The Big Picture of Monetary–Fiscal Interactions*

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The paper offers a schematic game theoretic approach to thinking about medium-term strategic interactions between monetary and fiscal policy. We show that under some circumstances fiscal excesses may spill over to monetary policy, but a legislated commitment to a numerical inflation target can sometimes prevent this through providing the central bank with ammunition to counter-act excessive fiscal actions. As such, a more explicit monetary commitment may have a 'disciplining effect' on fiscal policy, and improve fiscal outcomes as well as monetary outcomes. We present some empirical evidence for this finding.

Keywords: fiscal-monetary policy interaction, commitment, inflation targeting.

1. Introduction

Many countries face an era of substantial fiscal stress. Will it spill over and cause monetary stress too? We offer a schematic way of thinking about such fiscal–monetary interactions, focusing on medium–long-term scenarios and outcomes.[4]

As the policy interactions are strategic in nature, we will use standard game-theoretic tools for that purpose. An advantage of such approach is to be able to examine the effect of policy *commitment*. We show that under some (but not all) circumstances, a stronger long-term monetary commitment may avoid undesirable spillovers from fiscal policy.

Interestingly, monetary commitment may also be able to indirectly discipline the government, that is, improve fiscal outcomes as well as monetary outcomes. This is through a credible threat from the central bank of a tug-of-war between the two policies. We conclude by showing that this prediction is supported by data: adoption of numerical inflation targets did seem to have such a disciplining effect.

2. Game-Theoretic Representation

Consider two medium-run options for each policy: *discipline*, *D*, delivering the socially optimal levels on average, and *indiscipline*, *I*, delivering some discretionary but socially inferior levels. In terms

of monetary policy, the natural interpretation of *D* is achieving a low inflation target on average over the business cycle, and *I* represents the target's over-shooting on average. In regards to fiscal policy, *D* and *I* can be interpreted as running, on average over the medium term, a balanced budget vs a structural deficit. Importantly, the fiscal balance measure includes intertemporal considerations (such as ageing populations) as well as the expected value of non-standard potential future outlays (such as those arising from guarantees for financial institutions).[5]

The payoff matrix in Equation (1) summarises the game using a 2×2 game-theoretic representation. The policy-makers are denoted by *M* and *F* respectively, and their payoffs $\{a,b,c,d,w,x,y,z\}$ are functions of the deep parameters of the underlying macroeconomic model.[6]

		*F*	
		D	*I*
M	*D*	*a, w*	*b, x*
	I	*c, y*	*d, z*

(1)

The outcomes of the game are determined by the exact payoffs. What are the scenarios that obtain in real world countries, and under what circumstances? Arguably, that depends on the type of policy-makers as well as various characteristics of the economy.

3. Possible Scenarios

Let us categorise the policy-makers into two types: "responsible" and "ambitious." Responsible policy-makers can be defined as preferring the socially optimal (*D,D*) outcome, that is, $a > \max\{b,c,d\}$ and $w > \max\{x,y,z\}$. In contrast, ambitious policy-makers prefer one of the three remaining socially inferior outcomes, (*I,I*), (*D,I*) or (*I,D*). Figures 1 and 2 summarise the outcomes and describe various scenarios of interest (the list is obviously not exhaustive).

Let us focus on the case receiving most attention in the literature, media and financial markets, namely a responsible central bank facing an ambitious government. Intuitively, to secure votes, the government prefers to spend excessively or avoid necessary welfare/health/pension reforms, and would like the central bank to reduce the resulting debt through inflation. Whether the central bank will do so depends on its payoff *d* relative to *b*.

In the *tug-of-war* scenario, in which (*D,I*) is the unique Nash equilibrium, the central bank resists fiscal pressures, and fiscal excesses will not spill over to monetary policy in the medium-run.[7] In the *Neglect* scenario, the opposite is the case: fiscal–monetary spillovers will surely occur as (*I,I*) is the unique Nash equilibrium. In the *Battle* scenario, such spillovers may or may not eventuate, and interestingly the outcome of fiscal policy itself is ambiguous. This is because there are two (potentially fully symmetric) pure Nash equilibria: (*D,D*) and (*I,I*).

In the *Battle* scenario, there exist both a coordination problem (to avoid the inferior mixed Nash) and a policy conflict (to secure its preferred pure Nash: (*D,D*) for the central bank and (*I,I*) for the government). We will focus on this scenario given that a large body of interaction models following Sargent and Wallace (1981) has these two features, for example, Adam and Billi (2008), Branch

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[5]Iceland and Ireland are prime examples of how important it is to incorporate the latter component of fiscal policy. As Kotlikoff (2006) and many others have argued, making inferences solely based on the current budget position may lead to serious underestimates of potential fiscal problems.

[6]Libich *et al.* (2010a) lay out a simple macro model and show how analytically tractable macro models of policy interaction can be mapped into such a 2×2 game using the approach of Cho and Matsui (2005).

[7]Let us note that the (*D,I*) outcome cannot obtain in the (very) long-run when the government's intertemporal budget constraint has to hold. For this reason, our analysis should be interpreted as the medium-run, which is free of cyclical considerations, but in which the budget constraint is not "fully binding." For an example of an economy temporarily reaching a situation with unsustainable macroeconomic policies, see Davig and Leeper (2011). See also Davig *et al.* (2010) who examine whether, once the economy is nearing the fiscal limit, the (*D,I*) outcome will be replaced by (*I,I*), or (*I,D*), or some combination of the two.

Central bank/government	Responsible	Ambitious
Responsible	Symbiosis Pure coordination	Tug-of-war Battle of the sexes Neglect
Ambitious	...	Game of chicken Prisoner's dilemma Battle of the sexes Neglect

Figure 1. *Scenarios Under Various Types of Policy-makers*

Scenario	Pure Nash	Mixed Nash	Coordination problem	Policy conflict	Socially optimal outcomes
Symbiosis	(D,D)	No	No	No	Yes
Pure coordination	$(D,D),(I,I)$	Yes	Yes	No	Likely
Battle of the sexes	$(D,D),(I,I)$	Yes	Yes	Yes	Uncertain
Game of chicken	$(D,I),(I,D)$	Yes	Yes	Yes	At most one policy
Tug-of-war	(D,I)	No	No	Yes	Only M policy
Prisoner's dilemma	(I,I)	No	Yes	No	No
Neglect	(I,I)	No	No	No	No

Figure 2. *Description of Possible Scenarios*

et al. (2008), Resende and Rebei (2008), Hughes Hallett and Libich (2007), Benhabib and Eusepi (2005), Dixit and Lambertini (2003, 2001), Blake and Weale (1998), Nordhaus (1994), Sims (1994), Woodford (1994), Leeper (1991), Wyplosz (1991), Petit (1989) and Alesina and Tabellini (1987).

3.1 Commitment

There are two ways of thinking about (long-term) policy commitment in our framework. First, commitment can be modelled as a punishment for deviating from the socially optimal action, and as such it would reduce the players' payoffs from playing *I*. This corresponds to the Walsh's (1995) channel, and may lead to a change of policy outcomes within a given scenario, or to a change of the scenario itself.

Second, commitment can be modelled as a change in the rules of the game without necessarily changing the payoffs of each strategy profile. Most commonly, this has been performed by implementing Stackelberg leadership of one player, as in the Sargent and Wallace's (1981) literature.[8]

The *Battle* scenario is the most interesting one from this ''institutional'' point of view as policy commitment (leadership) alters the set of equilibria. If the central bank is the Stackelberg leader, then its preferred (*D,D*) outcome obtains, the intuition of which is comparable to the dominant monetary policy in Sargent and Wallace (1981), active fiscal/passive monetary policy in Leeper (1991) or a Ricardian regime in Woodford (1995). In contrast, under the government's leadership, its preferred (*I,I*) uniquely obtains, which can be roughly related to the dominant fiscal regime in Sargent and Wallace (1981), accommodating monetary policy in Sims (1988), active monetary/passive fiscal policy in Leeper (1991) or a non-Ricardian regime in Woodford (1995).[9]

[8]Let us note that the timeless perspective type of commitment is not applicable here as it focuses on short-run stabilisation and biases, not medium/long-run levels.

[9]Our companion game-theoretic work refines and partly qualifies these standard conclusions by generalising the commitment concept from static to dynamic. It offers frameworks that allow the players to commit to their actions for different periods of time, and/or with different probability distributions, which leads to an asynchronous game (with deterministic timing: Libich and Stehlík, 2010, or stochastic timing: Basov *et al.*, 2010).

4. Testable Hypotheses and Empirical Assessment

The *Battle* scenario has two main testable predictions about the effect of legislating a stronger monetary commitment – commonly implemented as an explicit numerical target for average inflation.

Prediction 1: Stronger monetary commitment may lead to an improvement in monetary out-
comes: lower and/or less variable inflation, and higher policy credibility.

Prediction 2: Stronger monetary commitment may be able to discipline fiscal policy. This is because
the government realises that a strongly committed central bank will not accommo-
date excessive fiscal spending, and is willing to engage in a policy conflict by strongly
counter-acting fiscal actions and tightening monetary conditions. This reduces the
government's payoff from engaging in such excessive actions, and provides strong
incentives for improving fiscal balances towards long-term sustainability.[10]

It is important to note that both predictions (i) refer to medium-term averages, not short-run stabilisation outcomes, and (ii) obtain under some – but not all – circumstances. For example, if we only consider commitment through Stackelberg leadership, that is, changes of outcomes within a given scenario, then the prediction may only apply in the *Battle* or *Pure coordination* scenario, and only if the socially optimal outcome (*D,D*) does not obtain initially.

Under other scenarios, monetary leadership will not alter monetary outcomes. Therefore, the predictions are *not* equivalent to the statement that adoption of explicit inflation targeting (EIT) necessarily improves monetary and fiscal outcomes. In empirical testing, the exact nature of the claim has to be taken into account, and guide the selection of countries and sample periods.

4.1 Prediction 1: Monetary Commitment May Discipline Monetary Policy

Unfortunately, the literature assessing the effects of EIT on the level and variability of inflation has not commonly accounted for these issues, and therefore has not reached a consensus.

Our analysis implies that: (i) papers only including industrial countries are likely to find weak or insignificant effects of EIT on inflation and its volatility (Ball and Sheridan, 2005; Willard, 2006), whereas (ii) papers with larger samples including emerging and developing countries are likely to find strong and significant effects (e.g. Corbo *et al.*, 2001; Neyapti, 2009; Fang and Miller, 2010).

Furthermore, in line with the prediction of our model, inflation has been found negatively correlated with two common proxies for monetary commitment: accountability (Briault *et al.*, 1997) and transparency (Fry *et al.*, 2000; Chortareas *et al.*, 2002). See also Debelle (1997) who finds EIT to increase the monetary policy's credibility. All these papers include either pre-1980 inflation data and/or developing countries. In contrast, papers that only focus on industrial countries and use post-1990 data often find no correlation between transparency and inflation, see, for example, Eijffinger and Geraats (2006).

4.2. Prediction 2: Monetary Commitment May Discipline Fiscal Policy

Our companion work in progress attempts to test the hypothesis that stronger monetary commitment may also indirectly improve the outcomes of fiscal policy. Focusing on industrial countries, we (i) compare policy behaviour and macroeconomic outcomes of five early adopters of an explicit inflation target (New Zealand, Canada, United Kingdom, Sweden and Australia) pre- and post-

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[10]Libich *et al.* (2010b), however, show formally that such disciplining may be ineffective in a monetary union. Intuitively, a small country's fiscal mismanagement only has a negligible effect on the average inflation outcomes of the union, and hence the muted response of the common central bank will not provide a sufficiently strong punishment to that country – especially if it ignores the negative externalities it imposes on other members. The behaviour of Greece after joining the European Monetary Union seems an example of this.

adoption of the regime, and (ii) contrast these with outcomes in the main non-EIT (United States, Switzerland and Japan).[11]

As a starting point, it is illustrative to examine the behaviour of central government debt to GDP ratio, reported in Figure 3 separately for the two groups of countries. In all five depicted EIT countries, there was a reduction in government debt starting about one to three years after the adoption of the regime (in the case of the United Kingdom, after the subsequent granting of central bank instrument independence – which is a prerequisite of the EIT regime). On the other hand, the non-EIT countries have either experienced little change in the ratio since the early 1990s (United States and Switzerland), or an increase (Japan). Although these findings are consistent with the disciplining effect discussed above, it should be stressed that they do not constitute evidence of causality.

To capture finer details of the monetary–fiscal interactions and the role of monetary policy commitment, we set up a structural vector autoregression (SVAR) model and estimate it using Bayesian techniques.[12] Drawing on the literature that deals with the identification of fiscal policy shocks within SVAR models, the model includes the main variables through which monetary and fiscal authority interact: government expenditures, output, private consumption, monetary policy rate and central government debt.

The following table reports the posterior means of the standard deviation of structural shocks (identified using Cholesky decomposition).[13] The table suggests that the volatility of monetary policy shocks, as well as the volatility of government debt shocks have decreased substantially in EIT countries after adoption of the regime, and to a larger extent than in non-EIT countries.

Means for the groups/periods	Government spending	Policy interest rate	Government debt
EIT: 1980-adoption	0.008	1.509	0.025
EIT: adoption-2008	0.006	0.357	0.017
Non-EIT: 1980–1992	0.008	0.820	0.014
Non-EIT: 1993–2008	0.007	0.353[14]	0.013

Let us now focus on the impulse responses of the monetary policy rate to unexpected government spending and debt shock respectively. Our results show that introduction of EIT commonly led to a change in the direction of the central bank's responses: in each of the five EIT countries post-adoption there is less accommodating behaviour by the central bank to the government spending shock and/or the debt shock. The central banks either does not react at all or tries to offset fiscal shocks. In case of non-EIT countries, the changes are mainly in the opposite direction towards a more accommodative policy. In the later period, in all three non-EIT countries, the monetary authority accommodates either the government spending shock or the debt shock.[15]

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[11]The sample selection is driven by data availability and need for a heterogenous sample. It follows the sample choice of inflation targeters by Dotsey (2006) – see his paper for further justification. Nevertheless, due to such small sample, the findings should only be taken as indicative rather than conclusive.

[12]We will below report some results for the baseline specification with fixed parameters, but the time-varying parameters VAR (vector autoregression) produces similar results. The reader should, however, keep in mind the potential shortcomings expressed in Leeper *et al.* (2009).

[13]Data are expressed in log of real per capita terms (except the interest rate which is in levels).

[14]Japan is excluded from this mean as it had near-zero rates for most of the period (if included, the non-EIT mean is 0.278).

[15]It should, however, be noted that there are instances in which the direction of change is the opposite in the two groups. For example, there is some evidence of increased monetary accommodation in the post-adoption period in the United Kingdom, and decreased accommodation of government debt shocks in the United States.
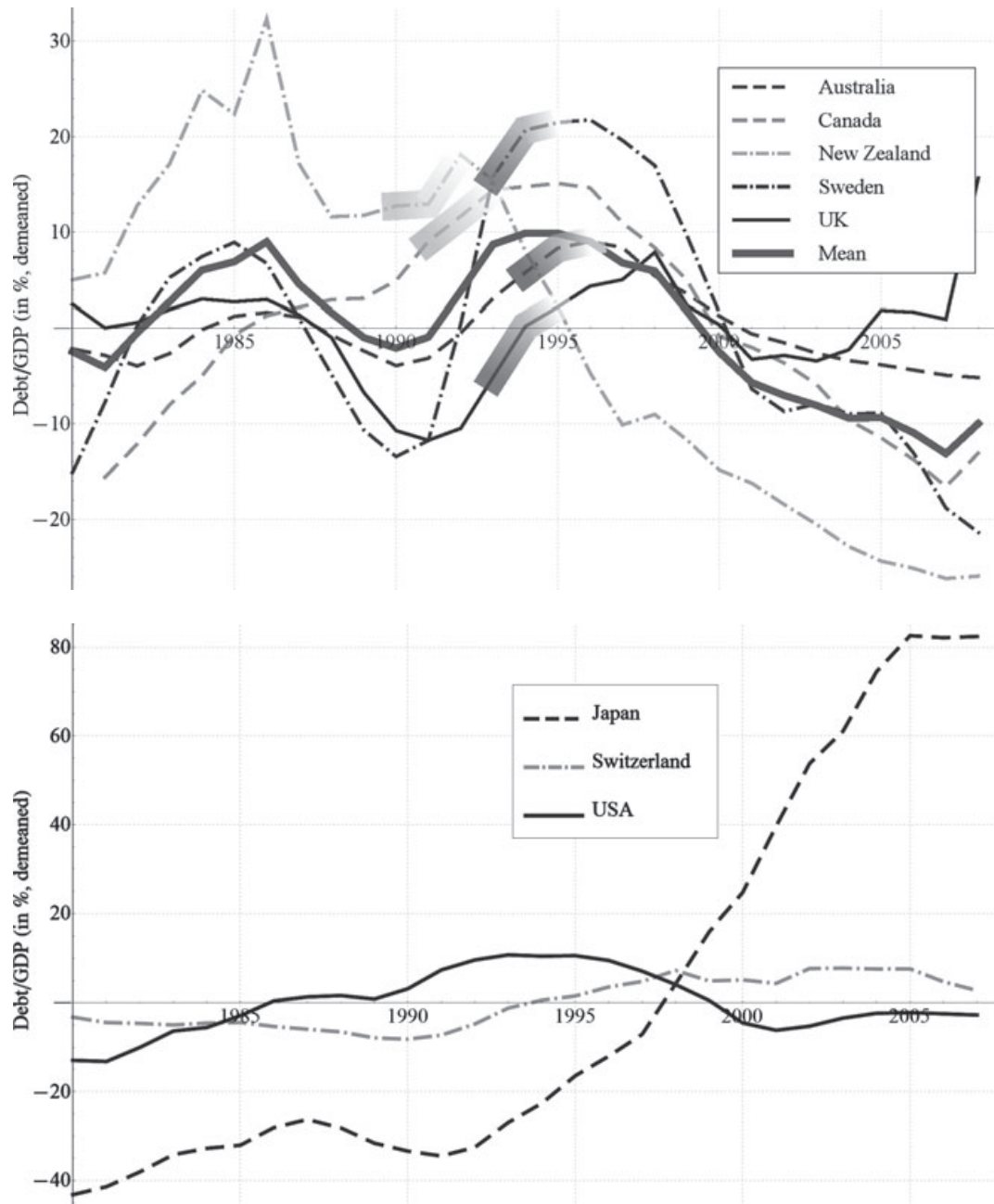
Figure 3. *Evolution of the Government Debt to GDP Ratio (in Per Cent, Demeaned) in EIT Countries (Top) and Non-EIT Countries (Bottom)*
Note: The start of the shaded area indicates the regime's adoption.
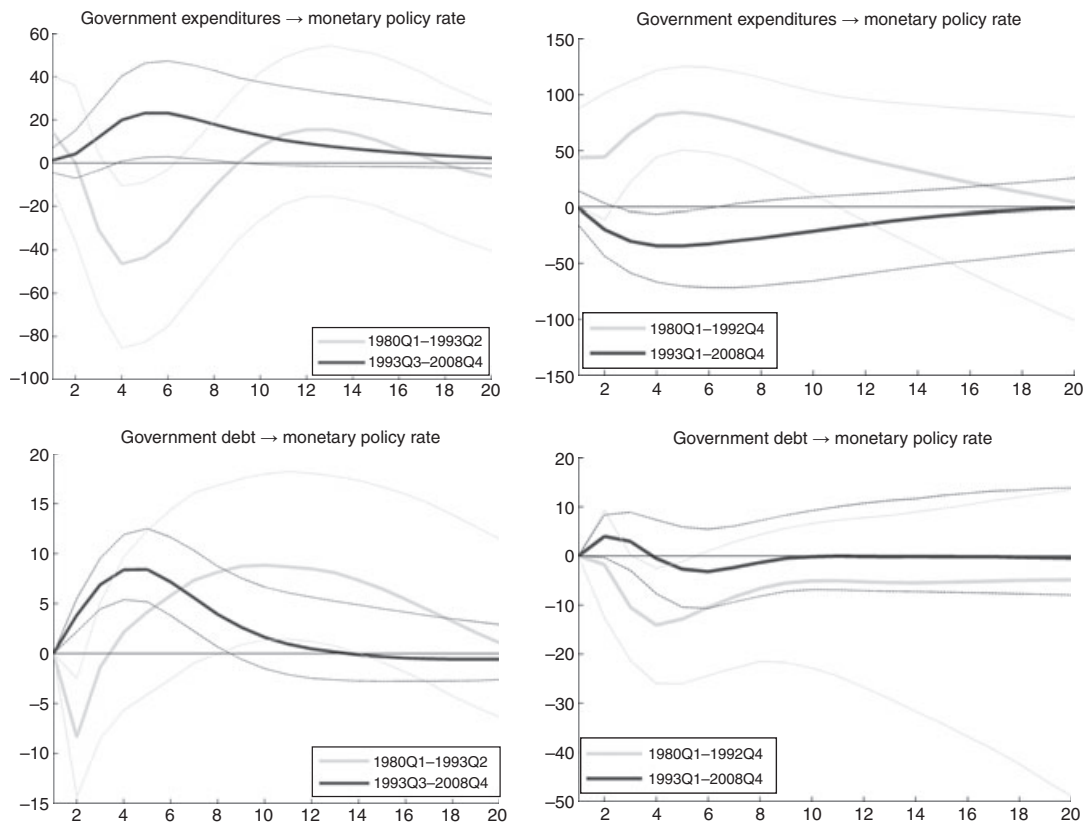
Figure 4. *The Effect of a Government Spending Shock (Top) and Government Debt Shock (Bottom) on the Policy Interest Rate Over Twenty Quarters: Australia (Left) and Switzerland (Right)*

As an example, Figure 4 presents median and middle 68 per cent of the distribution of impulse responses for Australia (EIT) and Switzerland (non-EIT). Note that because the shock is normalised to enable the comparison between the two periods, the numbers on the vertical axis are not directly interpretable as changes in the monetary policy rate.

The figure shows that, in Australia, accommodative approach of the central bank changed post-adoption of EIT to one in which shocks to both government spending and debt are strongly offset. The developments in Switzerland have been the opposite for government spending shocks.

5. Other Institutional Remedies and Short-Run Considerations

The above discussion stressed that although monetary commitment (leadership) may discipline fiscal under some circumstances, in some scenarios the monetary threat of policy conflict is insufficient to discourage the government from excessive spending and avoiding necessary fiscal reforms. In such cases, direct fiscal commitment is required to ensure medium-term fiscal discipline. Although many proposals have been made, only a handful of countries have legislated explicit fiscal rules to that effect – for a discussion, see Libich *et al.* (2010b).

It should, however, be emphasised that even if medium-run discipline is achieved for both policies, and long-term expectations of monetary and fiscal outcomes are thus anchored, expectations

of short-term stabilisation still matter in an important way. This has long been recognised, and the trend in monetary policy-making of publishing forecasts and communicating policy intentions and explanations more effectively has been driven by this need. As Leeper (2010) convincingly argues, fiscal policy should follow in these footsteps.

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