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Rogoff revisited: The conservative central banker proposition under active fiscal policies[☆]

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ABSTRACT

The paper re-examines Rogoff's [Rogoff, K., 1985. The Optimal Degree of Commitment to an Intermediate Monetary Target. *Quarterly Journal of Economics* 100, 1169–1189.] influential monetary policy result. It shows that responses of a conservative central banker and the resulting macroeconomic outcomes may be substantially different if interactions with (ambitious) fiscal policy are taken into account.

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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. In the light of the financial crisis of 2007–9, it is important to ask: do these results still hold in the presence of active fiscal policies?

We show that, under some circumstances, they may not. This is an illustration of an old Tinbergen (1954) proposition, that policy interactions can change outcomes. In order to provide a formal but intuitive treatment, we confine ourselves to a familiar reduced-form model. Both policymakers (i) have quadratic preferences over

inflation and output, and both (ii) can directly or indirectly affect both of these variables.

Importantly, the policymakers are assumed here to be fully independent in setting their 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 serves as a simplified representation of the Rogoff's (1985) model. The framework keeps all the original features and hence allows a direct comparison. We focus, as Rogoff (1985) does, on a one shot game. The Lucas supply relationship summarizes the economy and also includes the effect of fiscal policy

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

where x_t , π_t , π_t^e , and g_t denote the output gap, inflation, inflation expected by the public, and the growth rate of real debt respectively. The supply

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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.¹ We define the growth rate of real debt in the standard fashion

$$g_t = G_t - \pi_t, \quad (2)$$

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 monetary (M) and fiscal (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:²

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

where $i \in \{M, F\}$ is the set of players, and the inflation target of both policymakers is normalized 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 of a 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 $x_T^i > 0$.³

The public is, like the policymakers, assumed to be rational and have 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.⁴ Following the literature, the policymakers are assumed to be able to observe the shock in real time (i.e., before making their t period move).

In terms of the public, as a robustness check, we will consider two scenarios. First, an *information symmetry* (denoted by S) in which the public can observe the shock in real time (as in Cukierman (2001) and Gersbach (2003)). Second, an *information asymmetry* (denoted by A) in which the public cannot do so (as in Rogoff (1985)).

2.2. Solution: the Rogoff case

This case, denoted by R , will refer to a situation in which $\rho > 0$. Using these assumptions, and Eqs. (1)–(3), we have the following equilibrium outcomes under information symmetry and asymmetry

$$\pi_t^{RS} = \mu\beta^M (x_T^M - \varepsilon_t), \quad x_t^{RS} = \varepsilon_t, \quad (4)$$

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

2.3. Solution: the interaction case

This case, denoted by I , will refer to a situation in which $\rho > 0$. Focusing on the one shot simultaneous game we have, using Eqs. (1)–(3),

¹ Note that the 'expansionary fiscal contractions' literature can also be accommodated here (if $\rho > \mu$). Our companion paper Hughes Hallett et al. (submitted for publication) considers some extensions to the supply curve and shows that our findings are unchanged.

² The players can be thought of as discounting the future, but as we will be focusing on the one-shot game the players' impatience will not play any role in the analysis.

³ We prefer the term ambitious to *irresponsible* since we want to allow, following Rogoff (1985), for the socially optimal output gap target to be positive.

⁴ 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 e.g., Libich et al. (2007). For analysis of reputation see Backus and Driffill (1985) or Hughes Hallett and Libich (2007).

the following equilibrium inflation and output under information symmetry and asymmetry

$$\pi_t^{IS} = \beta^M(\rho - \mu)(x_T^F - x_T^M), \quad G_t^{IS} = \pi_t^{IS} + \frac{x_T^F - \varepsilon_t}{\rho}, \quad x_t^{IS} = x_T^F, \quad (6)$$

$$\pi_t^{IA} = \pi_t^{IS}, \quad G_t^{IA} = \pi_t^{IS} + \frac{x_T^F}{\rho} - \frac{1}{1 + \beta^M(\rho - \mu)^2} \varepsilon_t, \quad x_t^{IA} = x_t^{IS}. \quad (7)$$

Naturally, the *steady-state levels* of inflation, nominal debt and output (which we denote below by bar) are the same under symmetry and asymmetry – in both the Rogoff and the Interaction cases (compare Eq. (4) with Eq. (5) and Eq. (6) with Eq. (7)).⁵

3. Results

To keep the paper focussed, we will only report results that deviate from the findings of Rogoff (1985).⁶ Our Propositions 1–3 are applicable regardless of the assumption on the public's information set, as they relate to the steady-state outcomes.

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 claims that $\bar{\pi}^R \neq 0$ iff $x_T^M > 0$ and $\bar{\pi}^R = 0$ iff $x_T^M = 0$, which follows by inspection of Eqs. (4)–(5).⁷ The second claim is that there exist parameter values under which $\bar{\pi}^I \neq 0$ even if $x_T^M = 0$, and $\bar{\pi}^I = 0$ even if $x_T^M > 0$. Inspection of Eqs. (6)–(7) 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 $\rho = \mu$. \square

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 (on average) 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.

⁵ Note that our model's specification does not include some long-term budget constraint of the government. We exclude it to better describe the excessively ambitious behaviour of real world governments. Because of that, the steady-state outcomes should be interpreted as medium-run rather than long-run.

⁶ For additional results from this model see Hughes Hallett et al. (submitted for publication).

⁷ 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 Kydland and Prescott (1977).

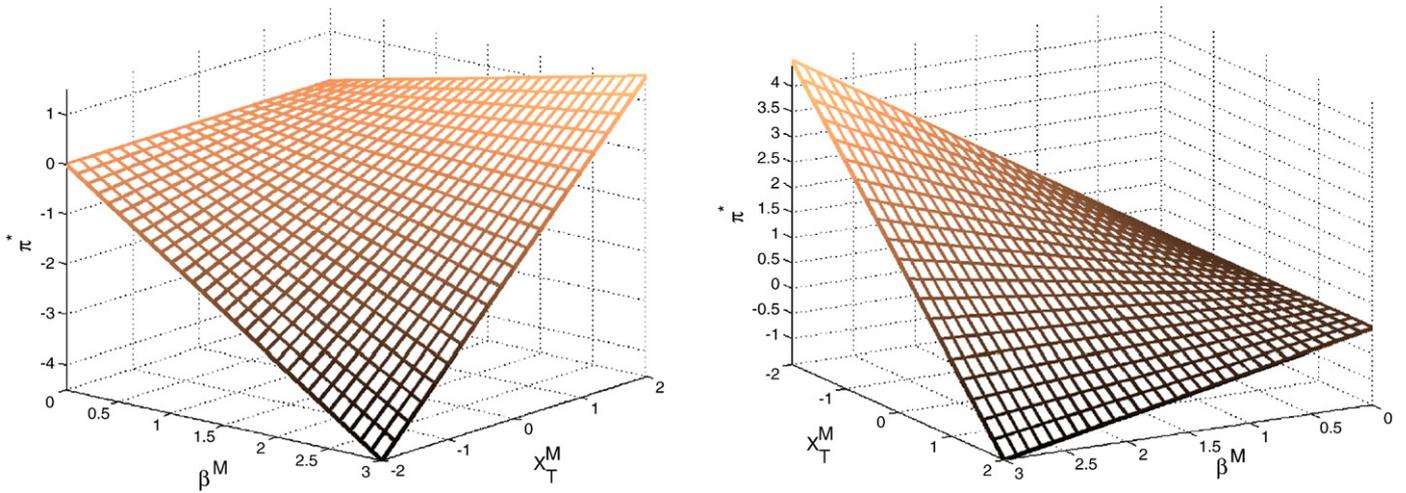


Fig. 1. Equilibrium levels of inflation (z axis) as a function of the degrees of M policy conservatism and ambition under $x_T^F = 1; \beta^F = 1$ and $\mu = 1; \rho = 0.5$ (left) or $\mu = 0.5; \rho = 1$ (right).

Proof. It is claimed that $\bar{\pi}^R \geq 0$ for all parameter values. This follows by inspection of Eqs. (4)–(5). Further, it is argued that parameter values exist under which $\bar{\pi}^I < 0$ for both $x_T^M = 0$ and $x_T^M > 0$. This can be seen in Eqs. (6)–(7). 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 may stimulate the economy better than inflation – by increasing the value of real debt and hence magnifying the expansionary effect of F policy.

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 (i.e., 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 $\bar{\pi}^R$ is either increasing in, or independent of, β^M . Inspection of Eqs. (4)–(5) shows that this is the case under $x_T^M > 0$ and $x_T^M = 0$ respectively. Eqs. (6) and (7) then prove the second claim by showing that under either $\rho < \mu$ and $x_T^M < x_T^F$, or $\rho > \mu$ and $x_T^M > x_T^F$, we have $\bar{\pi}^I$ decreasing in β^M . Finally, the sign of the effect of β^M on $\bar{\pi}^I$ is a function of $(\rho \neq \mu)$ 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 $G^I \neq 0$, where x_T^F is large and ρ small, is overcome. That yields $\bar{\pi}^I < 0$ and $\bar{\pi}^I > 0$ in Eq. (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.

Fig. 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, $\bar{\pi}^I \neq 0$, for almost all parameter

values, (ii) the possible deflation, $\bar{\pi}^I < 0$, and (iii) the decrease as well as the increase of average 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 (with 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 (with 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, these levels may be 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), 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 might 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 Eq. (7). But the sign of this F response as a function of the central bank conservatism can be positive as well as negative (Eq. (7) shows that G_t^I may be increasing or decreasing in β^M). Hence the reversal 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 since it may be exploited to surprise the public. This is because, in the presence of F policy, an additional instrument exists so that the stabilization of shocks may not require an informational asymmetry to be exploited.

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. In particular, in contrast to the influential result of Rogoff (1985), it shows that the 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. Nevertheless, as our insights have been obtained from a simple reduced-form model, more research is needed to assess their real world relevance (e.g., for the current financial crisis), and to formulate specific policy recommendations.

Appendix A1. Proof of Proposition 4

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

$$\pi_t^{*S} = \hat{\pi}_t - \frac{\beta^M(\mu - \rho)}{1 + \beta^M\rho(\rho - \mu)}\varepsilon_t, \pi_t^{*A} = \hat{\pi}_t - \frac{\beta^M(\mu - \rho)}{1 + \beta^M(\rho - \mu)^2}\varepsilon_t, \quad (8)$$

where $\hat{\pi}_t = \frac{\beta^M(\mu - \rho)(x_t^M - \rho G_t)}{1 + \beta^M\rho(\mu - \rho)}$. In terms of claim (i), Eqs. (4)–(5) show that x_t^{RS} and x_t^{RA} are decreasing in ε_t for all parameter values. In contrast, Eq. (8) shows that x_t^{S} and x_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 (i.e., 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^{*S} in Eq. (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.⁸

In terms of claim (ii), Eqs. (4)–(5) show that $\{\pi_t^{RS}, \pi_t^{RA}, x_t^{RS}, x_t^{RA}\}$ are all functions of ε_t for all parameter values. In contrast, Eq. (6) shows that $\{\pi_t^{S}, \pi_t^{A}, x_t^{S}, x_t^{A}\}$ are independent of ε_t for any $\{\mu, \rho, \beta^i, x_t^i, i\}$.

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

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⁸ In the asymmetry scenario this reversal cannot happen – which follows from the denominator of the stochastic component of π_t^{*A} in Eq. (8).