates under discretion. Contrary to Walsh (2000), it can be seen from Table 1 that, in the revised model, (1) the discretionary inflation rate at $t+1$ is not affected by γ, and (2) discretionary inflation at t lowers as the share of short-term contracts increases.

[4] If $\gamma = 0$ and ρ is close to 1, then $\overline{\rho}$ is close to 1/2 and past expectations of current inflation are approximately $(1/2)E_{t-1}\pi_t + (1/4)E_{t-2}\pi_t$ whereas expectations of future inflation are close to $(1/4)E_{t-1}\pi_{t+1}$.

Table 1 Compared results of the models: sign of inflation outcomes[5]

Walsh (2000)	Revised expectations setting
Separating equilibrium	
$\pi^W_{t+1} = \alpha/\beta > 0$	$\pi^W_{t+1} = \bar{a}/\beta > 0$
$\partial\pi^W_{t+1}/\partial\gamma > 0$	$\partial\pi^W_{t+1}/\partial\gamma = 0$
$\pi^W_t = \alpha/\beta = \pi^W_{t+1} > 0$	$\pi^W_t = (\bar{a}/\beta)(1 + ((1-\gamma)/2)\rho) > \pi^W_{t+1}$
$\partial\pi^W_t/\partial\gamma > 0$	$\partial\pi^W_t/\partial\gamma < 0$
$\pi^a_t = (\alpha/\beta)[1 - (1-k)q] < \pi^W_t$	$\pi^a_t = (\bar{a}/\beta)[1 - ((1+\gamma)/2)q + \rho((1-\gamma)/2)(1-q)] > 0$
$\partial\pi^a_t/\partial\gamma < 0$ if $q < 0.5$	
> 0 if $q > 0.5$	$\partial\pi^a_t/\partial\gamma < 0$
$\pi^a_{t+1} = 0$	$\pi^a_{t+1} = (\bar{a}/\beta)((1-q)(1-\gamma)/2) > 0$ (if $\gamma = 1$ then $\pi^a_{t+1} = 0$)
$\partial\pi^a_{t+1}/\partial\gamma = 0$	$\partial\pi^a_{t+1}/\partial\gamma < 0$
Pooling equilibrium	
$\pi_t = k(\alpha/\beta) < \pi^W_t$ (separating)	$\pi^a_t = (\bar{a}/\beta)((1-\gamma)/2) > 0$ (if $\gamma = 1$ then $\pi^a_t = 0$)
$\partial\pi^a_t/\partial\gamma < 0$	$\partial\pi^a_t/\partial\gamma < 0$
$\pi^a_{t+1} = (1-q)(\alpha/\beta) < \pi^W_{t+1}$	$\pi^a_{t+1} = (\bar{a}/\beta)(1-q) > 0$
$\partial\pi^a_{t+1}/\partial\gamma > 0$	$\partial\pi^a_{t+1}/\partial\gamma = 0$

3.2 The impact of multi-period contracts in announced inflation rates

A higher share of long-term contracts in the economy generally increases inflation under commitment. The one exception is the second period of a pooling equilibrium, when γ has no effect in optimal inflation announcements, which also contrasts with Walsh.

3.3. Size of the inflation bias

Table 2 compares the inflation results in Walsh with those under homogeneous information sets. Inflation is higher with homogeneous information sets.[6]

[5] The superscript *a* in the tables stands for 'announced'.

[6] Of course, when contracts are only short term ($\gamma = 1$), the results obtained here are the same as in Walsh, which in turn converge to the standard model of time inconsistency.

Table 2 Compared results of equilibrium inflation

Equilibrium	Separating				Pooling	
	π_t^W	π_{t+1}^W	π_t^a	π_{t+1}^a	π_t^a	π_{t+1}^a
a–**b** ($\gamma<1$)	>0	>0	>0	>0	>0	>0

a = Results with homogeneous information sets; **b** = Walsh (2000) results.

Table 3 New signs for the output gap ($0<\gamma<1$, $0<q<1$, $\rho=0.9$)

Central banker's type	Time	Sign of the output gap
Separating equilibrium		
S	t	<0 unless ($q=0.1$ or 0.9, $\gamma\leq 0.2$)
W	t	>0
S	$t+1$	<0
W	$t+1$	>0 unless ($\gamma=0.1$, $q\leq 0.2$) or ($\gamma\in[0.2,0.5]$, $q=0.1$)
Pooling equilibrium		
S and W (with W at $t-1$)	t	>0 unless ($q\leq 0.4$, $\gamma\leq 0.5$) or ($q\leq 0.5$, $\gamma\geq 0.6$)
S and W (with S at $t-1$)	t	<0 unless ($q=0.9$, $\gamma\leq 0.3$)
S	$t+1$	<0 unless ($q=0.1$, $\gamma\leq 0.5$)
W	$t+1$	>0

3.4. Output gap predictions

The predictions for economic growth with homogeneous information sets are not as straightforward as those in Walsh (2000). As Table 3[7] shows, because of the inertial component in the output gap equation, the sign of the output gap may depend on the type of the *previous* central banker.

Incomplete information in this model may force the economy into recession under a weak type central banker. Episodes of high inflation delivered under discretionary monetary policy and economic recession were common in the 80s in several countries worldwide. Although a deeper investigation of the institutional framework would be needed to link these stylized facts with the revised model, it is interesting to note that the model might be able to replicate a wider range of real world problems.

In Walsh, the output gap in the first period of the separating equilibrium under commitment can take positive, null or negative values, but the conditions

[7] Matlab numerical calculations were used in order to obtain the results in Table 3. The corresponding programs can be obtained upon request to the authors.

for each of these cases are quite different from the ones obtained with homogeneous information sets.

3.5 Market power to discipline an opportunistic central bank

An important difference, which changes what we consider to be the core of Walsh (2000), is the influence of the heterogeneity of contracts in the likelihood of the pooling equilibrium. Walsh argues that 'the greater the prevalence of multi-period wage contracts, the more likely it is that pooling results'. Later in the paper, the author goes on further to say that a higher k (which is decreasing with γ) will force the opportunistic central bank to be patient, and make the separating equilibrium unlikely. As a result, 'market discipline may serve to constrain the behavior of the central bank, forcing the central bank to ''do the right thing'' '.

We found that this argument holds only for heterogeneous information sets. With homogeneous information sets, the pooling equilibrium is very unlikely. With standard discount rates ($\rho \geq 0.9$), pooling exists only for very high credibility levels and a relatively high share of short-term contracts[8]. Therefore, the present model predicts that the weak central banker will usually not mimic the strong one in a pooling equilibrium, and thus the expectations channel derived from multi-period wage contracts loses the disciplinary property highlighted in Walsh (2000).

4. Conclusion

The assumption that different wage contracts signed simultaneously have different information sets is crucial for Walsh (2000) to conclude that forward looking expectations are an important disciplinary device for central bankers. The present article shows that, with homogeneous information sets, pooling equilibria will generally not occur, so that the disciplinary channel will be lost.

In the aggregate supply function, unanticipated inflation persistence affects the output gap and thus future expectations weight less than past expectations of current inflation. In Walsh, a strong central banker is expected to drive output growth to levels below the trend in the second period of a pooling equilibrium, whereas under homogeneous information sets, the conservative central banker may in some cases generate output growth above trend levels. This result is particularly important, not only from a theoretical viewpoint, but also to give further support to Cukierman and Liviatan's (1991) argument that by observing output expansions above trend levels one cannot immediately conclude that the central bank was lenient with inflation.

[8] The conditions for pooling are only satisfied if ($\gamma \in [0.3,0.6]$, $q = 0.9$) or ($\gamma \geq 0.7$, $q \geq 0.8$).

Under discretion, the economy will not always expand. This new theoretical result may explain why several countries experienced high inflation with deep economic recessions in the 80s.

Finally, optimal inflation is higher with homogeneous information sets, which implies that the power of time inconsistency is higher here than in Walsh (2000).

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