Explaining an Inflation Bias without Using the Word "Surprise"*

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This version: February, 2003

Abstract

The seminal theory of monetary credibility problems due to Barro and Gordon has recently been widely criticized. A main element in this criticism is that the model's equilibrium inflation bias emerges from the monetary authority's incentive to "surprise" the private sector. This is argued as being an inadequate description of real life monetary policymakers, who are purportedly not in the business of surprising or fooling people. The main purpose of this note is to show that by reformulating the original model, one can derive and explain its excessive equilibrium inflation without any use of the word "surprise."

Keywords: Monetary policy; surprise inflation; inflation bias; Barro and Gordon model.

JEL: E42, E52, F58.

*Financial support from EPRU is gratefully acknowledged (the activities of EPRU are financed by a grant from The Danish National Research Foundation).

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1. Introduction

In 1983, Robert J. Barro and David B. Gordon published the article "A Positive Theory of Monetary Policy in a Natural Rate Model" in the Journal of Political Economy (Barro and Gordon, 1983a). It contained a very simple model of monetary policy featuring a time-inconsistency of optimal policy.[1] The main implication of this, is that if the monetary policymaker lacks the ability to precommit (i.e., lacks credibility), the inflation rate will be excessive. I.e., an inflation bias prevails in a discretionary equilibrium, but the real side of the economy — the unemployment rate — is left unchanged and in a socially inefficient state. The model thus provided a possible explanation for the occurrence of excessive inflation in economies where monetary authorities have the incentives to perform expansive policies to raise unemployment above its natural rate. An incentive that turns out to lead nowhere in a rational expectations framework where the incentive is well understood by the private sector.

Due to its intuitive appeal and analytical tractability, it became the work-horse model in a large literature on credibility problems in monetary policy.[2] A literature focusing on how and why such problems may arise, and also — in particular — on which means may mitigate them; see, e.g., Walsh (1998, Chapter 8) and Persson and Tabellini (2000) for recent surveys.

After a long period of popularity, the model, however, seems to have become more and more unfashionable. One explanation could simply be that the falling inflation rates in most industrialized economies in the recent decade have made theories attempting to explain sustained inflation of less interest.[3] Another reason, and an important one in my opinion, is that when the model's equilibrium inflation bias is explained, it is often stated that it arises from the policymaker's incentive to create "surprise inflation," or, incentive to "fool the public." This follows from the original model's Lucas-style supply equation, where unemployment only differs from the natural rate if inflation differs from inflation

[1] Models of the time-inconsistency of optimal monetary policy had earlier been presented by Calvo (1978) and Kydland and Prescott (1977). The latter contribution actually contains an example very close to that of Barro and Gordon (1983a). However, the model has subsequently been dubbed the Barro-Gordon model.

[2] The impact of the theory can roughly be quantified by the number of citations the paper, and its cousin (Barro and Gordon, 1983b, focusing on reputational solutions to credibility problems), has in the Social Sciences Citation Index. As of february 2003, the number is around 900, which is very high in the economics profession.

[3] In this respect, it is nevertheless interesting to note that Ireland (1999) finds empirical support for the model on US data including recent periods of low inflation. The reason being that these periods have been associated with falls in the natural rate of unemployment. This is perfectly consistent with the Barro and Gordon model, which predicts a positive relationship between the inflation bias and the natural rate of unemployment.

expectations; i.e., if those forming expectations are "surprised" or "fooled." Since many economists find that policymakers are not in the business of "fooling" people (if the world was just such a place....), they have therefore labelled the Barro and Gordon model as more or less irrelevant for monetary policy analysis.

For example, former Vice-Chairman of the Board of Governors of the Federal Reserve Board, Alan Blinder has recently criticized the theory, and the literature that followed (see Blinder 1997, 1998). The following quote summarizes in my view his position:

> "academic economists have been barking loudly up the wrong tree (...) many theorists have fretted over the following time-inconsistency problem that allegedly bedevils monetary policy. (...) well-meaning central bankers are constantly tempted to reach for short-term employment gains by engineering inflation surprises (...) during my brief career as a central banker, I never once witnessed nor experienced this temptation." Blinder (1997, p. 13).

Also, chief economist of the Bank of England, John Vickers, has recently questioned the relevance of the theory:

> "There is a large literature on inflation bias, but it is simply not applicable (...) We have no desire to spring inflation surprises to try to bump output above its natural rate" Vickers (1999, p. 6).

Finally, it is obvious that Executive Board Member of the newly established European Central Bank, Otmar Issing, finds the theory of little interest:

> "Let me make absolutely clear that I reject the idea that central banks should make imprecise announcements in order to retain room for manoeuvre to exploit 'surprise inflation' " Issing (1999, p. 507).

I have two main remarks to these statements. First, they do not, to me, constitute any "proof" of the irrelevance of the Barro and Gordon model. Secondly, they show that the citizens of the United States, England and Euroland should be very pleased with their monetary policymakers, as they, at least according to their own words, do not act according to the predictions of the model.

However, a positive theory of credibility problems cannot, of course, be expected to apply to every monetary policymaking body in the world. Instead, it should be seen as a story of what *can* go wrong *if* policy lacks credibility, and thereby a potential story about the deadlocks a policymaker lacking the virtues of Blinder, Vickers and Issing may find him-

or herself caught in. Hence, the main lesson of the model — that if you try solving permanent structural imbalances by monetary policy you get in permanent trouble — remains worthy its reputation. Also, its normative implications about how policymakers can build up credibility for not making these futile monetary experiments remain very important for institution building for economies not endowed with perfectly credible policymakers (on this, I return in the concluding section).

Since mere semantics like "surprise inflation" or "fool the public" nevertheless seem to be about to bury a well-established theory and literature, I offer in this note an alternative exposition of the Barro and Gordon model, where one need not use such terms in order to explain the equilibrium outcome of the model. First, however, I review the model in its original form.

2. The Barro and Gordon (1983a) model

The basic Barro and Gordon (1983a) model has essentially only two ingredients. A reduced-form specification of the (closed) economy, and a loss function of the monetary policymaker. The economy is represented by a conventional Lucas-style equation relating unemployment, U, to the natural rate of unemployment, $U^{\mathsf{n}} > 0$, as well as actual and expected inflation, π and π^{e}, respectively:

$$U = U^{\mathsf{n}} - \alpha\left(\pi - \pi^{\mathsf{e}}\right), \quad \alpha > 0. \tag{1}$$

Unemployment will equal the natural rate unless inflation deviates from expected inflation. Inflation expectations are assumed to be rational, and formed at the beginning of the period.[4] The loss function of the policymaker is

$$Z = a\left(U - kU^{\mathsf{n}}\right)^2 + b\pi^2, \quad a, b > 0, \quad 0 \leq k \leq 1. \tag{2}$$

I.e., the policymaker dislikes deviations in unemployment from kU^{n} and price instability. Of crucial importance for the ensuing equilibrium is the value of k. In the case of $k = 1$, the policymaker's preferred value for unemployment equals the natural rate. However, to provide a rationale for activist policy in the model, Barro and Gordon assume $k < 1$ reflecting that the natural rate of unemployment is socially inefficient. Monetary policy

[4] The original model was formulated in an infinite horizon setting with the natural rate of unemployment varying exogenously over time. For the purpose of this note, however, nothing is lost by considering a single period.

aims at minimizing Z, and the policy instrument is taken to be π.[5] Performing this minimization subject to (1), taking as given π^e, results in the first-order condition

$$-a\alpha\left(U - kU^n\right) + b\pi = 0, \tag{3}$$

which states that the policymaker equates the marginal gain of inflation in terms of reduced unemployment with the marginal loss in terms of inflation per se. Since expectations are rational, it follows that $\pi = \pi^e$ applies in equilibrium. By (1), it then follows that $U = U^n$. Inserting this into (3) then results in the equilibrium inflation rate

$$\pi = \frac{a}{b}\alpha\left(1 - k\right)U^n > 0. \tag{4}$$

Equation (4) exhibits the famous inflation bias. Inflation exceeds the socially optimal level even though all actors behave rationally and even though the policymaker acts in the interest of the public. This is, therefore, a rather astonishing result, because why doesn't the policymaker choose $\pi = 0$? We, of course, all know by now that $\pi = 0$ is dynamically inconsistent, since if $\pi^e = 0$, the policymaker would have the incentive to deviate (upwards) as this would entail a first-order gain in terms of lower unemployment but only a second-order loss in terms of inflation. As such a deviation involves $\pi \neq \pi^e$, the public is "surprised" or "fooled," which cannot be a rational expectations equilibrium.

Indeed, when explaining why the inflation bias arises in equilibrium, Barro and Gordon (1983a) write:

> "The policymaker is not required to select an inflation rate that equals the given expected inflation rate. However, people also realize that the policymaker has the power to fool them (...) Since the formation of expectations takes this potential for deception into account, a full equilibrium will ultimately involve $\pi = \pi^e$." (p. 598),

and in the abstract they note that

> "A discretionary policymaker can create surprise inflation, which may reduce unemployment . . . But when people understand the policymaker's objectives, these surprises cannot occur systematically (...) Then, (...) the rates of monetary growth and inflation are excessive" (p. 589).

[5] In the working paper version of the model, Barro and Gordon used an extended model, where money growth was the policy instrument. This did not affect the main results. So, as is also well known and noncontroversial by now, the assumption of inflation being the instrument is merely a convenient model simplification.

Subsequently, when others have been applying or amending the model, the phrases "surprise inflation" or "fool the public" have, as mentioned, therefore been predominant when the inflation bias result has been explained.[6] Phrases, which has led many economists to discard the relevance of the theory; cf. the Introduction. In the next section I demonstrate, by performing a minor twist on the model, how to derive the equilibrium featured in (4), without having to rely on explanations involving "surprise inflation"-terminology or the like.

3. A reformulation of the model

Consider the following reformulation of the equation describing the supply side of the economy:

$$\pi = \pi^{e} - (1/\alpha)(U - U^{n}). \tag{5}$$

This is a conventional expectational-augmented Phillips curve, where inflation — now an endogenous variable — is increasing in expected inflation and decreasing in deviations of actual unemployment from the natural rate. E.g., unemployment below the natural rate puts upwards pressures on prices. This description of the supply side, is probably more in accordance with how policy practitioners view an economy (at least compared to the Lucas-style output equation of the former section).

Since the model (in either formulation) features incomplete nominal adjustment, output and unemployment is demand determined. Assume therefore that the policymaker controls demand (say, through the short interest rate), and assume for simplicity that it controls the unemployment rate directly. In determining the optimal monetary policy, the policymaker therefore chooses U so as to minimize Z, subject to (5) and taking as given π^{e}. The associated first-order condition is

$$a(U - kU^{n}) - (b/\alpha)[\pi^{e} - (1/\alpha)(U - U^{n})] = 0, \tag{6}$$

implying that the policymaker equates the marginal gain of higher demand (in terms of reduced unemployment) with the marginal loss in terms of the associated inflationary pressures. Again, since expectations are assumed to be formed rationally, $\pi^{e} = \pi$, and it

[6] Ironically, when setting expectations, the private sector is actually preempting the policymakers' incentive to "surprise." So, the model's equilibrium prediction is that the policymaker never has an incentive to "surprise." This is also clearly stated by Persson and Tabellini (2000).

follows by (5) that $U = U^n$. Inserting this into (6), results in

$$a(1-k)U^n - (b/\alpha)\pi^e = 0,$$

from which expected inflation, and thus actual inflation, emerges as

$$\pi^e = \pi = \frac{a}{b}\alpha(1-k)U^n > 0. \tag{7}$$

Of course, the equilibrium solution for inflation in (7) is the same as that of (4), which was derived in the standard fashion. However, when one explains the intuition behind the excessive inflation result, as it emerges in this slightly-amended version of the model, differences will emerge.

Consider the following explanation. Since $k < 1$, it is known by all that the policymaker considers the natural rate of unemployment to be inefficient. It is therefore rational to expect that the policymaker will conduct an expansive demand policy in order to push unemployment below the natural level. Such policy, however, is known to lead to inflation; cf. the Phillips curve (5). As a result, the private sector's inflation expectations rise. This feeds into actual inflation thereby making the inflationary costs of the planned expansion higher. In a rational expectations equilibrium, inflation expectations are at a level such that the level of actual inflation deters the policymaker from lowering unemployment below the natural rate. So, the implication of the policymaker's desire for lower unemployment causes the economy to end up with excessive inflation, and unemployment to remain at its natural rate.

No surprises or fooling here.

4. Conclusions

In this note, I have shown that the Barro and Gordon inflation bias result can be derived without having to resort to explanations relying on "surprise inflation" or "fooling the public." Phrases, which to me appear to have been a main course in the model's recent unpopularity. An unpopularity, which in my view is unwarranted as the model is a simple and elegant way of modelling potential credibility problems in monetary policymaking. Most importantly, the model therefore formed the basics for ensuing theories on how to set up institutions for monetary policymaking in order to obtain sound, credible monetary policy in countries where this is needed (such theories are, of course, irrelevant for lucky countries with monetary policymakers who enjoys full credibility). This seems to me as a

quite relevant contribution, and it, e.g., has had enormous influence in the stronger and stronger emphasis on central bank independence in many countries. I.e., the design of a monetary institution — independent from political pressures — with a charter clearly describing the goals of monetary policy.

In the simple version of the Barro and Gordon model portrayed here this would, of course, be a simple charter stating "set $\pi = 0$." More complex economies would require more complex charters, but the basic idea remains the same.[7] Incidentally, Barro and Gordon themselves did note this important aspect of their model, when they wrote:

> "The model stresses the importance of monetary institutions, which determine the underlying rules of the game." (p. 608),

and

> "The most likely general role for policy advice consist of identifying and designing improvements in present policy institutions" (p. 609).

In a seemingly forgotten Footnote 19, they even formalize this point within the context of their model, and thereby predate elements of several ensuing papers focusing on delegation to an independent central banker with appropriately shaped incentives; i.e., preferences:

> "the parameters of the policymaker's preferences could be artificially manipulated in order to generate a noncooperative solution where $\pi = 0$. This result follows if the policymaker gives infinite weight to inflation ($b = \infty$), gives zero weight to unemployment ($a = 0$), or regards the natural unemployment rate as optimal ($k = 1$). In the context of discretionary policy, outcomes may improve if there is a divergence in preferences between the principal (society) and its agent (the policymaker)." (p. 607).

These important insights should not be forgotten, just because some societies apparently do not experience credibility problems of any kind in monetary policy, or just because the concept of "inflation surprise" is disliked. Many countries do have credibility problems in monetary policy, and the Barro and Gordon model provides a simple framework for thinking about them, and a simple framework to use as a starting point for thinking about how to overcome them.

[7] The Barro and Gordon model should today therefore more be seen as a simple parable of credibility problems. In recent, more elaborate, models of monetary policy, other types of credibility problems are identified; see, e.g., Clarida et al. (1999) and Woodford (1999). The literature following the Barro and Gordon model, however, is applicable in such models as well. This is evident in, e.g., Jensen (2002), Svensson and Woodford (2003) or Woodford (1999) (in all cases "institutional designs" are suggested which eliminate or reduce the credibility problem).

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