Economic Volatility and Institutional Reforms in Macroeconomic Policymaking:
The Case of Fiscal Policy

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Economic Volatility and Institutional Reforms in Macroeconomic Policymaking: The Case of Fiscal Policy

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Abstract:
We evaluate proposals for independent fiscal authority put forward as a solution to excessive public spending. Our main conclusion is that moving the responsibility to set broad measures of fiscal policy from the hands of government to an independent fiscal council is not necessarily welfare improving. We show that the change is welfare improving if nature of uncertainty between fiscal and monetary policymakers does not change as a result. However, if this institutional change involves considerable decrease of capacity of the new agency to recognize economic shocks, citizens' welfare can decrease as a results. This is especially significant in times of increased economic volatility such as in a recent global financial crisis. Faced with the ambiguous theoretical result, we try to gain deeper insight by calibrating our simple model.

1 Introduction

Global financial crisis has hit the fiscal positions of many countries. The main channels were not only direct government involvement in saving the banking system, but also drop in tax revenues due to the economic slowdown and increased costs of long-term debt. As a result, budget deficits and the level of government debt are increasing. Especially in the EU, some countries such as Greece started to feel the consequences of badly run fiscal policy of the past as the level of debt and the expected fiscal deficit reach values which could bring the country almost to a sovereign bankruptcy. Given that most of the EU countries run common monetary policy (euro area), serious fiscal problems of one of its members could possibly endanger the stability of the common currency, the euro.

As a reaction to deteriorating fiscal positions that revealed the imprudent fiscal policy of the past, policymakers started once again to discuss the agenda how to set fiscal framework that would prevent accumulation of deficits especially in good times. One can remember that this discussion has already been led by academics and policymakers in the EU in late 1990s and early 2000s together with the establishment and reform of the EU's Stability and Growth Pact. The then debate emphasized that while a rule-based fiscal policy that includes deficit or debt limits is desirable, it is difficult to safeguard the compliance with the rules if fiscal policy stays in hands of elected policymakers. Some authors (Poterba (1996), Strauch and von Hagen (1999) or European Commission (2003)) argued for fiscal policy to be taken from the hands of elected governments and to be vested into the hands of independent institution. Such an independent institution would set broad measures of fiscal policy such as budget deficit or public debt.

From a political economy perspective, crisis periods provide a window of opportunity to change macroeconomic policy frameworks. The experience of Asian countries after the 1997 financial crisis shows that the hard landing the East Asian countries experienced moved them to implement better macroeconomic and financial policies oriented towards economic and financial stability so that during the recent global financial crisis 2007-2009 they stayed relatively resilient. However, establishing new institutions and policies such as an independent fiscal council still within a period of increased economic volatility may also bring some risks (Saint-Paul (2002)). New institutions need time to perform well their function, they have to be equipped with sufficient financial and human resources, the objective must be set clearly

in order to avoid confusion and misunderstanding etc. Thus, the timing of the set-up and the initial conditions may co-determine the success of such an independent fiscal institution.

In this paper we argue that setting up an independent fiscal council is a wealth-improving measure under the condition that the institution is able to identify shocks well (i.e. with at least broadly the same or higher probability as government, the initial fiscal authority). We construct a dynamic microeconomic model of macroeconomic policymaking that involves always two players (government versus central bank or fiscal council versus central bank) which are uncertain about the actions of the other policymaker. We investigate the claim for an independent fiscal authority from the point of view of citizens who prefer optimal and stable economic environment. We show that in a period of higher economic volatility the failure of the fiscal council to recognize shocks has significant negative effect on the final welfare which can even outweigh the positive effects of getting rid of the politically-motivated fiscal deficit bias. We calibrate the model in order to be able to quantify the effects in empirical terms. We are able to show that an ill-designed fiscal authority with virtually zero ability to recognize shocks and to optimally react to them that would be established in turbulent times can decrease general welfare by roughly 20%.

The paper is structured as follows. Next section relates our work to existing literature. Section 3 introduces the model, derives its equilibrium and discusses the welfare measure. Section 4 includes our calibration exercise. Section 5 concludes the paper. Derivation of the model equilibrium is relegated to appendix A1.

2 Relation to other literature

Our work is related to several strands of literature. Most importantly, we investigate the claim of several authors who call for a designation of independent fiscal authority as a means to prevent excessive public spending and budget deficits run by elected governments (see survey in Debrun, Hauner, and Kumar (2009) for detailed overview of the topic). In this respect, von Hagen and Harden (1994) and Eichengreen, Hausmann, and von Hagen (1999) call for the 'National Debt Board' and 'National Fiscal Council' respectively. Both institutions would be independent apolitical institutions which would set maximum allowable increase of a government debt in each year, limit to

which proposed public budget would have to comply. In the similar spirit, Wyplosz (2005) calls for 'Fiscal Policy Committee' which would set maximum allowable budget deficit. von Hagen (2003) then proposes 'European Stability Council' as an institution which would focus on change of a public debt.[1]

Logic of all the proposals is to vest a broad aggregate of fiscal policy into the hands of independent institution following the logic which led to an institution of independent central banks. This independent fiscal authority would set binding limit on a size of public debt or budget deficit, while democratically elected governments would decide about the composition of public spending and revenues. Argument is that the independent fiscal authority would not be subject to short-sighted behaviour of elected governments which leads to the spending bias. Also, by focusing solely on the debt or deficit, the independent fiscal authority would not be subject to the public tragedy of commons which is due to the fact that costs of public spending (deadweight loss of taxation) are not borne by agents who decide about size and composition of public spending.

All the authors mentioned argue that the proposed independent fiscal authority has a potential to improve problematic conduct of fiscal policy. While certainly correct, we feel it is a partial equilibrium argument. What consequences, if any, would result with respect to monetary policy? What would be a relation between the independent fiscal authority and the monetary policy-maker? What are the consequences for economic agents and can this proposed institutional change be evaluated based on some welfare measure? Those are the questions we try to address in this paper.

In order to do so, we set up a model which can be regarded as belonging to the Kydland and Prescott (1977) dynamic inconsistency tradition. In spirit, our model is similar to Barro and Gordon (1983) model. Differently from most of the work this paper initiated, our model explicitly allows for fiscal policy and is thus more suited for an investigation of the questions we ask. Rather than surveying whole strand of literature which followed Barro and Gordon (1983) which has been surveyed elsewhere (see chapters 4 through 6 in Drazen (2000) or chapters 15 and 17 in Persson and Tabellini (2000)), there are three papers closely related to ours in that they explicitly deal with

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[1] For proposals intended to solve the excessive public spending and deficit problem that do not require fiscal policy to be (partly) taken from the government, see Boonstra (2005), Saraceno and Monperrus-Veroni (2004) or von Hagen and Harden (1995).

fiscal policy.

First is Alesina and Tabellini (1987) paper. They specify a model in which central bank sets inflation and fiscal authority taxes. Their model differs from ours in objectives of both policy-makers. Output, inflation and public expenditure enter a loss function of both policy-makers, possibly with different weights. In our model, central bank cares only about output and inflation and fiscal authority cares only about output and public budget deficit. Their paper also differs in questions asked. They investigate welfare impact of commitment and of degree of central bank independence. We focus on the welfare impact of different institutional setups which differ in an identity of fiscal policy-maker. Furthermore, our model includes stochastic shocks hitting an economy and thus allows for a case of imperfect information between the policy-makers.

Second closely related paper is Dixit and Lambertini (2003). They focus on a role of discretion and commitment in a model with fiscal and monetary authorities. They allow for two types of interaction of both players. One in which both authorities move simultaneously and second in which one of the authorities moves first. Their work differs from ours in that they focus on different questions. Furthermore, in their model loss function of the fiscal authority is identical to social welfare function. In our model, fiscal authority has a loss function of its own.

Third closely related paper is Lambertini and Rovelli (2003). Their model has again fiscal and monetary policy and they investigate an impact of relative timing of decisions of both policy-makers, allowing for simultaneous or sequential decisions to be made. In their model government has loss function equal to social welfare function. But government can delegate fiscal policy to be made by non-independent institution government cannot control fully - bureaucracy - with a different loss function. Again, their model differs in questions asked and in loss functions different players possess.

All the models mentioned above also differ in details of economy they specify but share in common (including our model) two features. First is an effect of unexpected expansionary monetary policy which has positive effect on output. Second is a positive effect of expansionary fiscal policy (Dixit and Lambertini (2003) subject to parameter constraints).[2]

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[2] There is another strand of literature related to our work that uses models with multiple fiscal authorities and unique monetary authority (monetary union setup). We do not survey this literature here for the sake of space. Nevertheless, it can be divided

3 Model

We study very simple model of interaction of fiscal and monetary policy. We use basic insights of the dynamic inconsistency literature which has traditionally dealt with monetary policy and extend it to an environment which incorporates fiscal policy as well.

The model has three players. Fiscal policy-maker, monetary policy-maker and general public (government, central bank, citizens). There are three basic equations. First one is an expectation-augmented Phillips equation in the form

$$y(I_\mu, I_\phi) = y^* + \alpha(\pi(I_\mu) - \pi^e) + \beta(d(I_\phi) - d^*) + \varepsilon \tag{1}$$

where $y(I_\mu, I_\phi)$ is (log)deviation of output from its natural level y^*, $\pi(I_\mu)$ is inflation set by the monetary authority, π^e is rationally expected inflation by citizens based on the past behaviour of monetary authority, $d(I_\phi)$ is budget deficit set by the fiscal authority and d^* is optimal level of budget deficit.

Both policies $\pi(I_\mu)$ and $d(I_\phi)$ and hence output $y(I_\mu, I_\phi)$ are dependent on information sets I_μ and I_ϕ of the policy-makers. Those are explained in detail below.

Parameters α and β denote effectiveness of monetary and fiscal policy respectively so it is natural to limit our attention to $\{\alpha, \beta\} \in \langle 0; 1 \rangle^2$. Shock ε is *i.i.d.* normal, zero-mean shock with constant variance σ^2, i.e. $\varepsilon \sim N(0, \sigma^2)$. It can be observed by policy-makers and is not observed by the public.

Our choice of behaviour of the economy warrants further comments. Note that implicit assumption about monetary policy in (1) embodies a notion of long-term neutrality of money as well as an idea that only unexpected changes in monetary policy have an impact on output. Any level of inflation chosen by the monetary authority will not influence real side of the economy once public expectations incorporate this level of inflation. In a sense, what we are assuming is that the monetary authority possesses only a *nominal* instrument.

On the other hand, assumption behind (1) concerning fiscal policy is that by choosing certain level of budget deficit, fiscal authority has the power to

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into two strands. First one deals with an effect of unification, see e.g. Beetsma and Bovenberg (1998) or Cooper and Kempf (2000). Second one deals with a question whether coordination of national fiscal policies with each other and eventually also with monetary policy can be welfare improving. For this, see e.g. Chari and Kehoe (2007) or survey in Beetsma, Debrun, and Klaassen (2001).

influence output without a need to be concerned about changes in publics' expectations. In other words, fiscal authority can influence *real* side of the economy. We think both assumptions capture important aspect of working of economy and are quite realistic. What seems to be unrealistic is our assumption, made purely on convenience grounds, that both authorities can set their instruments perfectly, which is certainly not true in the reality.

One possible concern arises with our notion of optimal budget deficit. In one interpretation, $d^* = 0$, which is relevant in a long-term context when the fiscal authority surely must keep its budget deficit balanced on average in order not to become insolvent. However, we do not make such an assumption and let d^* to take on any (reasonable) value, since in reality there might be prolonged periods when its optimal to have either positive (e.g. expectation of ageing of population) or negative (e.g. debt financed public investment in developing countries) budget deficit.

Second key equation is government's loss function

$$\mathbb{G} = \mathbb{E}_\phi \left[(y(I_\mu, I_\phi) - \bar{y}_\phi)^2 + \phi(d(I_\phi) - d^*)^2 \right] \tag{2}$$

and third key equation is central bank's loss function

$$\mathbb{M} = \mathbb{E}_\mu \left[(y(I_\mu, I_\phi) - \bar{y}_\mu)^2 + \mu(\pi(I_\mu) - \pi^*)^2 \right] \tag{3}$$

where $\mathbb{E}_\mu(\cdot)$ and $\mathbb{E}_\phi(\cdot)$ denote expectations of central bank and government respectively. Parameter μ (ϕ) denotes the weight central bank (government) attaches to squared deviations of π (d) from its bliss level π^* (d^*) relative to squared deviation of y from $\bar{y}_\mu$ $(\bar{y}_\phi)$. It is natural to assume $\{\mu, \phi\} \in \mathbb{R}_+^2$. For political economy reasons, $\bar{y}_i - y^* = k_i$ where k_i is any non-negative constant for $i \in \{\mu, \phi\}$.

Government minimizes its loss function (2) by choosing d subject to constraint represented by the economy equation (1) taking behaviour of central bank and expected inflation as given. Similar holds for the central bank that sets π[3].

Before any of the policy-makers makes a decision about the policy, nature determines a size of the shock ε and whether given policy-maker observes it. Central bank observes the shock with probability p_μ and government with probability p_ϕ.

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[3] As to the central bank, it is believed in the so called 'divine coincidence' (Gersl (2007), Blanchard (2005)), i.e. the idea that stabilizing inflation is under some reasonable assumptions equivalent to stabilizing output around its natural level.

Denote by I_μ central bank's information set and by I_ϕ government's information set. By abuse of notation, $I_\mu = 1$ if $\varepsilon \in I_\mu$, i.e. if the central bank observes the shock, and $I_\mu = 0$ if $\varepsilon \notin I_\mu$, i.e. if the central bank does not observe the shock, and similarly for the government. Last piece of notation is $\varepsilon(I_\mu)$ with the meaning $\varepsilon(I_\mu = 1) = \varepsilon$ and $\varepsilon(I_\mu = 0) = 0$.

Solving the model amounts to finding expressions for $\pi(I_\mu)$, $d(I_\phi)$ and $y(I_\mu, I_\phi)$ which maximize policy-makers' expected utility given constraint represented by economy equation (1), given behaviour of the other policy-maker and with citizens expectations being correct. We relegate detailed derivation of the equilibrium into appendix A1 in which we show that the equilibrium inflation can be expressed as

$$\pi(I_\mu = 0) = \pi^* + \frac{\alpha}{\mu}k_\mu - \frac{\alpha\beta^2}{\kappa}k_\phi$$

$$\pi(I_\mu = 1) = \pi^* + \frac{\alpha}{\mu}k_\mu - \frac{\alpha\beta^2}{\kappa}k_\phi - \frac{\alpha\phi + \alpha\beta^2(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon$$

with $\kappa = \beta^2\mu + \mu\phi$ and $\lambda = \alpha^2\phi + \beta^2\mu + \mu\phi$ or using more compact notation

$$\pi(I_\mu) = \pi^* + \frac{\alpha}{\mu}k_\mu - \frac{\alpha\beta^2}{\kappa}k_\phi - \frac{\alpha\phi + \alpha\beta^2(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon(I_\mu). \tag{4}$$

Similarly, equilibrium deficit is given as

$$d(I_\phi = 0) = d^* + \frac{\beta\mu}{\kappa}k_\phi$$

$$d(I_\phi = 1) = d^* + \frac{\beta\mu}{\kappa}k_\phi - \frac{\beta\mu + \alpha^2\beta(1 - p_\mu)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon$$

or using more compact notation

$$d(I_\phi) = d^* + \frac{\beta\mu}{\kappa}k_\phi - \frac{\beta\mu + \alpha^2\beta(1 - p_\mu)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon(I_\phi). \tag{5}$$

Finally, equilibrium inflation and deficit can be used to calculate the

output, which is given by

$$y(I_\mu = 1; I_\phi = 1) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \frac{\mu\phi - \alpha^2\beta^2(1 - p_\mu)(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon$$

$$y(I_\mu = 1; I_\phi = 0) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \frac{\mu\phi + \beta^2\mu + \alpha^2\beta^2 p_\phi(1 - p_\mu)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon$$

$$y(I_\mu = 0; I_\phi = 1) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \frac{\mu\phi + \alpha^2\phi + \alpha^2\beta^2 p_\mu(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon \qquad (6)$$

$$y(I_\mu = 0; I_\phi = 0) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \varepsilon.$$

Equilibrium inflation given by (4), deficit given by (5) and output given by (6) can be used to calculate variance of inflation, deficit and output. To simplify our discussion below we focus on the case with $k_\mu = 0$ or in other words we assume that the central bank targets natural level of output. This simplification is made only for convenience as our focus is institutional change which involves fiscal policy and having $k_\mu \neq 0$ would not alter any of the results below.

To evaluate welfare under the different institutional arrangements we use a welfare function of the form

$$\mathbb{W}_i = - \left[\sum_v \left(\mathbb{E}(v - v^*) \right)^2 + \sum_v var(v) \right]$$

for $v \in \{y, \pi, d\}$ and $i \in \{cb, fc\}$ where cb stands for current setup in which government sets deficit and central bank inflation and fc denotes *fiscal council* institutional setup. The welfare function embodies both, citizens' preference for an economy to be close to its optimum and citizens' preference for a stable economic environment.

From (4), (5) and (6) it is easy to confirm

$$\sum_v \left(\mathbb{E}(v - v^*) \right)^2 = \psi_1 k_\phi^2$$

$$\sum_v var(v) = \psi_2 \sigma^2$$

where $\psi_1 > 0$ and $\psi_2 > 0$. To show the following results we will need some additional notation. Denote by $\xi = [\alpha, \beta, \mu, \phi] \in \mathbb{R}_+^2 \times [0, 1]^2 = \mathbb{Q}$ a

vector of parameters capturing policy effectiveness and policy preferences. Furthermore, denote by $p = [p_\mu, p_\phi] \in [0,1]^2 = \mathbb{P}$ vector of probabilities of observing the shock by the policy-makers. Furthermore, let X^O denote an interior of a set X. To make dependence on the parameters explicit, denote ψ_1 by $\psi_1(\xi, p)$ and ψ_2 by $\psi_2(\xi, p)$. Then the welfare can be written as

$$\mathbb{W}(\xi, p, k_\phi, \sigma^2) = -\psi_1(\xi, p)k_\phi^2 - \psi_2(\xi, p)\sigma^2. \tag{7}$$

We assume that the institutional change from cb to fc does not change policy effectiveness or policy preferences regarding trade-off between inflation or deficit and output. In other word we assume ξ is not affected by the institutional change. Furthermore we assume the institutional change has no effect on the variance of the economic shocks σ^2.

On the other hand the institutional change alters the target output of a fiscal policy-maker. We assume that the cb institutional environment is characterized by $k_\phi > 0$ while the fc institutional environment is characterized by $k_\phi = 0$. The last thing the institutional change can affect is nature of policy uncertainty. Hence we assume that the probabilities of observing shocks by the policy-makers under the cb institutional setup are $p = p^{cb}$ while under the fc institutional setup those are denoted by $p = p^{fc}$.

Substituting into the welfare function the cb institutional setup is characterized by $\mathbb{W}_{cb} = \mathbb{W}(\xi, p^{cb}, \sigma^2, k_\phi)$ while the fc institutional setup is characterized by $\mathbb{W}_{fc} = \mathbb{W}(\xi, p^{fc}, \sigma^2, 0)$ with the institutional change increasing welfare if $\mathbb{W}_{fc} - \mathbb{W}_{cb} > 0$. With this we can prove following.

Proposition 1. *[welfare improving institutional change] If the institutional change does not affect nature of uncertainty between the policy-makers then it is welfare improving.*

Proof. For $p^{cb} = p^{fc} = p$ welfare under the two institutional arrangements is

$$\mathbb{W}_{cb}(\xi, p, \sigma^2, k_\phi) = -\psi_1(\xi, p)k_\phi^2 - \psi_2(\xi, p)\sigma^2$$
$$\mathbb{W}_{fc}(\xi, p, \sigma^2, 0) = -\psi_2(\xi, p)\sigma^2$$

with difference being $\mathbb{W}_{fc} - \mathbb{W}_{cb} = \psi_1(\xi, p)k_\phi^2 > 0$. $\qquad\square$

Intuitively in our model the uncertainty between the policy-makers presents a cost of having two institutions participating in economic policy-making. If nature of uncertainty is not affected by the institutional change, the only effect is removal of the fiscal policy-maker's incentive to induce high output.

As this incentive creates sub-optimally high output and deficit on the one hand and sub-optimally low inflation on the other, removing it is welfare improving.

While the first result is a positive one, the second results we prove is a negative one.

Proposition 2. *[welfare reducing institutional change] For any generic $\xi \in \mathbb{Q}^O$, any $k_\phi \in \mathbb{R}_+$ and any $p^{cb} \in \mathbb{P}^O$ there exists σ^2 and vector of probabilities p^{fc} such that the institutional change from cb to fc is welfare reducing.*

Proof. Fix generic ξ, k_ϕ and p^{cb}. We want to show there exists (p^{fc}, σ^2) such that $\mathbb{W}(\xi, p^{fc}, \sigma^2, 0) - \mathbb{W}(\xi, p^{cb}, \sigma^2, k_\phi) < 0$. First note $\psi_2(\xi, p)$ is continuous and continuously differentiable in p. Moreover

$$\frac{\partial \psi_2(\xi, p)}{\partial p_\mu} \neq 0 \qquad \frac{\partial \psi_2(\xi, p)}{\partial p_\phi} \neq 0$$

for generic ξ. It follows there exists p^{fc} in the neighbourhood of p^{cb} such that $\psi_2(\xi, p^{cb}) < \psi_2(\xi, p^{fc})$. Since $\mathbb{W}(\xi, p^{fc}, \sigma^2, 0) - \mathbb{W}(\xi, p^{cb}, \sigma^2, k_\phi) < 0$ rewrites as $k_\phi^2 \psi_1(\xi, p^{cb}) < \sigma^2(\psi_2(\xi, p^{fc}) - \psi_2(\xi, p^{cb}))$ where the both sides of the inequality are positive it follows there exists σ^2 for which the institutional change is welfare reducing. $\qquad\square$

Intuitively, the result relies on the fact that we can always find a direction in which nature of uncertainty induces a higher ψ_2 in the variance term of the welfare function. As this term multiplies σ^2 we can find high enough variance of the economic shocks which out-weights any benefit from $k_\phi = 0$.

4 Calibration

To shed more light on the issue we calibrated the model. We use $\alpha = 0.645$ from Mishkin (1983), $\beta = 0.552$ from Perotti (2002), $\mu = 2$ from Taylor (1999) and $\phi = 1$ the last of which is set to capture an idea that fiscal policy-makers are in general believed to be more concerned about output compared to monetary policy-makers.[4]

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[4] Mishkin (1983) comes from table 6.5 on page 122 and captures the effect of unanticipated money growth on log of GNP estimated from US data. Perotti (2002) comes from table 3 on page 44 and captures effect of government spending increase equal in size to 1%

To calibrate k_ϕ we do the following. First, we take our model and solve its version for the institutional setup when government sets both monetary and fiscal policy. The resulting expected inflation is then subsequently subtracted from the expected inflation in the model where government sets deficits and central bank sets inflation. Resulting difference is a function of ξ and k_ϕ only. We set k_ϕ so that the term is equal to 0.7 which is a difference between 3.8 and 3.1 both of which are average inflation rates under the corresponding institutional arrangements from Bordo and Schwartz (1999).[5] Note that this gives us $k_\phi = 2.17$.

Finally to derive σ^2 we use $var(y) = 7.84$ from Basistha and Nelson (2007) along with other parameters in ξ.[6] One problem is that we need probabilities in p to evaluate $var(y)$. In order not to bias our results in a particular way we maximize and minimize $var(y)$ for a fixed value of ξ which gives us two values of p, p_{min} and p_{max} respectively. In the calibration exercise we then use an average of p_{min} and p_{max} which turns out to be $[0.5, 0.5]$. Overall this gives us $\sigma^2 = 11.49$.

Figure 1 shows result of the calibration exercise. Assuming probability that the central bank observes shocks does not change shaded area in the picture shows all combinations of p_ϕ before (p_ϕ^{cb}) and after (p_ϕ^{fc}) the institutional change under which this change is welfare reducing.

What the figure shows is that the institutional change we study can be welfare reducing if the newly established fiscal authority has considerably lower probability of assessing state of an economy compared to government, a fiscal authority before the change. The figure also shows that a room for the institutional change to decrease welfare shrinks with an increase in probability of central bank observing economic shocks.

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of GDP on log GDP. We take one quarter effect and average over estimates for US, UK, Germany, Canada and Australia. Finally Taylor (1999) comes from table 7.1 on page 330 (middle column) and is estimated on US data. As the estimates imply that a monetary authority reacts twice as strongly to inflation compared to output, we set $\mu = 2$.

[5] The inflation of 3.8 is average over US, UK, Germany, France and Japan over the 1946-1970 period, i.e. before the recent wave of increases in central bank independence. The 3.1 is an average for the same countries over the 1983-1995 period. We drop the intermediate period as the inflation was influenced by different factors. All the data come from Bordo and Schwartz (1999) table 4.1 on page 205.

[6] Notice $var(y)$ can be interpreted as a variance of output gap since $var(y) = var(y - y^*)$. The value then comes from Basistha and Nelson (2007) table 2 on page 505. We first calculate average standard deviation of their proposed two measures of output gap and square it.

Figure 1: Calibration of the model
$\alpha = 0.654$, $\beta = 0.552$, $\mu = 2$, $\phi = 1$, $k_\phi = 2.17$, $\sigma^2 = 11.49$
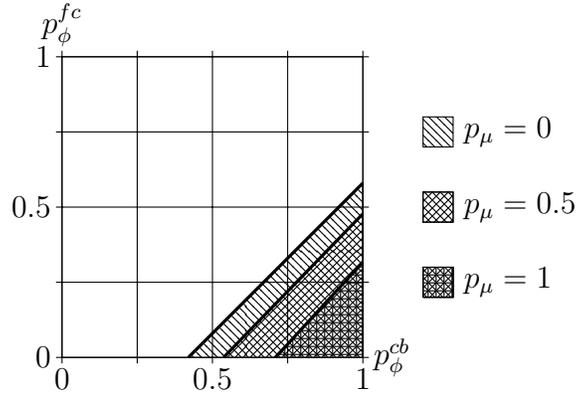
Our proposition 2 suggest that an increase in volatility of economic environment decreases a potential for institutional change involving establishment of independent fiscal council to be welfare improving. In order to confirm this intuition we repeated the calibration exercise for value of σ doubled with figure 2 showing the result.

Comparing the two pictures the intuition turns out to be correct. The shaded region is considerably larger in figure 2 compared to figure 1. It is also considerably closer to the main diagonal of the figure which, by proposition 1, includes points for which the institutional change under consideration is welfare improving.

Finally, we were interested in extent of potential welfare losses. We evaluated welfare change stemming from the institutional change as a percentage of the pre-change welfare. Figure 3 depicts resulting percentage change in the welfare as a function of p_μ assuming a scenario with probability of fiscal policy-maker observing the shock before the institutional change being unity and after the institutional change begin zero. We have picked this scenario as the figure 1 suggest it is the worst case one.

Message of the figure 3 is clear. Potential welfare loss produced by the institutional change is rather sizeable if it induces large change in an ability of fiscal policy-makers to assess state of an economy. For an extreme scenario we consider here, potential welfare loss is somewhere between 5% and 15%

Figure 2: Calibration of the model (doubled σ)
$\alpha = 0.654$, $\beta = 0.552$, $\mu = 2$, $\phi = 1$, $k_\phi = 2.17$, $\sigma^2 = 45.96$
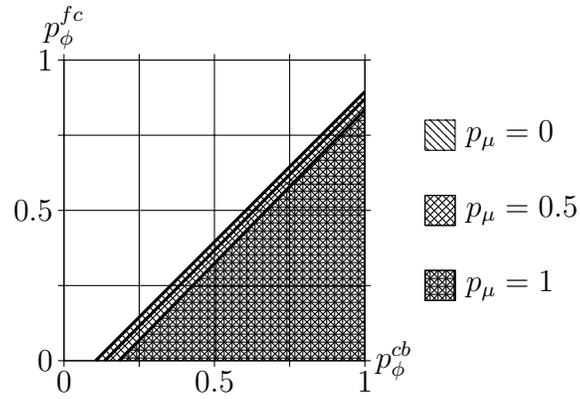
Figure 3: Percentage welfare change for $p_\phi^{cb} = 1$, $p_\phi^{fc} = 0$
$\alpha = 0.654$, $\beta = 0.552$, $\mu = 2$, $\phi = 1$, $k_\phi = 2.17$
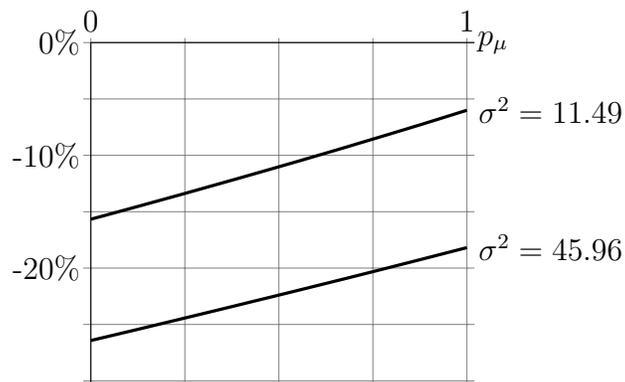
depending on an ability of monetary policy-maker to detect economic shocks, even for the low value of σ^2.

5   Conclusion

This paper evaluates the claim that a conduct of fiscal policy should be delegated to an independent institution in a dynamic microeconomic model that recognizes the fact that fiscal policy interacts with monetary policy. Once the interdependence between both policies is recognized and the volatility of economic environment taken into account, fiscal policy delegation needs not be welfare improving.

Our model focused on two aspect of the proposed institutional change towards independent fiscal authority. First aspect relates to the motivation of elected governments to run excessive public deficits that would be eliminated by delegating some features of fiscal policy (mainly setting the deficit or debt levels) to independent fiscal council. If this is the only change the institutional change induces, then it is unambiguously welfare improving.

Second aspect we focus on is the potential change in the interaction of the policymakers. In our model this is captured by a change in nature of uncertainty between the policy-makers regarding information they posses about the current state of an economy. Once the potential for change in the probability of recognizing the shocks and the consequences for mutual interaction of both policymakers are recognized, the institutional change we consider needs not be welfare improving.

Given the ambiguous theoretical result, we calibrated the model to empirically estimated parameters. The calibration exercise leads to three main conclusions. First, institutional change can be welfare reducing if the new independent fiscal policymaker is significantly less able to assess the state of the economy than the initial policymaker (i.e. government, or ministry of finance, respectively). Second, the room for the welfare reduction increases with volatility of economic environment. Third, the welfare losses can be significant, reaching some 5% to 15% of welfare in calm times and roughly 20% to 25% in turbulent times.

We interpret the results as follows. Generally, establishing independent fiscal council is a desirable institutional change. However, under certain conditions, namely if the probability of the new agency to recognize shocks to the economy is low, the institutional change does not have to be necessarily

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welfare improving. The negative effect of ill-designed institution with low capacity to recognize shocks increase significantly in times of increased economic volatility such as in a recent global financial crisis. Given the fact that turbulent times (i.e. crisis periods) often open a window of opportunity for institutional reforms that would not be available in normal times, the conclusion of the analysis should be taken into account when discussing institutional changes in fiscal framework.

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A1   Appendix

We now explicitly derive equilibrium policies given in the main part of the paper. Restating the three main equations we have economy described by

$$y(I_\mu, I_\phi) = y^* + \alpha(\pi(I_\mu) - \pi^e) + \beta(d(I_\phi) - d^*) + \varepsilon \qquad (A1)$$

government's loss function

$$\mathbb{G} = \mathbb{E}_\phi \left[(y(I_\mu, I_\phi) - \bar{y}_\phi)^2 + \phi(d(I_\phi) - d^*)^2 \right] \tag{A2}$$

and central bank's loss function

$$\mathbb{M} = \mathbb{E}_\mu \left[(y(I_\mu, I_\phi) - \bar{y}_\mu)^2 + \mu(\pi(I_\mu) - \pi^*)^2 \right]. \tag{A3}$$

Differentiating and rearranging loss functions of both policy-makers gives two F.O.C.'s (it is easy to check that S.O.C.'s are satisfied)

$$d(I_\phi) = d^* + \frac{\beta k_\phi - \alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi] - \beta\varepsilon(I_\phi)}{\beta^2 + \phi} \tag{A4}$$

$$\pi(I_\mu) = \frac{\alpha^2\pi^e + \mu\pi^* + \alpha k_\mu - \alpha\beta\mathbb{E}_\mu[d(I_\phi) - d^*|I_\mu] - \alpha\varepsilon(I_\mu)}{\alpha^2 + \mu}. \tag{A5}$$

Expectations of both policy-makers are given by

$$\mathbb{E}_\mu[d(I_\phi) - d^*|I_\mu] = \mathbb{E}_\mu[d(I_\phi = 1) - d^*|I_\mu]p_\phi \tag{A6}$$
$$+ \mathbb{E}_\mu[d(I_\phi = 0) - d^*|I_\mu](1 - p_\phi)$$

$$\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi] = \mathbb{E}_\phi[\pi(I_\mu = 1) - \pi^e|I_\phi]p_\mu \tag{A7}$$
$$+ \mathbb{E}_\phi[\pi(I_\mu = 0) - \pi^e|I_\phi](1 - p_\mu)$$

where for example (A6) reads as follows: central bank forms its expectation about the difference between d and d^* as the difference $d - d^*$ when government observes the shock, which happens with probability p_ϕ, plus the difference $d - d^*$ when government does not observe the shock, which happens with probability $1 - p_\phi$. Interpretation of (A7) is similar.

To derive (A6) we use F.O.C.'s to get

$$\mathbb{E}_\mu[d(I_\phi = 1) - d^*|I_\mu = 1] = \frac{\beta k_\phi - \alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 1] - \beta\varepsilon}{\beta^2 + \phi}$$

for the case when central bank observes the shock and assumes that government also observed the shock since

$$\mathbb{E}_\mu\{\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 1]|I_\mu = 1\} = \mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 1]$$
$$\mathbb{E}_\mu[\varepsilon(I_\phi = 1)|I_\mu = 1] = \varepsilon.$$

For the case when central bank does not observe the shock and assumes that the government did observe the shock we get

$$\mathbb{E}_\mu[d(I_\phi = 1) - d^*|I_\mu = 0] = \frac{\beta k_\phi - \alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]}{\beta^2 + \phi}$$

since

$$\mathbb{E}_\mu\{\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 1]|I_\mu = 0\} = \mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]$$
$$\mathbb{E}_\mu[\varepsilon(I_\phi = 1)|I_\mu = 0] = 0.$$

For the case when central bank does observe the shock and assumes that the government did not observe the shock we get

$$\mathbb{E}_\mu[d(I_\phi = 0) - d^*|I_\mu = 1] = \frac{\beta k_\phi - \alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]}{\beta^2 + \phi}$$

since

$$\mathbb{E}_\mu\{\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]|I_\mu = 1\} = \mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]$$
$$\mathbb{E}_\mu[\varepsilon(I_\phi = 0)|I_\mu = 1] = 0.$$

For the case when central bank does not observe the shock and assumes that the government also did not observe the shock we get

$$\mathbb{E}_\mu[d(I_\phi = 0) - d^*|I_\mu = 0] = \frac{\beta k_\phi - \alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]}{\beta^2 + \phi}$$

since

$$\mathbb{E}_\mu\{\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]|I_\mu = 0\} = \mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]$$
$$\mathbb{E}_\mu[\varepsilon(I_\phi = 0)|I_\mu = 0] = 0.$$

To derive (A7) we use F.O.C.'s to get

$$\mathbb{E}_\phi[\pi(I_\mu = 1) - \pi^e|I_\phi = 1] = \frac{\mu(\pi^* - \pi^e) + \alpha k_\mu - \alpha\beta\mathbb{E}_\mu[d(I_\phi) - d^*|I_\mu = 1] - \alpha\varepsilon}{\alpha^2 + \mu}$$

for the case that government observes the shock and assumes that the central bank also observed the shock since

$$\mathbb{E}_\phi\{\mathbb{E}_\mu[d(I_\phi) - d^*|I_\mu = 1]|I_\phi = 1\} = \mathbb{E}_\mu[d(I_\phi) - d^*|I_\mu = 1]$$
$$\mathbb{E}_\phi[\varepsilon(I_\mu = 1)|I_\phi = 1] = \varepsilon.$$

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For the case that government does not observe the shock and assumes that the central bank observed the shock we get

$$\mathbb{E}_\phi[\pi(I_\mu = 1) - \pi^e | I_\phi = 0] = \frac{\mu(\pi^* - \pi^e) + \alpha k_\mu - \alpha\beta\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0]}{\alpha^2 + \mu}$$

since

$$\mathbb{E}_\phi\{\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 1] | I_\phi = 0\} = \mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0]$$
$$\mathbb{E}_\phi[\varepsilon(I_\mu = 1) | I_\phi = 0] = 0.$$

For the case that government does observe the shock and assumes that the central bank did not observe the shock we get

$$\mathbb{E}_\phi[\pi(I_\mu = 0) - \pi^e | I_\phi = 1] = \frac{\mu(\pi^* - \pi^e) + \alpha k_\mu - \alpha\beta\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0]}{\alpha^2 + \mu}$$

since

$$\mathbb{E}_\phi\{\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0] | I_\phi = 1\} = \mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0]$$
$$\mathbb{E}_\phi[\varepsilon(I_\mu = 0) | I_\phi = 1] = 0.$$

For the case that government does not observe the shock and assumes that the central bank also did not observe the shock we get

$$\mathbb{E}_\phi[\pi(I_\mu = 0) - \pi^e | I_\phi = 0] = \frac{\mu(\pi^* - \pi^e) + \alpha k_\mu - \alpha\beta\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0]}{\alpha^2 + \mu}$$

since

$$\mathbb{E}_\phi\{\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0] | I_\phi = 0\} = \mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0]$$
$$\mathbb{E}_\phi[\varepsilon(I_\mu = 0) | I_\phi = 0] = 0.$$

Substitution of the above expressions into (A6) gives

$$\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 1] = \frac{\beta k_\phi}{\beta^2 + \phi} - \frac{\alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 0]}{\beta^2 + \phi}(1 - p_\phi) \quad \text{(A8)}$$
$$- \frac{\alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 1] + \beta\varepsilon}{\beta^2 + \phi}p_\phi$$
$$\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0] = \frac{\beta k_\phi - \alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 0]}{\beta^2 + \phi} \quad \text{(A9)}$$

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and substitution into (A7) gives

$$\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 1] = \frac{\mu(\pi^* - \pi^e) + \alpha k_\mu}{\alpha^2 + \mu} \tag{A10}$$
$$- \frac{\alpha\beta\mathbb{E}_\mu[d(I_\phi) - d^*|I_\mu = 0]}{\alpha^2 + \mu}(1 - p_\mu)$$
$$- \frac{\alpha\beta\mathbb{E}_\mu[d(I_\phi) - d^*|I_\mu = 1] + \alpha\varepsilon}{\alpha^2 + \mu}p_\mu$$
$$\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 0] = \frac{\mu(\pi^* - \pi^e) + \alpha k_\mu}{\alpha^2 + \mu} \tag{A11}$$
$$- \frac{\alpha\beta\mathbb{E}_\phi[\pi(I_\mu) - \pi^e|I_\phi = 0]}{\beta^2 + \phi}.$$

Note that expressions (A8), (A9), (A10) and (A11) constitute system of four equations with four unknown terms involving $\mathbb{E}_\mu(\cdot)$ and $\mathbb{E}_\phi(\cdot)$ with solution given by

$$\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 1] = -\frac{\alpha\beta\mu(\pi^* - \pi^e) + \alpha^2\beta k_\mu - \beta(\alpha^2 + \mu)k_\phi}{\lambda} \tag{A12}$$
$$- \frac{\beta[\alpha^2(1 - p_\mu) + \mu]p_\phi\varepsilon}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}$$
$$\mathbb{E}_\mu[d(I_\phi) - d^* | I_\mu = 0] = -\frac{\alpha\beta\mu(\pi^* - \pi^e) + \alpha^2\beta k_\mu - \beta(\alpha^2 + \mu)k_\phi}{\lambda} \tag{A13}$$

$$\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 1] = \frac{(\pi^* - \pi^e)\kappa + \alpha(\beta^2 + \phi)k_\mu - \alpha\beta^2 k_\phi}{\lambda} \tag{A14}$$
$$- \frac{\alpha[\beta^2(1 - p_\phi) + \phi]p_\mu\varepsilon}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}$$
$$\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 0] = \frac{(\pi^* - \pi^e)\kappa + \alpha(\beta^2 + \phi)k_\mu - \alpha\beta^2 k_\phi}{\lambda} \tag{A15}$$

with $\kappa = \beta^2\mu + \mu\phi > 0$ and $\lambda = \alpha^2\phi + \beta^2\mu + \phi\mu$.

Substituting (A12) and (A13) into the central bank's F.O.C. (A5) gives

$$\pi(I_\mu = 0) = \frac{\alpha^2 \phi \pi^e + \kappa \pi^*}{\lambda} + \frac{\alpha(\beta^2 + \phi)k_\mu - \alpha\beta^2 k_\phi}{\lambda} \tag{A16}$$

$$\pi(I_\mu = 1) = \frac{\alpha^2 \phi \pi^e + \kappa \pi^*}{\lambda} + \frac{\alpha(\beta^2 + \phi)k_\mu - \alpha\beta^2 k_\phi}{\lambda} \tag{A17}$$
$$- \frac{\alpha[\beta^2(1 - p_\phi) + \phi]}{\lambda + \alpha^2 \beta^2 (1 - p_\mu p_\phi)} \varepsilon$$

for the central bank's optimal inflation depending on whether central bank observed the shock (equation (A17) applies) or not (equation (A16) applies) which does not involve expectations of the government. Equations (A16) and (A17) can be used to derive inflation expected by citizens. Using $\pi^e = \mathbb{E}[\pi(I_\mu = 1)]p_\mu + \mathbb{E}[\pi(I_\mu = 0)](1 - p_\mu)$ some algebra gives

$$\pi^e = \pi^* + \frac{\alpha k_\mu}{\mu} - \frac{\alpha\beta^2 k_\phi}{\kappa} \tag{A18}$$

which substituted back into (A17) and (A16) gives equilibrium inflation

$$\pi(I_\mu = 0) = \pi^* + \frac{\alpha}{\mu}k_\mu - \frac{\alpha\beta^2}{\kappa}k_\phi \tag{A19}$$

$$\pi(I_\mu = 1) = \pi^* + \frac{\alpha}{\mu}k_\mu - \frac{\alpha\beta^2}{\kappa}k_\phi - \frac{\alpha\phi + \alpha\beta^2(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon.$$

Using the equilibrium inflation to derive $\pi^* - \pi^e$, expressions (A14) and (A15) become

$$\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 1] = -\frac{\alpha[\beta^2(1 - p_\phi) + \phi]p_\mu \varepsilon}{\lambda + \alpha^2\beta^2(p_\mu p_\phi)} \tag{A20}$$

$$\mathbb{E}_\phi[\pi(I_\mu) - \pi^e | I_\phi = 0] = 0 \tag{A21}$$

which used in government's F.O.C. (A4) gives expression for equilibrium deficit

$$d(I_\phi = 0) = d^* + \frac{\beta\mu}{\kappa}k_\phi \tag{A22}$$

$$d(I_\phi = 1) = d^* + \frac{\beta\mu}{\kappa}k_\phi - \frac{\beta\mu + \alpha^2\beta(1 - p_\mu)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon.$$

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Finally, equilibrium inflation and deficit can be used to calculate the output, which is given by

$$y(I_\mu = 1; I_\phi = 1) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \frac{\mu\phi - \alpha^2\beta^2(1 - p_\mu)(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon$$

$$y(I_\mu = 1; I_\phi = 0) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \frac{\mu\phi + \beta^2\mu + \alpha^2\beta^2 p_\phi(1 - p_\mu)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon$$

$$y(I_\mu = 0; I_\phi = 1) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \frac{\mu\phi + \alpha^2\phi + \alpha^2\beta^2 p_\mu(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}\varepsilon$$

$$y(I_\mu = 0; I_\phi = 0) = y^* + \frac{\beta^2 \mu}{\kappa} k_\phi + \varepsilon.$$

(A23)

Equilibrium inflation given by (A19), deficit given by (A22) and output given by (A23) can be used to calculate the variance of inflation, deficit and output. To calculate welfare few more results are useful.

Denoting

$$\nu_1 = \frac{\alpha\phi + \alpha\beta^2(1 - p_\phi)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}$$

$$\nu_2 = \frac{\beta\mu + \alpha^2\beta(1 - p_\mu)}{\lambda + \alpha^2\beta^2(1 - p_\mu p_\phi)}$$

variance of inflation and deficit can easily be shown to be

$$var(\pi) = p_\mu \nu_1^2 \sigma^2$$
$$var(d) = p_\phi \nu_2^2 \sigma^2.$$

From the equation for economy (A1) variance of output is

$$var(y) = \alpha^2 var(\pi) + \beta^2 var(d) + \sigma^2 + 2\alpha\beta cov(\pi, d) + 2\alpha cov(\pi, \varepsilon) + 2\beta cov(d, \varepsilon)$$

which after some algebra gives

$$var(y) = [p_\mu(1 - \alpha\nu_1)^2 + p_\phi(1 - \beta\nu_2)^2 + 1 - p_\mu - p_\phi + 2\alpha\beta p_\mu p_\phi \nu_1 \nu_2]\sigma^2.$$

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