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Rogoff Revisited: The Conservative Central Banker Proposition Under Active Fiscal Policies

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Abstract

This paper generalizes and qualifies an influential monetary policy result due to Rogoff (1985) by taking fiscal policy, and fiscal-monetary interactions, into account. It shows that an appointment of a conservative central banker may, under a range of circumstances, (i) increase the average level of inflation; or (ii) decrease this level too much, producing deflation; and/or (iii) reverse the direction of the monetary response to shocks (from tightening to easing and vice versa). We show the conditions under which this can happen.

Keywords: conservative central banker, monetary and fiscal policy interaction, inflation, deficit, debt.
JEL classification: E61, E63

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1. Introduction

In the theory of monetary policy, conventional results state that discretionary policies will lead to a positive inflation bias; and that an independent and conservative central bank will achieve lower average inflation without losses in average output (Rogoff (1985); Barro and Gordon (1983)). However, this theory derives from models that exclude fiscal policy. It is therefore important to ask: do these results still hold in the presence of active fiscal policies?

We show that, in a range of circumstances, they do not. This is an illustration of an old Tinbergen (1954) proposition, that policy interactions can change outcomes. In order to provide a formal comparison, we confine ourselves to an uncontroversial extension of the Barro-Gordon model. We focus, as Rogoff (1985) does, on a one shot game.[2] We also assume fully independent policies. We thus focus on the indirect policy interactions in the Sargent and Wallace (1981) sense, and control for any direct linkages as examined by Walsh (1995), Lohmann (1992) and the subsequent literatures.

2. Model

2.1. **Setup.** Our setting is a straightforward extension of Barro and Gordon (1983), which is a simplified representation of Rogoff's (1985) model. The framework keeps all the original features and hence allows a direct comparison. The Lucas supply relationship summarizes the economy and also includes the effect of fiscal policy

$$x_t = \mu(\pi_t - \pi_t^e) + \rho g_t + \varepsilon_t, \tag{1}$$

where x, π, π^e, and g denote the output gap, inflation, inflation expected by the public, and the growth rate of real debt respectively. The supply shock ε has a zero mean and variance σ_ε^2. The parameters $\mu > 0$ and $\rho \geq 0$ denote the *potency* of monetary and fiscal policy respectively.[3] We define the growth rate of real debt in the standard fashion

$$g_t = G_t - \pi_t. \tag{2}$$

where G is the growth rate of nominal debt (which can be thought of as the size of budget deficit, where $G_t = 0$ expresses a balanced budget). G and π represent M and F policy instruments that are assumed to be independently set and perfectly controlled.

The policymakers' one period utility function follows the convention in the literature:[4]

$$u_t^i = -\beta^i (x_t - x_T^i)^2 - \pi_t^2, \tag{3}$$

where $i \in \{M, F\}$ is the set of players and the inflation target of both policymakers is set to zero. Further, $\beta^i > 0$ denotes the degree of policy *conservatism* (lower β^i values denoting greater conservatism). We will refer to $\beta^M < \beta^F$ and $\beta^M \geq \beta^F$ as the cases

[2]Reputation will not add anything unless the policy horizon is infinite, and even it that case, as Barro and Gordon (1983) has shown, it simply enlarges the set of equilibrium outcomes rather than eliminates the one-shot Nash.

[3]Note that the 'expansionary fiscal contractions' literature can also be accommodated here (if $\rho < \mu$). Our companion paper Hughes Hallett, Libich, and Stehlík (2007) considers some extensions to the supply curve and shows that our findings are unchanged.

[4]The players can be thought of as discounting the future with δ_M and δ_F being their discount factors. But as we will be focusing on the one-shot game the players' impatience will not play any role in the analysis.

of conservative and liberal central banker respectively. The parameter $x_T^i \geq 0$ denotes the degree of policy *ambition.* We distinguish between two types of policymaker: the *responsible* with $x_T^i = 0$, and the *ambitious* with $x_T^i > 0$.[5]

The public is, like the policymakers, assumed to have rational expectations and complete information about the structure of the economy and the policymakers' preferences. These standard assumptions will enable us to focus on the policy interaction as there will be no reputational issues.[6] Following the literature, the policymakers are assumed to be able to observe the shock in real time (ie ε_t before making their t period move). In terms of the public, as a robustness check we will consider both the scenario of *information symmetry* in which the public can observe the shock in real time (as in Cukierman (2001) and Gersbach (2003)), and *information asymmetry* in which it cannot do so (as in Rogoff (1985)). We show that since the *average* values of all macroeconomic variables in equilibrium are the same in both scenarios, our Propositions 1-3 apply regardless of the informational assumption imposed. Proposition 4 that deals with the policy response to shocks then reports some novel insights into the difference between the two scenarios.

2.2. **Solution: The Rogoff Case.** This case will refer to a situation in which $\rho = 0$. Using these assumptions, and (1)-(3), we have the following equilibrium outcomes under information symmetry and asymmetry (denoted by ^{R} and ^{RA} respectively)

$$\pi_t^R = \mu\beta^M(x_T^M - \varepsilon_t) \text{ and } x_t^R = \varepsilon_t. \tag{4}$$

$$\pi_t^{RA} = \mu\beta^M\left(x_T^M - \frac{\varepsilon_t}{1+\mu^2\beta^M}\right) \text{ and } x_t^{RA} = \frac{\varepsilon_t}{1+\mu^2\beta^M}. \tag{5}$$

2.3. **Solution: The Interaction Case.** This case will refer to a situation in which $\rho > 0$. Focusing on the one shot simultaneous game we have, using (1)-(3), the following equilibrium outcomes under information symmetry and asymmetry (denoted by * and ^{*A} respectively)

$$\pi_t^* = \beta^M(\rho - \mu)(x_T^F - x_T^M) \text{ and } G_t^* = \pi_t^* + \frac{x_T^F - \varepsilon_t}{\rho} \text{ and } x_t^* = x_T^F, \tag{6}$$

$$\pi_t^{*A} = \pi_t^* \text{ and } G_t^{*A} = \pi_t^* + \frac{x_T^F}{\rho} - \frac{1+\beta^M\rho(\rho-\mu)}{\rho\left[1+\beta^M(\rho-\mu)^2\right]}\varepsilon_t \text{ and } x_t^{*A} = x_t^*. \tag{7}$$

3. Results

To keep the paper focussed, we will only report results that deviate from the findings of Rogoff (1985).[7] Our Propositions 1-3 are applicable regardless of the assumption on the public's information set, which is implied by the fact that the *average* levels are the

[5] We prefer the term ambitious to *irresponsible* since we want to allow, following Rogoff (1985), for the socially optimal output gap target, $\bar{x}_T$, to be positive.

[6] For an alternative case in which the players' actions cannot be reconsidered every period (due to costly wage bargaining, information gathering, or due to the policymakers' commitment), see eg Libich, Hughes Hallett, and Stehlík (2007).

[7] For additional results from this model and its extensions, see Hughes Hallett, Libich, and Stehlík (2007).

same for the asymmetry and symmetry scenarios in both the Rogoff and Interaction case - compare (4) with (5) and (6) with (7).[8]

Proposition 1. ***(Time-consistency)*** *In the Rogoff case, the inflation target is time-inconsistent if and only if M is ambitious, and time-consistent if and only if M is responsible. In the Interaction case, the target may be time-inconsistent even if M is responsible, and time-consistent even if M is ambitious.*

Proof. The proposition first claims that the inflation target is not the optimal average action of the policymaker $\pi_t^R \neq 0$ iff $x_T^M > 0$ and $\pi_t^R = 0$ iff $x_T^M = 0$ which follows by inspection of (4).[9] The second claim is that there exist parameter values under which $\pi_t^* \neq 0$ even if $x_T^M = 0$ and $\pi_t^* = 0$ even if $x_T^M > 0$. Inspection of (6) reveals that the former is the case under $x_T^F > 0$ and $\rho \neq \mu$ and the latter under $x_T^F = x_T^M$ or $\rho = \mu$. □

This proposition shows that the conventional wisdom implied by the Barro-Gordon literature may be too optimistic under some circumstances and too pessimistic in others. In terms of being too optimistic, it shows that achieving the inflation target and its credibility is not guaranteed even if the central banker is fully independent, highly conservative, and targets the natural rate of output responsibly. Intuitively, a responsible central banker may find it optimal to inflate in an attempt to reduce the over-expansionary effect of F policy - higher inflation decreases the real value of the debt and hence stabilizes output closer to the natural rate. That is the justification for Dixit and Lambertini's (2003) concern that monetary policy cannot be committed if fiscal policy is not pre-committed at the same time.

In terms of being too pessimistic, it shows that the inflation target may be delivered and credible even if the central bank is not conservative and ambitiously aims at above-natural output. This is because of the offsetting effect of the interaction with F policy. These findings suggest that studying M policy in isolation, without the influence of F policy, can be seriously misleading.

Proposition 2. ***(Deflation)*** *In the Rogoff case, a deflation bias cannot occur. In the Interaction case, both inflation and deflation biases can occur - under both responsible and ambitious central bankers.*

Proof. It is claimed that, in expectation, $\pi_t^R \geq 0$ for all parameter values. This follows by inspection of (4). Further, it is argued that parameter values exist under which $\pi_t^* < 0$ for both $x_T^M = 0$ and $x_T^M > 0$. This can be seen in (6) - the former obtains if $\rho < \mu$ and $x_T^F > 0$ and the latter under either $\rho < \mu$ and $x_T^F > x_T^M$, or $\rho > \mu$ and $x_T^F < x_T^M$. □

Intuitively, an ambitious M may optimally deflate since under some circumstances deflation stimulates the economy better than inflation - by increasing the value of real debt and hence magnifying the expansionary effect of F policy.

[8] Note that while in both the symmetry and asymmetry scenarios the deterministic component is the same, the stochastic one differs which will be examined in Proposition 4.

[9] This implies that if the central bank was to announce the optimal zero inflation target, it would renege on its announcement. The rational public will expect this and hence the optimal target announcement will lack credibility, for more see Rogoff (1985) and Barro and Gordon (1983).

Proposition 3. ***(Effect on Average Inflation)*** *In the Rogoff case, a more conservative M policymaker either reduces average inflation, or does not alter average inflation. In the Interaction case a more conservative M may* ***increase*** *average inflation, and may do so even if he is the responsible type (ie for all $x_T^M \geq 0$). The direction of the effect of M policy conservatism on the average level of inflation depends on 1) the relative degree of M and F policy ambition, and 2) the relative potency of M and F policy.*

Proof. We need to show that the deterministic component of π_t^R is either increasing in, or idependent of, β^M. Inspection of (4) shows that this is the case under $x_T^M > 0$ and $x_T^M = 0$ respectively. Equation (6) then proves the second claim by showing that under either $\rho < \mu$ and $x_T^M < x_T^F$, or $\rho > \mu$ and $x_T^M > x_T^F$, the deterministic component of π_t^* is decreasing in β^M. Finally, the sign of the effect of β^M on the deterministic component of π_t^* is a function of $(\rho - \mu)$ and $(x_T^F - x_T^M)$ which completes the proof. □

It is usually argued that the longer term effects of a fiscal expansion are smaller than the impact of a change in monetary policy. That suggests $\rho < \mu$. In that case, the central bank will try to restrain the inflationary effects caused by the fiscal expansion which follows naturally if $x_T^M < x_T^F$. But that would create a deflation bias since the fiscal expansion is less powerful than the monetary restraint, so that $G_t^* \neq 0$, where x_T^F is large and ρ small, is overcome. That yields $\pi_t^* < 0$ and $x_T^* > 0$ in (6). Increasing conservatism would reduce this deflation bias because the central bank, being less concerned with its own x_T^M, will reduce its attempts to offset x_T^F and fiscal policy will have less need of a reflation. Greater conservatism therefore creates greater discipline with a smaller deflation threat, and the conventional negative relationship between inflation and central bank conservatism becomes reversed.

Figure 1 presents an illustration of the claims of Propositions 1-3 for the Interaction case, showing (i) the time-inconsistency of the inflation target in the Rogoff sense, $\pi_t^* \neq 0$, for almost all parameter values, (ii) the possible deflation, $\pi_t^* < 0$, and (iii) the decrease as well as the increase of inflation in β^M (under $x_T^M < x_T^F$ and $x_T^M > x_T^F$ respectively).

Proposition 4. ***(Stabilization of Shocks)*** *Assume a negative shock to output, $\varepsilon_t < 0$.*
(i) In the Rogoff case, the central banker (of any β^M and x_T^M) always eases M conditions in response to the shock. In the Interaction case, depending on the relative potency of M and F policy, the central banker (of any β^M and x_T^M and in both the symmetry and asymmetry scenarios) may either ease or tighten M conditions, or not respond to the shock at all. Furthermore, even for given potencies μ and ρ, the appointment of a conservative central banker may reverse the direction of the optimal M policy response.
(ii) In the Rogoff case, the equilibrium levels of inflation and output always depend on the shock. In the Interaction case (both the symmetry and asymmetry scenarios), these levels are independent of the shock.
(iii) In the Rogoff case, the shock is better stabilized - both inflation and output are less variable - in the asymmetry scenario than in the symmetry scenario. In the Interaction case this is not the case.

Proof. See the Appendix. □

These results are again due to the joint effects of M and F policy - the policies not only respond to shocks, but also to each other. In terms of the first statement in (i),

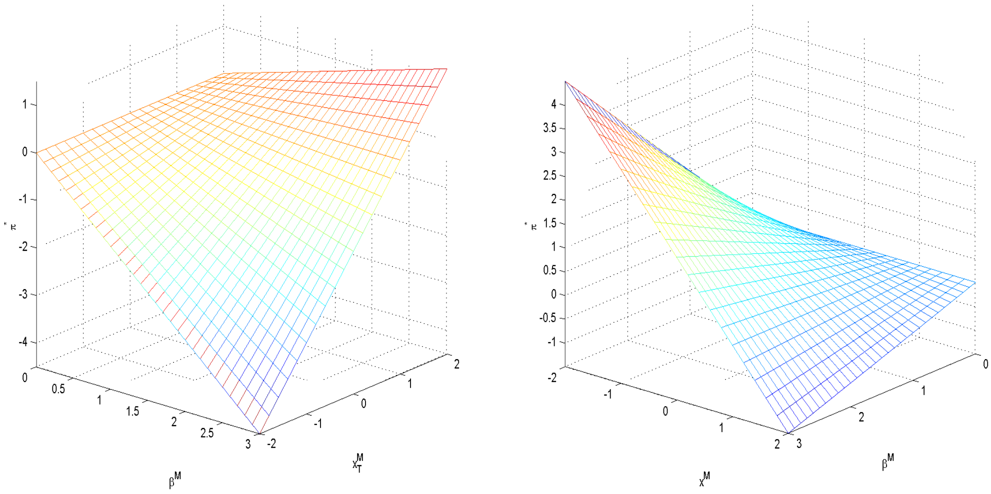

Figure 1. Equilibrium levels of inflation (z axis) as a function of the degrees of M policy conservatism and ambition under $x_T^F = 1, \beta^F = 1$ and $\mu = 1, \rho = 0.5$ (left) or $\mu = 0.5, \rho = 1$ (right).

in the absence of F policy the central banker attempts to stabilize output after $\varepsilon_t < 0$ by surprise inflating. However, in the presence of F policy there is an additional output stabilization option - lower inflation increases the value of real debt and boosts the economy in the desired direction. Which of the two options will be chosen therefore depends on how potent M policy is relative to F policy.

The second statement in (i) is yet stronger. It shows that for a *given* potency of the policies, under the symmetry scenario a liberal central banker may respond to the shock by tightening whereas a conservative central banker may ease monetary conditions. Intuitively, since the shock has a contractionary effect on the real economy, the F policymaker will attempt to offset that contraction by increasing the deficit and nominal debt; see (6). But the sign of this F response as a function of the central bank conservatism can be positive as well as negative ((6) shows that G_t^* may be increasing or decreasing in β^M). Hence the reversion in the M response after the appointment of a conservative central banker is induced by the change in the nature of F responses after this appointment.

Claim (ii) shows that since the optimal responses of M and F policies may turn out to be of equal magnitude, they may cancel each other out. Then the equilibrium values of inflation and output can be unaffected by the shock.

Finally, claim (iii) casts doubt on the conventional wisdom that the central banker's private information necessarily leads to an improvement in the stabilization outcomes as it may be exploited to surprise the public. This is because in the presence of F policy there exists and additional instrument and hence the stabilization of shocks may not require an informational asymmetry to be expoited.

4. Conclusion

The paper shows that including fiscal policy and its interactions with monetary policy in a simple Barro and Gordon (1983) type model can, under certain circumstances, reverse the standard conclusions on how monetary policy affects macroeconomic variables and how it should be conducted. In particular, in contrast to the influential result of Rogoff (1985) it shows that an appointment of a conservative central banker may (i) increase the average level of inflation; or (ii) decrease this level too much producing deflation; and/or (iii) alter the nature (direction) of the monetary responses to shocks.

Our analysis therefore suggests that monetary-fiscal policy interactions may have important implications for the optimal institutional design of both policies. More research is needed to improve our understanding of this interaction and formulate specific policy recommendations.

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6. Appendix: Proof of Proposition 4

Proof. The reaction functions of the central banker in the interaction case are, under symmetry and asymmetry respectively, the following

$$\pi_t^* = \bar{\pi}_t - \frac{\beta^M(\mu-\rho)}{1+\beta^M\rho(\rho-\mu)}\varepsilon_t \text{ and } \pi_t^{*A} = \bar{\pi}_t - \frac{\beta^M(\mu-\rho)}{1+\beta^M(\rho-\mu)^2}\varepsilon_t, \tag{8}$$

where $\bar{\pi}_t = \frac{\beta^M(\mu-\rho)(x_T^M-\rho G_t)}{1+\beta^M\rho(\rho-\mu)}$. In terms of claim (i), (4)-(5) show that π_t^R and π_t^{RA} are decreasing in ε_t for all parameter values. In contrast, (8) shows that π_t^* and π_t^{*A} may be decreasing, increasing, as well as independent of ε_t. Consider for example the asymmetry case in which, under $\mu > \rho$, any type of central banker (ie all β^M and x_T^M) tightens and reduces inflation as a response to the shock. However, under $\mu < \rho$ the central banker eases, and under $\mu = \rho$ he does not respond. In addition, consider the symmetry scenario with a given $\mu > \rho$. The optimal π_t^* in (8) is increasing in ε_t

iff $\beta^M > \frac{1}{\rho(\mu-\rho)}$, but decreasing in ε_t iff $\beta^M < \frac{1}{\rho(\mu-\rho)}$. Hence if a government with $\beta^F > \frac{1}{\rho(\mu-\rho)}$ appoints a conservative central banker with $\beta^M < \frac{1}{\rho(\mu-\rho)} < \beta^F$, then the direction of the M response to the shock, will change from positive to negative. In the asymmetry scenario this reversion cannot happen - which follows from the denominator of the stochastic component of π_t^A in (8).

In terms of claim (ii), (4)-(5) show that $\{\pi_t^R, \pi_t^{RA}, x_t^R, x_t^{RA}\}$ are all functions of ε_t for all parameter values. In contrast, (6)-(7) show that $\{\pi_t^*, \pi_t^{*A}, x_t^*, x_t^{*A}\}$ are independent of ε_t for any $\{\mu, \rho, \beta^i, x_T^i, i\}$.

In terms of claim (iii), comparing (4) and (5) shows that both π_t^R and x_t^R are more variable than their counterparts π_t^{RA} and x_t^{RA}. In contrast, the comparison of (6) and (7) reveals that π_t^* and x_t^* are equally well stabilized as π_t^{*A} and x_t^{*A}. $\square$