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Inflation and Grand Corruption:

Still More on the Time-Inconsistency of Monetary Policy

Frank Bohn

Nijmegen Center for Economics (NiCE)

Institute for Management Research

Radboud University Nijmegen

P.O. Box 9108, 6500 HK Nijmegen, The Netherlands

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Inflation and Grand Corruption:

Still More on the Time-Inconsistency of Monetary Policy

Frank Bohn*

Nijmegen University and University of Maryland

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Abstract

Theory and empirical evidence suggest that there is a positive nexus between petty corruption and inflation, but how does grand corruption (government expropriation) affect inflation? In a political economy model capturing the time-inconsistency problem of monetary policy, a cheating (expropriating) government may constrain the cheating (reneging) by the central bank and, thereby, limit the inflationary bias of monetary policy. The model nests the standard fiscal-monetary interaction logic with and without expropriation, Rogoff's (1985) argument of a conservative central banker, and the diametrical "symbiosis" result obtained by Dixit and Lambertini (2003**a**).

JEL classification: E52, E62, H39

Keywords: monetary policy, fiscal policy, inflationary bias, deficit bias, expropriation, political economy.

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*currently: University of Maryland, Department of Economics, 3105 Tydings Hall, College Park, MD 20742, Fax: ++1-301-405-3542, email: f.bohn@fm.ru.nl.

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1 Introduction

What is the nexus between corruption and inflation? As for empirical evidence, there seems to be some indications for a positive link, overall, although the literature base is thin, for instance Al-Marhubi (2000) and Smith-Hillman (2007).[1] A conceptual problem is that empirical studies do not take account of the difference between petty corruption on the one hand and grand corruption (henceforth also called expropriation) on the other hand.[2] In fact, the corruption indicators used either capture largely (Transparency International, Business International indices) or entirely (Mauro's, 1995, bureaucratic inefficiency index) petty corruption. From a theoretical point of view the effects of petty corruption and grand corruption may well be very different.[3] If petty corruption leads to tax evasion and firms going underground, then policymakers may find it optimal to lean towards higher inflation taxation. This is also the model-theoretic argument by Huang and Wei (2006) who contend that monetary policy should be allowed to be more expansionary, if there are a lot of administrative inefficiencies (or petty corruption). Based on a similar framework, but modelling grand corruption instead of petty corruption, this paper produces the opposite result: government expropriation may lead to lower inflation. It is argued that grand corrup-

[1] In both papers aggregation matters. Al-Marhubi (2000) finds strong evidence for a positive relationship, but his data is averaged over 15 years. Smith-Hillman (2007) studies inflation and corruption in African and industrial economies. She also finds a positive relationship, but it is only significant when both country groups are combined, not when each group is studied separately. Furthermore, all empirical results must be viewed with caution due to criticism of the available corruption variables discussed in the literature, in particular the fact that all corruption indices only measure subjective perceptions which depend on country, time or other variable influences.

[2] Corruption can be defined as the individual's (illegal) attempt to reap private benefits from public office. Petty corruption or bribery refers to government employees, whereas grand corruption means that the leadership uses its policy setting power for obtaining some personal advantage. This can take very different forms, for instance directly expropriating government funds, creating revolving-door opportunities (i.e. employment offers after one's term in office), or facilitating nepotism (e.g. granting advantages to family members, planting them in responsible government or business positions, or allowing them the legal exploitation of an artificial scarcity such as a monopoly). This paper does not make a distinction on legal grounds with corruption being illegal and rent-seeking being the overarching concept including both legal and illegal activities. However, a distinction between petty and grand corruption is made because it matters from an economic point of view.

[3] This could be the case, although model-theoretic analyses are still few and far between. To my knowledge, there is not even a "systematic analysis of the effects of corruption and inflation" – as already remarked by Al-Marhubi in 2000.

tion may actually produce better monetary policies, if policymakers expropriate the public at least to some degree. The reason is that expropriating behaviour shifts policymakers' attention away from output promotion through inflation surprises, thereby alleviating the time-inconsistency problem of monetary policy. Conceptually, the argument is similar to the general principle of second-best theory which says that an additional distortion may actually improve welfare in an imperfect world.[4]

The time-inconsistency problem of monetary policy and the exploitation of the short-run Phillips curve have first been studied by Kydland and Prescott (1977). The argument is that the central bank can renege on its promise of stable monetary policy and use surprise inflation (leading to lower real wages) for reducing unemployment below the natural rate of unemployment. Anticipating agents render the government's machinations ineffective despite increased inflation. Barro and Gordon (1983a and 1983b) argue that a commitment device is required for preventing such deviating policies, restoring private agents' trust in the policymaker, and thus ensuring an optimal outcome. Rogoff (1985) posits that an independent, inflation-averse ("conservative" in his terminology) central bank can establish a reputation for non-inflationary monetary policy and thus act as such a commitment device. However, a major limitation of this line of reasoning is that it ignores fiscal policy.[5] Alesina and Tabellini (1987) and many others show that the inflationary bias of monetary policy carries over, in principle, even if fiscal policy in included in the analysis. Nonetheless, the magnitude of the inflationary bias may be affected by behavioural and institutional assumptions. Huang and Wei (2006), for instance, maintain that central bank conservatism

[4] More specifically, it relates to the "greasing the wheels" hypothesis first suggested by Leff (1964). The hypothesis claims that corruption being an additional distortion may actually improve welfare in a second-best world. Empirically, this has been rejected, for instance by Mauro (1995), but also received some support, for instance by Méon and Sekkat (2005). The argument made in this paper is not the same though, because the focus of this paper is on limiting the inflationary bias, not on improving societal welfare.

[5] Another limitation is discussed by Nicolini (1998), who argues that the previous literature unrealistically assumed that newly injected money can immediately be used by all consumers. In the models he presents optimal monetary policy may even lead to lower than expected inflation rates instead of the standard inflationary bias. However, inflation is always set at the socially optimal level in their paper, and there is no endogenous fiscal policy choice or even expropriation by a selfish government – as modelled in this paper.

should be limited, if the institutional quality of the government is rather poor.[6] In addition, introducing fiscal policy *without* a strict (and unrealistic) budget constraint for each period leads to a deficit bias on top of the inflationary bias. For instance, Agell, Calmfors and Jonsson (1996) and Demertzis, Hughes Hallett and Viegi (2004) include a balanced budget objective in the government loss function and show that optimal fiscal policy is always expansionary because costs incurred by the deficit are offset by the benefit from stimulated output.[7]

This paper introduces expropriation as a government objective. Fiscal and monetary policymakers share the typical Barro-Gorden (1983**a** and 1983**b**) type inflation and output objectives, but the government has additional fiscal objectives. The central bank controls inflation and would like to create surprise inflation to stimulate output. The government determines fiscal policy while considering the trade-off of fiscal stimulation between the gain in terms of output and the loss caused by an unbalanced budget. Deficit spending is thus possible, but costly. There is yet another trade-off because, additionally, the government has an expropriation objective. It may choose to expropriate some of the government revenue and, thereby, forego the output stimulation effect. Overall, the results of the model confirm, qualitatively, what has been found in the literature without expropriation: there are deficit and inflation biases. The difference to earlier results only becomes clear when the findings for the model with expropriation are compared to the results for the model without expropriation. This is possible because the political economy model presented here actually nests the standard fiscal-monetary interaction logic without expropriation. On the one hand, if output expansion is an important goal, ignoring the expropriation objective leads to an increase in the inflationary bias. Conversely (and ironically), it is only when fis-

[6] The intuition is that conservatism makes (expansionary) monetary policy painful. So, policymakers would normally avoid monetary policy. But poor institutional quality (administrative inefficiency or petty corruption) makes fiscal policy also painful. Therefore, society would be better off with less conservatism.

[7] A major limitation of all of the aforementioned papers as well as most of the literature is, of course, that intertemporal implications including reputation effects are not or not fully worked out. However, Demertzis, Hughes Hallett and Viegi (2004) argue that the balanced budget argument "implies a policy feedback rule that satisfies the long-run solvency and 'cash in advance' constraints (Canzoneri, Cumby and Diba, 2001)".

cal policymakers are modelled to "cheat" the public (by expropriating government revenue) that monetary policymakers are constrained in their "cheating" of the public (by reneging on a promise to the public). On the other hand, expropriation renders fiscal policy partially ineffective. There is still a deficit bias, but the output stimulation effect may be lost.

In addition to these findings, the approach is very general and could be applied to many previously discussed issues. By introducing expropriation as a government objective, this paper moves the discussion away from a benevolent government setting to the perspective of a government with selfish interests.[8] This is done without losing the fundamental properties of earlier models while acknowledging a role for expropriation and, thereby, widening the scope of the time-inconsistency literature. Issues discussed in earlier papers can now be reconsidered within a more general framework: the effects of differences in preferences (different weights and/or bliss points in the objective function) between policymakers and society or amongst policymakers themselves, for instance central bank conservatism; or alternative forms of (strategic) interaction between central bank, government and/or wage setters, for instance cooperation, non-cooperation, or Stackelberg leadership. In this paper the model is employed for discussing previous "solutions" for the elimination of the time-inconsistency problem of monetary policy: (i) Rogoff's (1985) central bank conservatism; and (ii) the "symbiosis" result obtained by Dixit and Lambertini (2003**a**), i.e. that the introduction of fiscal policy alone suffices for eliminating the inflationary bias.

The paper is structured as follows. Section 2 presents a general political economy approach to modelling grand corruption in a time-inconsistency setting. In Section 3, the results for the case without expropriation are obtained and interpreted. Section 4 discusses the impact of expropriation on both the inflation and deficit biases by comparing the model results with and without expropriation. In Section 5, examples of applications of the general approach are presented. Section 6 concludes.

[8] It is important to note the conceptional difference between having similar preferences and objectives, albeit different bliss points or weights, on the one hand and including a pure self-interest objective, namely expropriation, on the other hand.

2 The Model

The government is assumed to have a linear quadratic loss function comprising the standard components, deviations of inflation π from desired (zero) inflation and of output y from desired (above trend) output $(1+\kappa)\bar{y}$, but also a fiscal policy and an expropriation component:

$$L = \frac{1}{2}\alpha\pi^2 + \frac{1}{2}\theta((1+\kappa)\bar{y} - y)^2 + \frac{1}{2}(T - \bar{G} - \epsilon E)^2 - \epsilon\delta E \quad \text{with} \quad \alpha, \theta, \kappa, \delta > 0, \quad (1)$$

$$\epsilon = 0 \text{ or } 1.$$

The third term captures the loss incurred from missing the balanced budget target.[9] Taxes T and government spending G are specified separately in order to distinguish G – as long as switch parameter ϵ equal to 1 – from an additional type of government expenditure, i.e. expropriation (or grand corruption) E. (The model without expropriation is obtained by setting ϵ equal to 0.) It is assumed that $G - T$ has an output stimulating effect according to equation (2), whereas E is extracted and totally lost for the economy, even though expropriated wealth may, in reality, positively affect the economy to some degree. This extreme assumption does not affect the substance of our argument. One could justify this simplification by assuming that the expropriated wealth is hoarded or taken abroad or used for buying imported luxury goods. For simplicity, it is also assumed that G is exogenous and only T and E can be changed by the government. (The opposite assumption, T exogenous and G and E endogenous, does not change the findings either.) The last term of equation

[9] The formulation is similar to Demertzis, Hughes Hallett and Viegi (2004) as well as Dixit and Lambertini (2003**b**). $(T - \bar{G})$ here, the difference between tax receipts and government spending, corresponds to τ in the former model; and $(T - \bar{G})$, if positive, corresponds to x in the latter model. A budget surplus carries a penalty due to presumed negative political implications. Not spending all the money means, for instance, providing less public goods, thereby affecting the government's reelection chances. A budget deficit has negative effects because it restrains the government's possibilities in the future. As an alternative to the balanced budget proposition the model could equally be specified in terms of a desirable level of deficit – without affecting the qualitative results.

(1) depicts the government gain from expropriation. It depends upon exogenous coefficient δ and is modelled linearly for simplicity.[10]

Output is determined by a modified short run expectations-augmented aggregate supply curve:

$$y = \bar{y} + \phi(\pi - \pi^e) - \eta(T - \bar{G}) \qquad \text{with } \phi > 0, 0 < \eta < 1. \tag{2}$$

For simplicity, an economy without shocks is considered. Output y deviates from trend output $\bar{y}$ for two reasons: (i) surprise inflation (based on the standard argument that lower expected inflation produces expansionary real wage cost reductions); and (ii) fiscal policy (which is expansionary, if $T < \bar{G}$). Coefficient η captures the crowding-out or crowding-in effect. This cannot be interpreted as a tax distortion because the output effect is linear in $(T - \bar{G})$, which is the budget deficit excluding expropriation. The effect can be positive or negative and does not merely depend on the level of T. In other words, fiscal policy, i.e. taxation in this model, is only costly, when it leads to an unbalanced budget.[11]

A setup is considered in which the central bank controls inflation and the fiscal authority's policy instruments are tax revenue and (with $\epsilon = 1$) expropriation. But they share the same aforementioned objective function (although the inflation objective is irrelevant for the fiscal authority and the balanced budget and expropriation objectives do not affect the decision taken by the monetary authority). Non-cooperative Nash equilibria are derived from the first order conditions with respect to inflation π, taxation T, and (with $\epsilon = 1$)

[10] It should certainly not enter in a quadratic way, but a decreasing marginal gain would be even more realistic. This does, however, not affect the results significantly. One of the changes would be that the optimal budget deficit with expropriation (15) would no longer be constant. See footnote 16.

[11] Note that this model does not incorporate tax distortions. Alesina and Tabellini (1987) claim that the inflationary bias of monetary policy would be eliminated, if taxation were non-distortionary. Then the government could use as much tax revenue as necessary to subsidise firms so that they produce the desired output without having to take recourse to surprise inflations. In this model, we shall see that the inflationary bias of monetary policy is preserved because fiscal policy comes with another cost. Expansionary fiscal policy is possible, but at the expense of an unbalanced budget, i.e. an intertemporal cost.

expropriation E.[12][13] As always three cases can be distinguished: (i) commitment [COM] (which implies that the central bank sticks to its promise of setting $\pi = 0$ and private agents believe it); (ii) reneging [REN] (which implies that private agents who assume $\pi^e = 0$ are cheated by the central bank which optimises with respect to π); and (iii) the time-consistent equilibrium [TCE] (which requires that the central bank validates private agents' rational inflation expectations, i.e. $\pi = \pi^e$).

3 The Monetary-Fiscal Interaction Logic

Here are the three equilibria, **COM**mitment equilibrium, **REN**eging equilibrium and **T**ime-**C**onsistent **E**quilibrium, when expropriation is not included in the model ($\epsilon = 0$):

$$\pi^{COM} = 0 \qquad T^{COM} = \bar{G} - \frac{\eta\theta}{\eta^2\phi + 1}\kappa\bar{y} \tag{3}$$

$$\pi^{REN} = \frac{\phi\theta}{\alpha(\eta^2\phi + 1) + \phi^2\theta}\kappa\bar{y} \qquad T^{REN} = \bar{G} - \frac{\alpha\eta\theta}{\alpha(\eta^2\phi + 1) + \phi^2\theta}\kappa\bar{y} \tag{4}$$

$$\pi^{TCE} = \frac{\phi\theta}{\alpha(\eta^2\phi + 1) + \phi^2\theta - \phi\theta}\kappa\bar{y} \qquad T^{TCE} = \bar{G} - \frac{\alpha\eta\theta}{\alpha(\eta^2\phi + 1) + \phi^2\theta - \phi\theta}\kappa\bar{y} \tag{5}$$

Comparing the three equilibria leads to the following orderings:

$$\pi^{TCE} > \pi^{REN} > \pi^{COM} \tag{6}$$

$$T^{TCE} < T^{REN} < \bar{G}, \tag{7}$$

$$T^{COM} < T^{REN} < \bar{G},$$

$$T^{TCE} < (=, >)\, T^{COM}, \text{ if } \phi < (=, >)\, 1. \tag{8}$$

[12] With or without expropriation being considered, the minimisation problem is always well-defined, because the corresponding Hessian is positive semi-definite.

[13] Indications on the derivation are given in the appendix, albeit for the more general case where θ is different for central bank and government. This form of central bank conservatism is discussed in Section 5.

Most results confirm our intuition, but not all. The ranking of optimal inflation outcomes (equation 6) is as it would be in the situation without fiscal policy. However, changes in ϕ, the slope parameter of the Lucas supply hyperplane, affect π^{TCE} and π^{REN} quite differently compared to the (two-dimensional) case without fiscal policy. In the standard Barro-Gordon (1983a) model, a flatter supply curve (higher ϕ) implies a higher TCE-equilibrium (though it does typically not lead to a higher inflation rate for the reneging equilibrium). Here, increasing ϕ above a certain value actually produces a counterintuitive result. As the expansionary *effect* of a surprise inflation on output increases (higher ϕ, flatter supply hyperplane), the optimal inflation rate π^{TCE} (as π^{REN}) goes down, not up. At the same time, T^{TCE} (and T^{REN}) increase, which means that expansionary fiscal policy is used less, not more as one might have expected as a compensation for the reduction in the use of monetary policy.

Optimal fiscal policy is always expansionary ($T < \bar{G}$) because there is a benefit from stimulated output (with its marginal benefit – in the optimum – being equal to the marginal loss from missing the balanced budget objective). This is a standard result in the literature.[14] Of course, the fiscal policy instrument is used in the COM case where the monetary instrument is not available (with inflation being constrained to 0) and in the TCE equilibrium where inflation corresponds to the rationally expected π^e. In the REN case, we are more flexible and can use both instruments. Graphically this means that we move on the supply hyperplane closer to the bliss point (where the curvature of the loss sphere is greater). Since both instruments can be used to expand output in the REN scenario, it is optimal to use expansionary fiscal policy only to a lesser degree – as shown by both equations in (7). The flatter the supply hyperplane (ϕ increases), the closer we get to the bliss point, ie. T^{REN} goes up which means getting closer to the balanced budget. If output responded infinitely ($\phi \to \infty$), we would be on the bliss point, ie. $T^{REN} = \bar{G}$.

[14] For instance, Agell, Calmfors and Jonsson (1996) and Demertzis, Hughes Hallett and Viegi (2004). Similar to this paper, they model centralised fiscal and monetary policy. By contrast, there is disagreement, when fiscal policy is decentralised. Aizenman and Isard (1993) claim that a monetary union with decentralised fiscal policy produces a budget deficit (and an inflationary bias), whereas Beetsma and Bovenberg (JIE, 1998) argue that fiscal discipline may be achieved, if fiscal policy is decentralised and uncoordinated. The deficit issue is ignored in Huang and Wei (2006) and Alesina and Tabellini (1987).

But why does the ordering of T^{TCE} and T^{COM} change with variations in ϕ (equation 8)? If ϕ were zero, i.e. no beneficial *effect* of a surprise inflation on output at all (the supply hyperplane would be vertical), all three equilibria would be at the same point. As ϕ goes up, T^{COM} increases, but only slightly, because the COM equilibrium is severely constrained.[15] T^{TCE} and T^{REN} increase more significantly though, when the supply hyperplane becomes flatter (though there is a reduction of T^{TCE} at first). It is optimal to use less and less expansionary fiscal policy, when the expansionary *effect* of a surprise inflation increases (ϕ up). This makes sense. The counterintuitive issue is only that the corresponding optimal inflation rate rises by less and less and then goes down as well. In other words, for a sufficiently flat supply hyperplane, both monetary and fiscal policy turn less and less expansionary.

4 What Changes when there Is Expropriation?

The key result of the non-expropriation case is that the inflationary bias ($\pi^{TCE} > 0$) as well as the deficit bias ($T^{TCE} < \bar{G}$) are always present and increase with the desired output gap $\kappa\bar{y}$. Monetary authorities facing rational agents cannot avoid being trapped in an inefficient equilibrium. Fiscal policy does not help; instead it produces an additional (deficit) bias of its own.

For comparison, here are the three equilibria, when expropriation is included in the model ($\epsilon = 1$):

$$\pi_X^{COM} = 0 \qquad T_X^{COM} = \bar{G} - \frac{1}{\eta}\kappa\bar{y} + \frac{\delta}{\eta^2\theta}$$

$$E_X^{COM} = -\frac{1}{\eta}\kappa\bar{y} + \frac{\delta}{\eta^2\theta} + \delta \tag{9}$$

[15] The commitment equilibrium represents a point of tangency in the two-dimensional $T-y$ space between the authorities' indifference curves (ignoring the π dimension) and the intersection of the supply hyperplane with the $T - y$ space. As the latter rotates slightly when the supply hyperplane becomes flatter, T^{COM} increases.

$$\pi_X^{REN} = \frac{\phi\delta}{\alpha\eta} \qquad T_X^{REN} = \bar{G} - \frac{1}{\eta}\kappa\bar{y} + \frac{\delta}{\eta^2\theta} + \frac{\phi^2\delta}{\eta^2\alpha}$$

$$E_X^{REN} = -\frac{1}{\eta}\kappa\bar{y} + \frac{\delta}{\eta^2\theta} + \frac{\phi^2\delta}{\eta^2\alpha} + \delta \tag{10}$$

$$\pi_X^{TCE} = \frac{\phi\delta}{\alpha\eta} \qquad T_X^{TCE} = \bar{G} - \frac{1}{\eta}\kappa\bar{y} + \frac{\delta}{\eta^2\theta}$$

$$E_X^{TCE} = -\frac{1}{\eta}\kappa\bar{y} + \frac{\delta}{\eta^2\theta} + \delta \tag{11}$$

Let me begin by commenting on the results for inflation in three respects. First, inflation outcomes can be ranked as follows:

$$\pi_X^{TCE} = \pi_X^{REN} > \pi_X^{COM} \tag{12}$$

If the central bank is trapped in a time-inconsistent equilibrium, the ensuing inflation rate is no worse than the one it achieves when it can cheat private agents. By itself, this does not imply that the result of the fully rational outcome (TCE) is now any better. Second, however, π_X^{TCE} and π_X^{REN} no longer depend on the desired output gap $\kappa\bar{y}$. This comparison to the outcome of the model without expropriation is the core result. Inflation rates only depend on the weights of the loss function (1) and the coefficients of the supply function (2). This is good news and bad news. If the central bank tried to achieve a large output increase (κ much larger than 0), inflation would still remain the same. However, even if the monetary authorities did not want to exploit agents at all ($\kappa = 0$), there would still be an inflationary bias. In other words, no matter how much the central bank wants to achieve by its cheating, inflation is not affected. Third, this result is produced by incorporating expropriation, but inflation rates are not affected by the weight expropriation receives in the loss function. (This is not surprising since expropriation is not a central bank instrument.)

The ranking of the three equilibria with respect to tax outcomes changes as well:

$$T_X^{TCE} < T_X^{COM} = T_X^{REN}. \tag{13}$$

Optimal tax revenues in the TCE equilibrium are now unambiguously smaller than those in the commitment equilibrium. It is not clear, if any of those tax equilibrium values are smaller (as in the case without expropriation) or larger than government spending $\bar{G}$. In other words, we cannot say, if fiscal policy is expansionary ($T < \bar{G}$) or not because of expropriation. What we know is that tax revenue minus expropriation is always smaller than government spending and all equilibria produce the same budget deficit:

$$T - E < \bar{G} \tag{14}$$

$$T - \bar{G} - E = -\delta < 0 \tag{15}$$

This key result shows that the existence of expropriation renders fiscal policy partially ineffective. When the government chooses optimally, there is still a deficit bias as in the non-expropriation scenario, but the output stimulation effect may be lost.[16] The government prefers to shift some of its resources from output stimulation to direct expropriation. In fact, there are two possibilities. If $E < \delta$, fiscal policy remains expansionary; the budget deficit is used for expropriation and also for output expansion. If $E > \delta$, then there is so much expropriation that the entire budget deficit is only used for financing expropriation. Some of the tax revenue is also used for expropriation and, consequently, fiscal policy turns contractionary.

5 Discussion and Applications

The model put forward in this paper can be used for analysing issues previously discussed in the literature on time-inconsistency in monetary policy, but with the inclusion of expropriation. Applications are, for instance, different forms of strategic interaction, for instance monetary versus fiscal leadership. Of course, we could also study the effect of relaxing some

[16] The deficit bias is constant and the same for all three equilibria. If the gain from expropriation were modelled with a decreasing marginal gain, the budget deficit inclusive of expropriation would be decreasing in the optimal level of expropriation. See footnote 10.

of the assumptions: monetary or output shocks, tax distortions, expropriation also having an output stimulation effect. Other examples include differences in objective functions between central bank, government and society. The weights and the bliss points of the players could be varied. A widely-studied issue is the effect of central bank conservatism which is typically seen as a solution to the time-inconsistency problem of monetary policy.[17] In this section our model is used for discussing the effect of central bank conservatism when the government and central bank share otherwise identical loss functions. Furthermore, our model is employed for illustrating the "symbiosis" result obtained by Dixit and Lambertini (2003**a**). They argue that the introduction of fiscal policy alone suffices for eliminating the inflationary bias.

Assuming that government and central bank share identical bliss points our model produces clear-cut results with respect to central bank conservatism: the inflationary bias of monetary policy could be eliminated by an extremely conservative central bank. Before discussing the results it must be noted that, in the model presented, central bank conservatism can be expressed in two ways. When the loss function contains only inflation and the output gap as arguments, increasing the *inflation-aversion* parameter of the central bank, α^{CB}, relative government parameter α^{G} corresponds to raising *output-aversion* θ^{G} relative to θ^{CB}. However, when there are additional loss terms as in this model, it does make a difference. Central bank inflation-aversion is modelled, for instance, in the original paper by Rogoff (1985), government output-aversion by, for instance, Demertzis, Hughes Hallett and Viegi (2004). The effects of central bank *inflation-aversion* for the expropriation case can be read directly from equations (9)-(11), because α only appears in the central bank's first order condition (with respect to inflation), but does not play a role for the government optimisation. The results for government *output-aversion* are derived in the appendix.

[17] Central bank conservatism can be achieved in various ways. First, central bank governors are penalised for inflation as proposed by Persson and Tabellini (1993) and Walsh (1995). Their idea of optimal central banker contracts is developed, for instance, by Candel-Sánchez and Campoy-Miñarro (2004) and Chortareas and Miller (2004 and 2007). Second, inflation targets are imposed as suggested by Svensson (1997) and discussed by Beetsma and Jensen (1999). Third, in Fatum (2006) conservatism results from central bank council decisions, if national delegates are strategically selected.

Despite their differences, the results for government output-aversion and central bank inflation-aversion are, qualitatively, largely the same. When expropriation is possible, optimisation under increased central bank conservatism leads to a reneging equilibrium as well as a time-consistent equilibrium with lower inflation and lower tax revenues, thereby confirming the typical output stimulation trade-off between inflation and deficit spending. However, the tax reductions do not imply an increase in the budget deficit because expropriation is reduced by the same amount. This implies that society is better off under a more conservative central bank in a time-consistent world: there is less inflation, more fiscal stimulation and less expropriation. Under a reneging scenario, we cannot be entirely sure because there is also less output stimulation through surprise inflation.[18] When expropriation is not possible, central bank conservatism has a less favourable effect because increased fiscal stimulation also implies a loss from incurring a higher budget deficit.[19]

So far, we confirmed in Section 3 what had been suggested in the literature before: fiscal policy does not eliminate the inflationary bias, but adds a budget deficit bias. Section 4 shows that it is only when the government is modelled to be allowed expropriating the public that the inflationary bias may actually be reduced. In this section, we have seen that central bank conservatism reduces the inflationary bias even more (while increasing the fiscal stimulation without negatively affecting the budget deficit). These results are in stark contrast to findings obtained by Dixit and Lambertini (2003**a**) who claim that monetary and fiscal policy can become symbiotic, if policymakers agree on their bliss points, irrespective of disagreement on weights, non-coordination, order of moves, etc. In their world, conservatism of the central banker does not matter at all. In stark contrast to all other papers, they emphasise that the presence of fiscal policy variables alone eliminates the

[18] The commitment equilibrium differs somewhat depending on whether we study increased central bank inflation-aversion ($\alpha^{CB} > \alpha^{G}$) or increased government government output-aversion $\theta^{G} > \theta^{CB}$ (see appendix). In the former case, there is no effect at all, in the latter case, there is less fiscal stimulation, but no higher budget deficit because of the decrease in expropriation.

[19] However, in the time-consistent equilibrium case (without expropriation), it is not impossible that central bank conservatism even leads to a reduction of both inflation *and* the budget deficit which, of course, also means less fiscal stimulation.

time-inconsistency problem. The remainder of this section will be used for explaining why the author disagrees with Dixit and Lambertini's logic and results.[20] Then it will be shown how their logic can be nested in the model analysed in this paper.

Dixit and Lambertini (2003**a**) study policy interaction when there are a union-wide monetary authority and a multitude of fiscal policymakers (thus resembling the situation in Euroland). Their underlying micro model is their own version[21] of Obstfeld and Rogoff's (1995) two-country general equilibrium model with monopolistic competition, the so-called redux model, which itself is based on Blanchard and Kiyotaki (1987). They obtain the steady state and derive some policy implications from perturbation results. Then they construct a macro model based on the steady state results of their micro model and derive far-reaching conclusions (based on different set of preferences) while at the same time acknowledging that their results are only relevant close to the steady state. By construction, fiscal policy in their macro model is totally unconstrained and fiscal policymakers can always choose a costless, even beneficial, way to expand output.[22] Their "symbiosis" result hinges on the costliness of fiscal policy and is actually a reiteration of two previous results. First, there is Alesina and Tabellini's (1987) basic insight that it is the distortionary nature of taxation, i.e. the fact the fiscal policy does not come free of charge, which preserves the inflationary bias. If the model captures neither tax distortions nor any other cost, fiscal policy can be used without bounds – as already outlined in footnote 11. Second, their symbiosis result is a special case of a general result by De Bruyne (1979), who proves in a very general setting that a non-cooperative equilibrium (for instance between monetary and fiscal policymakers) is Pareto-optimal, if there is no conflict of interest. In the Dixit-Lambertini paper, there is

[20] More details of the critique can be found in a discussion paper by Bohn (2009).

[21] Outlined in their appendix A which can be downloaded from Luisa Lambertini's webpage at http://www.claremontmckenna.edu/econ/llambertini/.

[22] Such a model strategy seems surprising given their other contributions to the time-inconsistency literature, for instance Dixit and Lambertini (2001) and Dixit and Lambertini (2003**b**). The latter paper is even based on the same micro model, but does contain a cost assigned to fiscal policy by capturing the deadweight loss of fiscal policy in the social and fiscal authority's loss functions. For a discussion thereof, see footnote 9.

no conflict of interest because the use of an instrument by one policymaker does not impede the policy choice of the other policymaker. The reaction functions of all policymakers always pass through the bliss point (which is, by the way, also noted by Dixit and Lambertini, 2003**a**).

Let us apply Dixit and Lambertini's (2003**a**) argument (that fiscal policy alone suffices to eliminate the inflationary bias) to our model. Their reasoning should certainly apply to the setting in this paper because it is a special case of theirs: (i) there is interaction between the central bank and just one fiscal authority (instead of Dixit-Lambertini's n fiscal authorities and their general matrix of spillover effects); and (ii) monetary and fiscal authorities have identical loss functions, not just the same bliss points. Costless fiscal policy would mean that expansionary fiscal policy comes without costs in terms of a budget deficit. This can be captured in the model of this paper by setting $\delta = 0$, which means that the government does not gain from expropriation. Hence there is no cost for withdrawing resources, nor for augmenting resources . In the equilibrium, the government optimally chooses a negative E to balance the budget despite expansionary fiscal policy. Of course, this is not a realistic scenario, but it illustrates the case of a government, which can produce any budget deficit without incurring a loss (albeit the situation is more favourable in Dixit and Lambertini, (2003**a**, because any suitably chosen fiscal policy even has an additional beneficial effect on output in their model). Not surprisingly, the conflict of interest between monetary and fiscal policy is gone. Results can be obtained by inserting $\delta = 0$ into equations (9)-(11). We can see that taxation is always smaller than government spending, but the difference is made up by negative expropriation. In fact, any desired output stimulation can be achieved without incurring costs caused by a budget deficit. Inflation surprises must not be feared. Thus, most importantly, the inflationary bias is gone under these conditions.

6 Conclusion

This paper contributes to the literature on the time-inconsistency problem of monetary policy by analysing a general political economy model including fiscal policy and grand corruption. The analysed case of identical loss functions for fiscal and monetary policymakers produces four main results. First, fiscal policy (without expropriation) does not eliminate the inflationary bias, but adds an additional budget deficit bias. This confirms previous results in the literature. Second, when a government expropriation objective is considered, the inflationary bias does no longer depend on the desired level of output. Even if a large output expansion is aimed for, the inflationary bias does not increase. Third, the existence of expropriation renders fiscal policy partially ineffective. The deficit bias of the no expropriation scenario is preserved, but the output stimulation effect may be lost. Forth, central bank conservatism is unambiguously beneficial in a situation with government expropriation and rational expectations. Central bank conservatism reduces the inflationary bias while increasing the fiscal stimulation, thereby confirming the standard monetary-fiscal trade-off. At the same time, the budget deficit does not worsen, but remains unchanged because government expropriation is reduced by the same amount.

These results were obtained under some more or less restrictive assumptions. A major caveat in the entire literature is that intertemporal, strategic and reputational effects are not explicitly accounted for as already discussed in footnote 7. Other than that, the model offers a general approach which can be used for studying most of what has been ignored in this paper, for instance, monetary and output shocks, differences in preferences between policymakers, the sequential order of moves, the output-stimulation effect of expropriation, wage setting behaviour, social welfare, etc. Two applications of the approach have been given: Rogoff (1985) style central bank conservatism; and costless fiscal policy emulating the results by Dixit and Lambertini (2003**a**).

There are two ways of thinking about the findings in this paper. First, suppose the model actually described reality. In particular, it could be argued that grand corruption is always present, at least to some degree, not just in developing countries, but even in advanced Western economies. Take for instance the state corruption under the Democratia Cristiana (DC) and under Craxi's socialist-DC coalition government in Italy. Or think about the corruption allegations against George W. Bush and other Western leaders. Giving the model a positive interpretation we could argue that the inflationary bias may not be as bad as commonly suspected. In addition, having established independent, conservative central banks in most Western countries greatly alleviates the problem. From a normative point of view, we are still stuck with a number of questions. Should we really try to eradicate grand corruption? What are the welfare implications?

Secondly, the findings actually raise even more questions and suggest topics for future research. Grand corruption may have an effect on the inflationary bias, but what happens, if we include tax distortions in our model as well. Does making fiscal policy more costly necessarily increase the inflationary bias? Similarly, what happens if we allow for both petty corruption and grand corruption. Huang and Wei (2006) argue that we may want to limit central bank conservatism when there are inefficiencies in the tax collection process. In this paper, we argued in favour of more conservatism. Is there a trade-off, if different forms of corruption are included in the analysis? Finally, the results suggest that expropriation may affect the time-inconsistency issue even in other models. Would the inflationary bias be constrained in the models considered by Nicolini (1998), i.e. when newly injected money cannot be used by all consumers in the current period?

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Appendix and/or Indications for the Referees

The derivation is given for the most general case, i.e. including expropriation and central bank conservatism (modelled as government output-aversion). This is the model version referred to in Section 5. Basically, it corresponds to the model outlined in Section 2 with $\epsilon = 1$, however, distinguishing the θ values for government G and central bank CB as follows: $\theta^G = g\theta$, $\theta^{CB} = \theta$, $g \geq 1$ (with $g = 1$ meaning that there is no central bank conservatism). On this basis, loss function (1) can be adjusted to reflect what each authority can actually influence and then combined with supply function (2) to form the consolidated loss functions for the government and the central bank:

$$L^G = \frac{1}{2} \quad g \quad \theta(\kappa\bar{y} - \phi(\pi - \pi^e) + \eta(T - \bar{G}))^2 + \frac{1}{2}(T - \bar{G} - E)^2 - \delta E \qquad \text{(A.1)}$$

$$L^{CB} = \frac{1}{2}\alpha\pi^2 + \frac{1}{2} \qquad \theta(\kappa\bar{y} - \phi(\pi - \pi^e) + \eta(T - \bar{G}))^2. \qquad \text{(A.2)}$$

Here are the first order conditions obtained by the central bank with respect to inflation and by the government with respect to taxation and expropriation:

$$\alpha\pi - \theta\phi(\kappa\bar{y} - \phi(\pi - \pi^e) + \eta(T - \bar{G})) = 0 \tag{A.3}$$

$$g\eta\theta(\kappa\bar{y} - \phi(\pi - \pi^e) + \eta(T - \bar{G})) + (T - \bar{G} - E) = 0 \tag{A.4}$$

$$-(T - \bar{G} - E) - \delta = 0 \tag{A.5}$$

(A.4)+(A.5):

$$\begin{aligned} g\eta\theta(\kappa\bar{y} - \phi(\pi - \pi^e) + \eta(T - \bar{G})) &= \delta \\ (\kappa\bar{y} - \phi(\pi - \pi^e) + \eta(T - \bar{G})) &= \frac{\delta}{g\eta\theta} \end{aligned} \tag{A.6}$$

Rewrite (A.3):

$$(\kappa\bar{y} - \phi(\pi - \pi^e) + \eta(T - \bar{G})) = \frac{\alpha}{\theta\phi}\pi \tag{A.7}$$

We obtain from (A.7)=(A.6):

$$\pi = \frac{\phi\delta}{g\eta\alpha} \tag{A.8}$$

Rewrite (A.3):

$$T = \bar{G} - \frac{\kappa}{\eta}\bar{y} + \frac{\phi^2\theta + \alpha}{\eta\phi\theta}\pi - \frac{\phi}{\eta}\pi^e \tag{A.9}$$

Insert (A.8) into (A.9):

$$T = \bar{G} - \frac{\kappa}{\eta}\bar{y} + \frac{(\phi^2\theta + \alpha)\delta}{g\eta^2\theta\alpha} - \frac{\phi}{\eta}\pi^e \tag{A.10}$$

Rewrite (A.5):

$$E = T - \bar{G} + \delta \tag{A.11}$$

Insert (A.10) into (A.11):

$$E = -\frac{\kappa}{\eta}\bar{y} + \frac{(\phi^2\theta + \alpha)\delta}{g\eta^2\theta\alpha} - \frac{\phi}{\eta}\pi^e + \delta \tag{A.12}$$

Equations (A.8), (A.10) and (A.12) form the reneging equilibrium. For the commitment equilibrium, we derive the solution from equations (A.4) and (A.5) only. The time-consistent equilibrium requires to form rational expectations of the inflation rate given in (A.8):

$$\pi^e = E[\pi] = \frac{\phi\delta}{g\eta\alpha} \tag{A.13}$$

Insert (A.13) into (A.10) and split up its third term:

$$\begin{aligned} T &= \bar{G} - \frac{\kappa}{\eta}\bar{y} + \frac{\delta}{g\eta^2\theta} + \frac{\phi^2\delta}{g\eta^2\alpha} - \frac{\phi}{\eta}\frac{\phi\delta}{g\eta\alpha} \\ T &= \bar{G} - \frac{\kappa}{\eta}\bar{y} + \frac{\delta}{g\eta^2\theta} \end{aligned} \tag{A.14}$$

Analogously, insert (A.13) into (A.12) and split up its third term:

$$\begin{aligned} E &= -\frac{\kappa}{\eta}\bar{y} + \frac{\delta}{g\eta^2\theta} + \frac{\phi^2\delta}{g\eta^2\alpha} - \frac{\phi}{\eta}\frac{\phi\delta}{g\eta\alpha} + \delta \\ E &= -\frac{\kappa}{\eta}\bar{y} + \frac{\delta}{g\eta^2\theta} + \delta \end{aligned} \tag{A.15}$$