

Comments on

Robert G. King and Alexander L. Wolman's

"Monetary Discretion, Pricing Complementarity and Dynamic Multiple Equilibria"

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This is a very nice paper. It shows that multiple equilibria with different levels of inflation may arise in a standard New Keynesian model because of the endogeneity of monetary policy to the expectations of price setters. In my comments I shall 1) summarize the argument, 2) discuss the paper's relationship to the literature, 3) discuss the relevance of this model for the real world, and some policy implications.

1) Summary of the argument

One nice thing about the model is that it is so close to the textbook macro models of the 1970-80s. It is more microfounded since it is a stochastic dynamic general equilibrium framework with monopolistic price-setting. But this is essentially a modern version of the Taylor (1979) model with price staggering.

The authors look at discretionary equilibria in which the government maximizes domestic welfare (rather than the ad hoc objective function used in the older literature). The main contribution of the paper is to show that discretion can give rise to multiple equilibria. This is another cost of discretion.

The mechanism at the heart of the model can be described by looking at two consecutive periods, say 1 and 2.

In period 1, one half of the firms set their price for period 1 and period 2. They set the same price $P_{1,2}$ for period 1 and period 2. In this regard the model is more like Taylor (1979) than Fischer (1977).

The multiplicity of equilibria comes from the following complementarity in price setting: the price set by an individual price-setter i is increasing with the price set by the other price setters.

$$\frac{dP_{1,2}^i}{dP_{1,2}} > 0,$$

where $P_{1,2}^i$ is the price set by firm i and $P_{1,2}$ the price set by the other firms (which is the same as the aggregate price index since i is atomistic).

For multiplicity to arise, however, it is not sufficient to have complementarity. The elasticity of the individual price to the aggregate price must be larger than 1

$$\frac{dP_{1,2}^i}{dP_{1,2}} > 1,$$

(see figure 1). This is where the endogeneity of monetary policy plays a key role.

The decision of an individual (atomistic) firm i can be written as a function of the aggregate price and of future money supply

$$P_{1,2}^i = F(P_{1,2}, M_2)$$

where M_2 is period 2 money supply. The function is increasing in both arguments. For simplicity I have omitted the fact that the function also depends on the price that will be set in period 2, $P_{2,3}$.

Then individual price decisions are **complementary** in two senses.

First, an individual price-setter increases its price in response to a price increase by the other price-setters (keeping money supply constant)

$$\frac{\partial P_{1,2}^i}{\partial P_{1,2}} = F_1 > 0.$$

This effect is present in any model with monopolistic price-setting: each firm takes advantage of an increase in the aggregate price level to increase its profits. However, this effect is not sufficient to generate multiple equilibria because the elasticity of the individual price to the aggregate price is lower than 1,

$$F_1 < 1.$$

The second effect stems from the endogeneity of monetary policy. The monetary authorities (maximizing domestic welfare in a discretionary way in period 2) respond to an increase in the aggregate price by increasing money supply,

$$M_2 = M(P_{1,2}), \quad M' > 0.$$

The monetary authorities *accommodate* the rise in the price level in order to mitigate the loss in period 2 output.

Once the endogeneity of monetary policy is taken into account, the elasticity of the individual price to the aggregate price could be larger than 1,

$$\frac{dP_{1,2}^i}{dP_{1,2}} = F_1 + M' F_2 > 1,$$

leading to the possibility of multiple equilibria. The endogenous response of money supply to price setting is crucial to the argument since without it the elasticity of individual decision to aggregate decisions would be smaller than 1, and the multiplicity of equilibria could not arise.

While I think that King and Wolman's analysis is entirely correct, I have a concern with the stability of the high-inflation equilibrium. To discuss stability one has to assume a tatonnement process for price setting. For example, let us consider a process of iterative price announcements in which each firm announces its optimal price conditional on the prices announced by the other firms in the previous step of the iteration, that is

$$P_{1,2}^i(s) = F(P_{1,2}(s-1), M(P_{1,2}(s-1)))$$

where s is the number of the step in the iteration. Then as figure 1 shows, the low inflation equilibrium is stable but the high inflation equilibrium is not. It would be interesting to look at other tatonnement processes but intuitively, the fact that the elasticity of individual decisions to aggregate decisions is larger than 1 should make the high inflation equilibrium less stable.

2) Literature

There are a number of papers on monetary policy and multiple equilibria. Most of them are related to interest rate pegging: McCallum (1981), Bernanke and Woodford (1997), Benhabib, Schmitt-Grohé and Uribe (2002).

In this paper the source of multiplicity is different. It is the endogeneity of money supply to past price-setting decisions.

A rather similar argument has been developed by Calvo (1988) in a different context.

Calvo's model involves government debt and the fiscal-monetary policy mix. Like for King and Wolman, the essence of Calvo's argument can be explained in a two-periods model. Expectation of high inflation forces the government to raise the nominal interest rate in period 1. This increases the service of debt in period 2. The government repays its debt in period 2 with fiscal receipts and seigniorage. At the margin the government responds to the higher nominal interest rate by increasing seigniorage, justifying ex post the inflationary expectations. Like in King and Wolman's model, therefore, a good equilibrium with low inflation may coexist with a bad equilibrium with high inflation.

Calvo's model is very different from King and Wolman in some respects. It does not involve price stickiness and it is not a dynamic general equilibrium model. But it is similar in that the multiplicity comes from the endogeneity of monetary policy to past inflation expectations.

There is another sense in which Calvo's model is relevant for this discussion. The Calvo model is helpful to think about the experience of countries with high inflation, especially in Latin America. It describes the vicious circle in which some of these countries have been caught---high inflation leading to a ballooning public debt and inflationary finance. As I am going to argue now, the King and Wolman is probably most relevant to think about high inflation too.

3) Relevance and policy implications

King and Wolman's paper makes a theoretical point, it does not make strong statements about the real world. However the authors provide a calibration of the model that is useful to think about the circumstances in which the model might be the most relevant.

King and Wolman's calibration suggests that in the high inflation equilibrium inflation is very high indeed. The inflation rate is equal to 9 percent in the good equilibrium and 68 percent in the bad equilibrium (these are annual inflation rates, four times the quarterly inflation rates reported in the paper). These figures are sensitive to the calibration, but my hunch is that the inflation rate cannot be decreased in the bad equilibrium without increasing the inflation rate in the good equilibrium. This would be true if changing the calibration shifted the curve in figure 1 without changing its shape.

The bad equilibrium, then, would seem to correspond to the high inflation episodes that Calvo had in mind. The King and Wolman model, as it stands, cannot explain a jump in the rate of inflation from say, 2 percent to 12 percent. So quantitatively, it does not seem to be a very good model for the "Great Inflation" of the 1970s in advanced countries.

Let us come to the policy implications. There is a huge literature on how to deal with the inflationary bias resulting from discretion in monetary policy and it has generally concluded to the benefits of delegating monetary policy to an independent and conservative central bank, or of monetary rules. In this paper, however, the main negative side effect of discretion is not the inflationary bias but the existence of a Pareto-dominated bad equilibrium with high inflation, i.e. a **coordination failure**. The optimal policies must remedy this coordination failure in one way or another.

There are several ways to solve the coordination problem in the King-Wolman model and they are reminiscent of policies that have been implemented in high inflation countries:

Coordination: the government could coordinate firms on the good equilibrium, for example with **price controls**. If the inflationary expectations are built in wages rather than prices, this coordination could take place in collective negotiation involving the government and the unions.

Indexation: firms could set their price in terms of a real unit instead of the domestic currency (see, for example, the Chilean UF). Then inflationary expectations would not build in nominal price increases, and the bad equilibrium would disappear.

Could more orthodox policies, such as central bank independence and inflation targeting, also succeed in removing the high inflation equilibrium? A conservative central banker will be less willing to accommodate inflationary expectations so its policy response should satisfy

$$M^{cb}(\cdot) < M(\cdot).$$

This will shift the curve downwards in figure 1. As shown in figure 2 this has an ambiguous effect on the set of equilibria. It could be that the curve no longer crosses the 45 degree line in point B, in which case central bank conservativeness not only reduces the inflation rate in the good equilibrium (the classical result) but also removes the bad equilibrium. However the bad equilibrium does not necessarily disappear, and in that case the conservativeness of the central banker increases the rate of inflation in the bad equilibrium. The intuition is that it takes more inflation to break the resolve of a conservative central banker.

In sum, the world described by King and Wolman is very different, in some respects, from the world that most monetary economists have in mind. In this paper the authors do not provide us with a lot of empirical evidence that we should take their world seriously. However, if their model came to be taken seriously, the policy implications might be quite unorthodox. This makes me curious about the empirical plausibility of King and Wolman's theory: I hope that the authors will look more into this in future work.

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Figure 1.

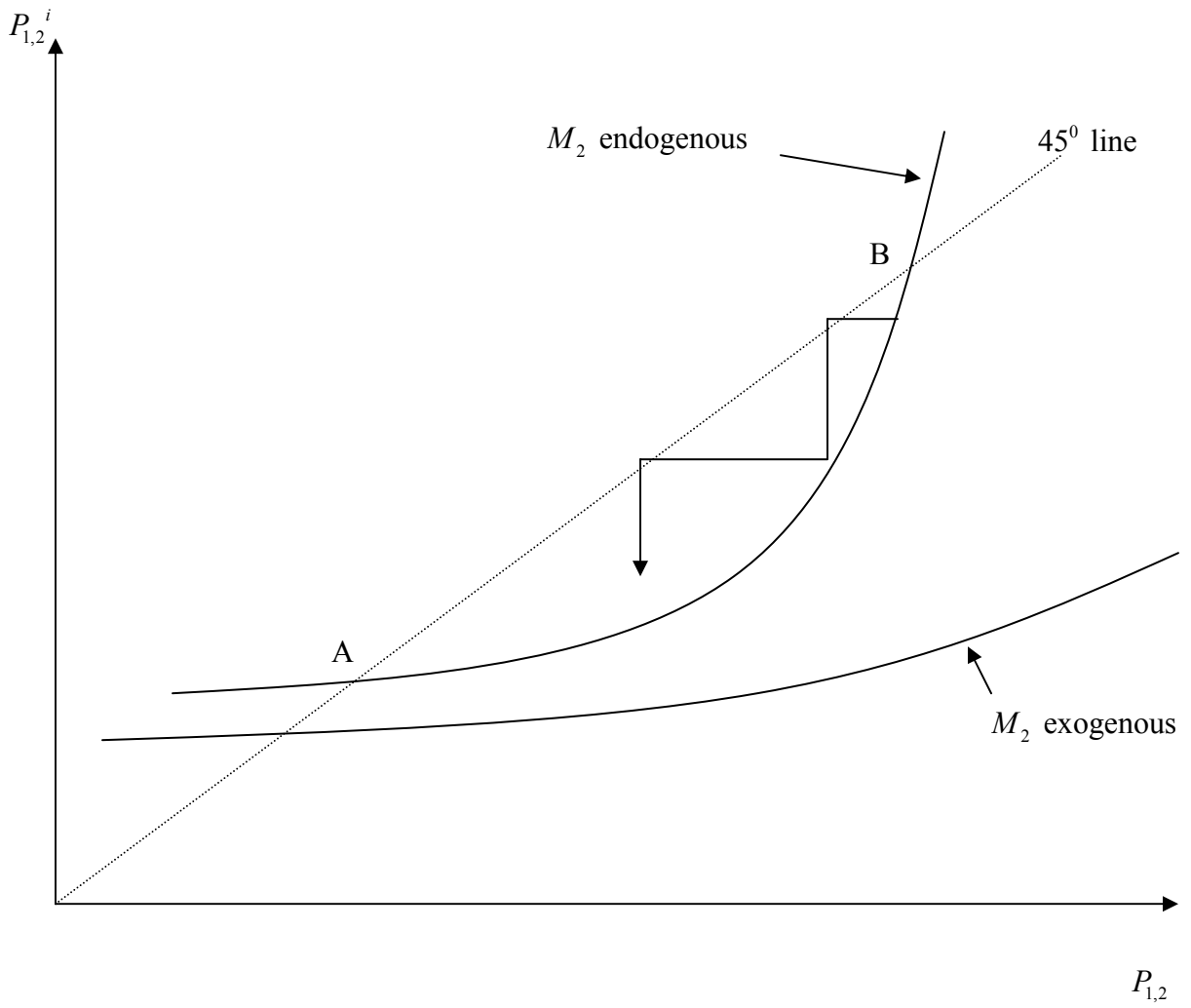


Figure 2.

