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The political economy of public income volatility: With an application to the resource curse ☆

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ABSTRACT

In recent years many countries have witnessed a great deal of volatility in public budgets, be it due to volatility in the access to foreign loans in Greece, or to unstable oil prices in Venezuela. We study the political consequences of such public income volatility. As is standard, in our model political incentives create inefficient policies to increase re-election probabilities, but we show that making public income uncertain creates specific new effects. Future volatility reduces the benefit of being in power, making policy more efficient. Yet at the same time it also reduces the re-election probability of an incumbent and since some of the policy inefficiencies are concentrated in the future, this makes inefficient policy, such as patronage public employment, less costly. Our model highlights a new political economy connection between the volatility of the public budget and economic growth. In the case where volatility comes from natural resource prices, a characteristic of many developing countries, we show that volatility in itself may be a source of inefficient resource extraction, jointly interacting with increased patronage employment.

1. Introduction

How does volatility affect political and economic equilibria? In recent years, a number of countries have experienced a great deal of volatility in economic variables, be it output fluctuations in Spain, volatility in the ability to borrow on the part of the public sector in Greece, or oil price volatility in Venezuela. A main effect of these types of volatility is that they translate into volatility in public budgets and therefore policy volatility. As testified by the various street protest movements, strikes and riots against current governments in these societies, such policy volatility and its associated uncertainty are clearly perceived as costly by voters as well as politicians. But while a lot of attention has been given to the political economy effects of public income, public wealth, or natural resource abundance, hardly any literature has studied the political economy of *volatility* in public budgets. In this paper we develop a first political economy approach to examine the consequences of such volatility. We particularly focus on the extent to which volatility may influence the efficiency of public policy.

The literature on the political economy of public policy has highlighted many mechanisms through which equilibrium policies chosen through a political process deviate from what is socially desirable. This is true even in simple models where the median voter theorem applies and when median and mean income differ (Romer, 1975; Roberts, 1977). In models where elections are modelled more explicitly many types of inefficiencies stem from the fact that incumbent politicians have an incentive to move policy away from what is socially desirable either because the probability of losing power makes them discount the future too much (Alesina and Tabellini, 1990a, b; Leblanc et al., 2000), or because this allows them to manipulate their re-election probability in a favorable way (Aghion and Bolton, 1990; Besley and Coate, 1998; Biais and Perotti, 2002; Robinson and Torvik, 2005; Robinson and Verdier, 2013).

These models tend to have simple and appealing comparative statics. For example, anything which increases the benefits of being in power or holding office tends to make policy less efficient. Anything which makes the election outcome less sensitive to policy,

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such as changes in the distribution of shocks in a probabilistic voting model, tends to make policy more efficient.

In this paper we develop a model of what to our knowledge is a new type of comparative static in a canonical political economy model of inefficient policy. Specifically we consider society to be divided into two groups: one associated with an incumbent, and one with an opponent. The two groups value different sorts of public goods which gives the members of a particular group a desire to elect their politician since only then will they benefit from the public goods that he and they value. In addition the incumbent uses patronage employment, which is socially inefficient, to induce voters to support him. In this set-up, for standard reasons policy is set inefficiently because this helps to raise the re-election probability of an incumbent.

The main innovation however is to embed this framework into an environment where government revenues are stochastic and future revenues, after re-election, are uncertain. We highlight two main channels though which the volatility of public resources affects the dynamics of political outcomes and the efficiency of policymaking. On the one hand, uncertainty about future government income tends to reduce the expected benefit of being in power to an incumbent, something which makes policy more efficient. On the other hand, when revenues and future public good provision are uncertain, the continuation expected utility that members of an incumbents group get from having him being re-elected is lower. This in turn reduces his re-election probability. With a lower probability of re-election, inefficient policy becomes less costly to the incumbent politician, since some of the costs are concentrated in the future. We show that this latter effect dominates when the incumbent politician is from the group which values public goods highest and when preferences for public goods are sufficiently heterogeneous between groups, or when public sector wages are not too high compared to private sector productivity. When this is true, higher volatility of government revenues reduces national income.

In the online appendix we extend this model by including public sector investment in the initial period, which can raise private sector productivity in the second period. Though this may be desirable from a social point of view it has an immediate unappealing political effect for the incumbent. By driving up private sector productivity, public investment reduces the gap between public sector wages and the returns in the private sector. This makes patronage employment less effective as a tool for influencing election results. At the same time though, an increase in private sector productivity leads to higher public resources through tax revenues raised on that sector. As these additional resources can be used for future public policies, this tends to stimulate public investment by the incumbent. In the plausible case where the return to holding power is large, we show that patronage employment and public investment are strategic substitutes in the following sense: when income volatility increases patronage employment, it simultaneously tends to decrease public investment. Interestingly, the intuition for the effect of volatility on patronage employment and on public investment are closely related.[1] Indeed, increased volatility that reduces the reelection probability reduces the expected future cost of patronage. At the same time, it also reduces the incentives for public investments as increased future tax revenues are less likely to benefit the incumbent politician. Consequently, the effects of volatility on patronage and public investment are pretty much the mirror image of one another. This makes the policy equilibrium even less efficient.

This model therefore produces a new mechanism which can help explain some important stylized facts. A large empirical literature documents a strong negative correlation between the volatility of output and economic growth (see the seminal work of Ramey and Ramey (1995), and Aghion and Banerjee (2005), Loayza et al. (2007) for overviews of this literature). The existing explanations emphasize the link between volatility and credit constraints (Aghion and Banerjee, 2005; Aghion et al., 2010). Recently however Fatas and Mihov (2013) presented empirical evidence that fiscal policy volatility exerts a strong and direct negative impact on growth.[2] Consistent with these results, our analysis provides an explicit politico-economic mechanism through which public policy volatility may influence economic growth. While most of the existing evidence typically looks directly at the impact of GDP volatility on growth, in our set-up anything which generates income volatility, such as shocks to total factor productivity or aggregate demand, would convert into shocks to the government budget via their impact on tax revenues. The higher volatility of public resources then creates lower GDP per-capita by inducing more wasteful patronage and lower public investment according to the political economy incentives we emphasize here.

For poor and developing countries, an important source of public budget volatility comes from the fact that they are highly dependent on natural resource rents and that natural resources have notoriously volatile prices. For instance, Bleaney and Halland (2010) find that a high share of resources in exports is associated with high economic and fiscal volatility and low growth. Similarly, van der Ploeg (2011) points out that resource revenues are much more volatile than GDP and he suggests several mechanisms via which the volatility of resource prices could translate into poor economic performance. For example, van der Ploeg and Poelhekke (2009) argue that commodity price volatility makes liquidity constraints more likely to bind and thus reduce innovation and growth. They present evidence that the adverse growth effect of natural resources results mainly from the volatility of commodity prices, though there are important heterogeneous effects.[3] Leong and Mohaddes (2011) also find robust evidence that volatility, rather than the level of natural resource rents, is negatively associated with economic growth. These evidences suggest a need to shift the focus of the resource curse literature from level impacts of resource abundance to volatility effects in resource income.

With these empirical connections in mind, we extend our model to take into account the fact that government revenues may be generated from natural resources, the prices of which are subject to uncertainty. This is particularly interesting since the revenues generated by resources in the future depend not just on the stochastic nature of the resource price, but also on the endogenously derived extraction path. We first show that even when there is no patronage employment, the path of natural resource extraction determined in a political equilibrium tends to deviate from the socially efficient (utilitarian) path. Part of the reason for this has nothing to do with uncertainty and relates to the simple fact that an incumbent choosing the amount of resource extraction today may not be re-elected in the future. In these circumstances, he tends to over-extract resources relative to the efficient path (Robinson et al., 2006, 2014).

More interestingly, when resource extraction is chosen by a politician, rather than a benevolent social planner, the politician only provides the type of public goods that he and his own client

[1] We gratefully thank a referee for pointing out this feature to us.

[2] Using panel data for 93 countries and constructing measures of policy volatility based on the standard deviation of the residuals from country-specific regressions of government consumption on output, their analysis suggests economically significant effects: a one-standard-deviation increase in policy volatility reduces long-term economic growth by about 0.74 % in the panel regressions, and by more than one percentage point in the cross-section.

[3] The impact of volatility is higher for point-based resources (oil, diamonds); in landlocked, ethnically polarized economies with weak financial institutions; where there are current account restrictions and when there is high capital account mobility. See also van der Ploeg and Poelhekke (2010).

group value. This implies that future uncertainty about the resource price creates greater volatility in public good provision (since the politician does not smooth public good provision across groups like the social planner would). This volatility effect promotes greater resource extraction in the present. The mechanism leads to even more resource extraction than would be socially desirable. Interestingly van der Ploeg (2010) characterized the socially efficient extraction path under uncertainty, showing that resource extraction in the present should be higher than when the price is deterministic. Our analysis shows therefore, that natural political economy considerations lead uncertainty to increase resource extraction by even more than what would be socially efficient under such uncertainty. This new result is due to the interplay between elections and volatility.

The rest of the paper is organized as follows. In Section 2 we set up a basic political economy model of public income volatility. In Section 3 we apply and extend our framework to study resource price volatility, resource extraction, and the political economy of the resource curse. In Section 4 we conclude. In a separate online appendix we show derivations and extensions left out of the main text.

2. A simple political economy model of public income volatility

We consider a society populated by a continuum of voters, with measure normalized to 1. Each voter belongs to one of two groups, and each group A, B is of equal size $\frac{1}{2}$. There is one politician from each group, and the politician from group A initially holds power. With a slight abuse of notation we use the subscript i to denote a voter, a politician, as well as the group the voter or politician belongs to. A voter i in group $i \in \{A, B\}$ has preferences over a private good C_t^i and a group-specific public good G_t^i at each point in time $t \in \{1, 2\}$, represented by the following per period utility function:

$$U_t^i = C_t^i - \gamma^i \frac{\left(\bar{G} - G_t^i\right)^2}{2} \text{ for } i \in \{A, B\}, \tag{1}$$

with $\bar{G} > 0$. There is no discounting, so total utility is simply the sum of the per period utilities. This quadratic (concave) specification of the public good utility introduces a motivation to smooth public policy. The higher is the parameter γ^i the more important are public goods for utility relative to private goods consumption, and we allow this valuation to differ across groups. Some groups may put a higher value on, or be in higher need of, public good provision than others. Unlike the previous literature, we investigate how public sector income volatility affects political incentives and equilibrium policy, in such a setting.[4]

In period $t \in \{1, 2\}$ there is some public sector income Z_t. Future public sector income is uncertain. We thus assume that Z_2 is stochastic, and such that $Z_2 = \bar{Z}_2 + \epsilon$ with $\bar{Z}_2 > 0$ and ϵ a random variable defined on $[-a, a]$ such that $E(\epsilon) = 0$ and $var(\epsilon) = \sigma^2$.[5]

2.0.1. First period

In the first period, the incumbent politician has to decide how to allocate public sector income between his own consumption, public goods, and patronage transfers to individual citizens (through the number of public offices L_t^i at a fixed public wage $W > H$ where H is the productivity of the private sector). Patronage is not socially optimal, and to capture this in a simple way we set the productivity in these types of public jobs to zero. At the end of the first period there is an election. We assume that the election may be affected by patronage. One simple way to do this is to assume that a politician in power in the future will not fire public workers from his own group, but will fire public workers from the other group. Then the future utility of workers who benefit from patronage is linked to the political success of their patron.[6]

The challenger cannot use patronage strategically since this politician has no decisions to make in the first period. The fact that the model has only two periods with the assumption that the politician in power has some monopoly over all current political decisions, implies a strong incumbency bias. This captures in a simple way the notion that politicians in power can use such power to strategically manipulate elections. One might argue that this set of assumptions implies an extreme form of asymmetry between politicians: only the politician in power will offer patronage in equilibrium. In Section C of the online appendix we show that a very similar mechanism carries through in an infinite horizon setting where *both* politicians offer the same amount of equilibrium patronage when in power, and where there is discounting.[7] The intuition is that the politician with current power can offer patronage ahead of the opposition politician. This allows him not only to increase his reelection probability directly, but also to increase the possibility that he remains in power tomorrow, and thus to be able to offer a new round of patronage to his supporters, increasing further their utility to support him. Although such a model becomes much more involved than the simpler model we present in the main text, it is interesting and important to note the robustness of the mechanism we model.

The crucial feature for our mechanisms to operate is that incumbent politicians give patronage to members of their own group, and also that when new politicians enter they dismantle the patronage of previous incumbents to reward their own clientelistic networks. Empirically, several country studies suggest that this is the case. In Brazil, for instance, Monteiro and Ferraz (2012) show that oil windfalls create an incumbency advantage since (p. 21) "an oil windfall is associated with a huge expansion in the public sector and the majority of new employees don't have tenure" and that (p. 23) "non-tenured employment and the threat of firing are crucial to guarantee that voters credibly support incumbent politicians". This is also in accordance with the study of Brazil by Caselli and Michaels (2013) who analyze the use of resource revenues and argue that (p. 231) "Taken together, the evidence leads us to conclude that the missing money result is explained by a combination of patronage spending/rent sharing and embezzlement" . Similar mechanisms are also highlighted for Venezuela by e.g. Penfold-Becerra (2006) who studies the use of social funds and finds that (p. 2) "the government used these funds clientelistically" . He also stresses that (p. 4) "Once elected to office, Chávez dismantled the existing social programs

[4] van der Ploeg (2010) uses a similar specification for the public good utility to analyze the question of optimal resource extraction. We will return to a comparison between his socially optimal extraction path and the political equilibrium extraction path when we apply and extend our approach to deal with resource extraction in Section 3.

[5] We extend the model to include taxes in the online appendix.

[6] There is an extensive literature discussing how and why patronage may be credible, and may therefore affect elections. A common element in the part of the literature where voting cannot be observed is that, in one way or another, a politician can more credibly commit not to fire public sector workers from his own group than from the other group. There may be many different reasons for patronage to groups close to the politician to be more credible than patronage to groups distant from the politician. These may include preferences for own group members, efficiency wages, higher costs of firing workers from your own group, the fact that it is easier to monitor how own group members vote, or the idea that politicians build their leadership on internal support from their own group. For different microfoundations see e.g. Robinson and Torvik (2005), Robinson et al. (2006), and Robinson and Verdier (2013). The particular microfoundation chosen is not essential for our analysis, and thus we use our reduced form assumption to simplify the analysis.

[7] For an infinite horizon probabilistic voting model, see also Robinson and Torvik (2009).

designed under the previous administrations and created a "Unified Social Fund" directly managed by the Armed Forces".[8]

2.0.2. Second period

In the second period, after the election, whichever politician wins takes power. That politician first decides how much to allocate from the government budget for his own consumption. Then there is the realization of the public revenues shock. After the realization of the shock to public revenues, provision of public goods is implemented. This formulation captures in a simple way the fact that shocks to public sector income affect the provision of public goods, since public policies have to be adjusted to satisfy the budget constraint after these shocks. This feature, and our assumption that voters dislike instability in the provision of public goods, provides a mechanism via which income volatility influences the reelection prospects of the policymaker.

Since politicians belong to one of the groups, they have the same preferences as other members of the group. The per period preferences V_t^i of a politician $i = A, B$ is therefore

$$V_t^i = R_t^i - \gamma^i \frac{\left(\bar{G} - G_t^i\right)^2}{2}.$$

Here R_t^i denotes the politician's private good consumption, which is determined by how much public resources the politician appropriates for himself.

The per period budget constraint for a politician $i = A, B$ in power is

$$G_t^A + G_t^B + R_t^i = Z_t - W\left(L_t^A + L_t^B\right), \tag{2}$$

which says that the total expenditure on public goods, $G_t^A + G_t^B$, plus rent extraction by the politician, R_t^i, must be equal to exogenous government income, Z_t, minus the wage bill incurred by patronage employment, $W\left(L_t^A + L_t^B\right)$ where L_t^A is public sector (patronage) employment of people from group A and L_t^B is employment from group B.

To find the re-election probability we employ a version of the probabilistic voting model (see Lindbeck and Weibull, 1987; Persson and Tabellini, 2000). Each voter i has an ideological bias s^i towards the incumbent politician A. Denoting $U_2^i(A)$ the expected future utility of a voter i if the incumbent wins, and $U_2^i(B)$ if the opposition wins, the voter supports the incumbent if

$$U_2^i(A) + s^i + \theta > U_2^i(B). \tag{3}$$

We assume that s^i is uniformly distributed at the interval $\left[-\frac{1}{2s}, \frac{1}{2s}\right]$ with density $s > 0$, and θ is a random shock affecting the popularity of the incumbent. It is assumed to be uniformly distributed at the interval $\left[-\frac{1}{2h}, \frac{1}{2h}\right]$ with density $h > 0$.

We make two assumptions to ensure interior solutions for second period rents for the politician in power and his level of public goods provision:

Assumption A1. $a < \min\left\{\frac{1}{\gamma^i}; \bar{G} - \frac{1}{\gamma^i}\right\}$.

Assumption A2. $\bar{Z}_2 - \frac{W}{2} > \bar{G} - \frac{1}{\gamma^i}$.

Assumption A1 says that the second period variation in public income is not too large, ensuring that there is always room in the budget to provide a positive amount of public goods (and at the same time that the provision is less than $\bar{G}$). Assumption A2 guarantees that the politician in power always obtains positive rents.

2.1. Timing of events and equilibrium

The timing of the game can be summarized as follows.

- The incumbent politician chooses the policy vector $\{R_1^A, G_1^A, G_1^B, L_1^A, L_1^B\}$ subject to the budget constraint (2).
- First period payoffs are realized.
- Politicians A, B compete in the election by non-cooperatively offering policies $\{R_2^A(A), G_2^A(A), G_2^B(A), L_2^A(A), L_2^B(A)\}$ and $\{R_2^B(B), G_2^A(B), G_2^B(B), L_2^A(B), L_2^B(B)\}$, respectively, which again must satisfy (2).
- Whichever politician wins the election takes power and chooses his rent and public employment.
- The public income shock ϵ is realized.
- Second period revenues are realized, and actual public good provision and consumption takes place for all agents.

Voters realize that for policies to be implemented they have to be ex post optimal for the chosen politician. Politicians cannot credibly commit to policies which are not in their own interest. As usual we find the pure strategy subgame perfect equilibrium, and in the continuation we thus apply backward induction to solve the model.

A full characterization of equilibrium would specify second period policies for any combination of patronage employment in the first period. However, it will become clear below that the incumbent politician A will never offer public employment to voters from group B (as this is costly and will also reduce his reelection probability since these voters realize they will only remain in employment should politician B win the election). Moreover, we have already specified that a politician will not fire workers from his own group should he win the election, but will fire workers from the other group. For these reasons we limit attention to situations where $L_1^B = L_2^B(A) = 0$ and $L_2^A(A) = L_1^A$.

2.2. Period 2: credible policies

The politician who wins the election decides post-election policies.

Consider first the case where the initial opposition politician B is elected. There will not be any patronage employment since such employment is only optimal when there are election incentives and period 2 is the final period. The politician does not provide public goods to group A voters, and thus $G_2^A(B) = 0$. His choice of $R_2^B(B)$ and $G_2^B(B)$ is the solution of the following program:

$$\max_{R_2^B, G_2^B} R_2^B - \gamma^B E\left[\frac{\left(\bar{G} - G_2^B\right)^2}{2}\right]$$

subject to the budget constraint (2), where $E(.)$ reflects the expectation operator with respect to the public revenue Z_2. From the budget constraint the level of public goods provided to his group is in general given by $G_2^B(B) = \max\left[Z_2 - R_2^B(B); 0\right]$. Due to Assumption A1 above, however, we only need to consider regimes in which $G_2^B(B) > 0$ for all realizations of Z_2. Given the quadratic utility function on the

[8] Other examples, from Africa, include Burundi where Nkurunziza and Ngaruko (2005) find that (p. 1) "The leaders have allocated public investment and public employment to benefit members of their group", and Kenya where Barkan and Chege (1989) show how under the Kenyatta presidency public expenditures strongly favored the Kenyatta provinces, but that with the election of Moi as president, within the first year after his election, public policy strongly shifted to benefit Moi provinces (see also Burgess et al. (2015)).

public good, the problem can then be rewritten in terms of certainty equivalent as

$$\max_{R_2^B} R_2^B - \gamma^B \frac{\left(\bar{G} - E\left[G_2^B(B)\right]\right)^2}{2} - \gamma^B \frac{\sigma^2}{2}, \tag{4}$$

with $E\left[G_2^B(B)\right] = \bar{Z}_2 - R_2^B(B)$.

The first order condition for an interior solution can be written as:

$$1 = \gamma^B \left(\bar{G} - E\left[G_2^B(B)\right]\right),$$

which gives the optimal level of politician B's rent to be:

$$R_2^B(B) = \bar{Z}_2 + \frac{1}{\gamma^B} - \bar{G},$$

and the level of provision of the public good specific to group B:

$$G_2^B(B) = Z_2 - \bar{Z}_2 + \bar{G} - \frac{1}{\gamma^B}.$$

Consider next the case where the initial incumbent politician A is reelected. Using the same solution procedure as for politician B, we find that politician A does not offer public goods to group B voters and hence $G_2^B(A) = 0$. The optimal level of politician A's rent is given by

$$R_2^A(A) = \bar{Z}_2 - WL_1^A + \frac{1}{\gamma^A} - \bar{G}, \tag{5}$$

and the level of group A specific public goods is

$$G_2^A(A) = Z_2 - \bar{Z}_2 + \bar{G} - \frac{1}{\gamma^A}. \tag{6}$$

Substitution of the above solutions immediately gives the second period expected utility of private sector voters of type $i \in A, B$ when a politician of type $j \in A, B$ is in power:

$$U_2^i(j) = H - \frac{1}{2\gamma^i} - \gamma^i \frac{\sigma^2}{2} \text{ when } i = j, \text{ and } U_2^i(j) = H - \frac{\gamma^i}{2}\left(\bar{G}\right)^2 \text{ when } i \neq j. \tag{7}$$

Private sector voters have their private consumption equal to their productivity H. Apart from that term, the expected utility of private sector voters changes with the identity of the politician in office. If the politician from the same group as a voter wins the election there is a utility gain of $\frac{\gamma^i}{2}\left(\bar{G}\right)^2 - \frac{1}{2\gamma^i}$ compared to the situation where the politician from the other group gets into power. At the same time though, with a politician from his own group in power, a voter also faces volatility in the level of public good provision that reduces his utility by $\gamma^i \frac{\sigma^2}{2}$. We show in the online appendix that the net utility stemming from having a politician from your own group in power is always positive.

Similar reasoning allows us to derive the expected utility for public employee voters of group A to be

$$U_2^L(A) = W - \frac{1}{2\gamma^A} - \gamma^A \frac{\sigma^2}{2} \text{ and } U_2^L(B) = H - \frac{\gamma^A}{2}\left(\bar{G}\right)^2, \tag{8}$$

where the only difference compared to Eq. (7) is that private consumption equals the public wage W when the incumbent politician A is reelected.

These expressions reflect the asymmetric commitment capacity between the incumbent A and the challenger B. When reelected the incumbent A keeps offering public jobs to his clients in group A. These public positions pay a public wage W which is larger than the private sector productivity H. Conversely, when getting into power, the challenger B has no interest in giving public sector jobs to any voter as this only reduces what he can get for himself out of the public budget. Individuals of type A having a public sector job from the incumbent in the first period, therefore loose some rent $W - H$ when the politician of type B is in power. Their private consumption is thus higher when their patron wins the election.

2.3. Period 1: voters and the reelection probability of the incumbent

We are now in a position to compute the probability of reelection of the political incumbent. In the online appendix we show that this is given by

$$\Pi = \frac{1}{2} + h\left(\left(\gamma^A - \gamma^B\right)\frac{1}{4}\left(\left(\bar{G}\right)^2 + \frac{1}{\gamma^A\gamma^B} - \sigma^2\right) + (W - H)L_1^A\right). \tag{9}$$

There are two noteworthy implications of this reelection probability. First, as expected, it depends positively on the level of public employment L_1^A that the incumbent allocates in the first period to his clients:

$$\frac{\partial \Pi}{\partial L_1^A} \equiv \Pi_L = h\,(W - H) > 0. \tag{10}$$

This is related to the asymmetric capacity of the incumbent to propose credibly some public sector rents to his clients in group A. This produces an incumbency bias. Having political power allows the incumbent to tie the continuation utility of some voters to his own political success.

Second, we see that in general the probability of reelection depends on the volatility of the resource price:

$$\frac{\partial \Pi}{\partial \sigma^2} \equiv \Pi_{\sigma^2} = -h\left(\gamma^A - \gamma^B\right)\frac{1}{4}. \tag{11}$$

To see the intuition behind this result, consider the case where the provision of public goods is more important for group A than for group B voters, i.e. $\gamma^A > \gamma^B$. We then note that $\Pi_{\sigma^2} < 0$. Conditional on the public good of a group being provided, voters suffer a utility loss which is increasing in the volatility of the provision. This utility loss is higher the more important the provision of the public good is. Thus, although increased volatility makes the utility of both groups of citizens less tied to the political success of their own politician, the fall in support is greater for politician A than for politician B. It follows that the incumbent's probability of reelection Π is decreasing in public revenue volatility when the incumbent belongs to the group where public provision is most needed. If, on the other hand, the incumbent belongs to the group where public provision is least needed, his election probability is increasing in volatility. This result therefore captures in a simple manner the fact that revenue volatility has an impact on political turnover. In this sense, political uncertainty is connected to economic uncertainty. We also note that this link is stronger the higher the heterogeneity in preferences between groups (i.e. the higher the absolute value of $\gamma^A - \gamma^B$).

2.4. Period 1: policy of the incumbent

Inserting from Eqs. (5) and (6) into the utility function of the incumbent politician A, the incumbent solves the optimization program:

$$\max_{R_1^A, G_1^A, L_1^A} R_1^A - \gamma^A \frac{\left(\overline{G} - G_1^A\right)^2}{2} + \Pi\left[\overline{Z_2} - WL_1^A + \frac{1}{2\gamma^A} - \overline{G} - \gamma^A \frac{\sigma^2}{2}\right] + (1-\Pi)\left[-\frac{\gamma^A}{2}\left(\overline{G}\right)^2\right],$$

subject to Π being given by Eq. (9), and the budget constraint:

$$G_1^A + R_1^A = Z_1 - WL_1^A. \tag{12}$$

The level of provision of the public good specific to group A in period 1 is given by

$$G_1^A = \bar{G} - \frac{1}{\gamma^A} > 0,$$

while the incumbent politician's rent is

$$R_1^A = Z_1 - WL_1^A + \frac{1}{\gamma^A} - \bar{G} > 0.$$

The equilibrium level of public (patronage) employment is the solution of the first order condition:

$$\Pi_L'\left(\bar{Z}_2 - WL_1^A + \frac{1}{2\gamma^A} - \bar{G} - \gamma^A\frac{\sigma^2}{2} + \frac{\gamma^A}{2}\left(\bar{G}\right)^2\right) - W(1+\Pi) = 0. \tag{13}$$

The solution of this equation provides the equilibrium level L_1^A of clientelistic public jobs. The first term $\Pi_L'\left(\bar{Z}_2 - WL_1^A + \frac{1}{2\gamma^A} - \bar{G} - \gamma^A\frac{\sigma^2}{2} + \frac{\gamma^A}{2}\left(\bar{G}\right)^2\right)$ reflects the marginal benefit of political patronage. It is given by the marginal probability of reelection Π_L' associated with a public job, multiplied by the term in bracket reflecting the increase in utility for the incumbent of staying in power in the second period.

The second term $W[1+\Pi]$ is the expected resource cost for the incumbent to offer a public job. As the incumbent commits to public positions while in power, this resource cost has to be paid in the first period and in expected terms in the second period. The larger the probability of reelection Π, the larger this cost. At equilibrium the marginal benefit of patronage has to be equal to its marginal cost.[9]

2.5. Revenue volatility and policy efficiency

The following proposition summarizes our first main result:

Proposition 1. *Higher volatility in public revenues, that is an increased σ^2, increases patronage employment L_1^A if and only if*

$$\frac{2\gamma^A}{\gamma^A + \gamma^B} > \frac{W}{H}. \tag{14}$$

[9] Note that the second order condition for L_1^A is $-2W\Pi_L' = -2Wh(W-H) < 0$ and is therefore satisfied.

Proof. We first differentiate Eq. (13) to obtain

$$\frac{\partial L_1^A}{\partial \sigma^2} = \frac{-\Pi_L'\frac{\gamma^A}{2} - W\Pi'_{\sigma^2}}{2W\Pi_L'}.$$

Inserting from Eqs. (10) and (11) we find

$$\frac{\partial L_1^A}{\partial \sigma^2} = \frac{\gamma^A H - \frac{W}{2}\left(\gamma^A + \gamma^B\right)}{4W(W-H)},$$

which is positive if and only if Eq. (14) holds.■

When the incumbent politician is the one associated with the group that values the public good most, then patronage employment increases with revenue volatility if policy preferences are sufficiently heterogenous across groups, and/or if public wages are not too high compared to private sector productivity. The intuition for this is the following. On the one hand, more fiscal volatility reduces the value of being in power for the incumbent, and therefore induces a lower level of public employment L_1^A since this is motivated by the payoff from securing reelection. On the other hand, higher revenue volatility implies that voter utility will be lower in the future if he wins future political power, and this reduces his probability Π of reelection. In turn, this reduces the expected cost of public jobs, and promotes the use of public employment as an instrument of political patronage to push his reelection probability back up. If the latter effect dominates, then patronage employment increases.

A first corollary to Proposition 1 is that:

Corollary 1. *Aggregate income in the present decreases with higher volatility if and only if patronage employment increases.*

Proof. The effect on current income $Y_1 = H + Z_1 - L_1^A H$ of increased volatility is given by

$$\frac{\partial Y_1}{\partial \sigma^2} = -H\frac{\partial L_1^A}{\partial \sigma^2},$$

and thus increased revenue volatility pushes current income down if and only if it induces higher patronage employment.■

This corollary shows that the effect on aggregate income from volatility in our basic model works exclusively through the effect on policy inefficiency due to patronage.

A second corollary to Proposition 1 is that:

Corollary 2. *When there is no heterogeneity in the valuation of public goods, i.e. $\gamma^A = \gamma^B$, increased revenue volatility reduces patronage employment.*

Proof. This follows by noting that when $\gamma^A = \gamma^B$ Eq. (14) reduces to $H > W$, which is never the case.■

Therefore, the possibility of increased policy inefficiency with higher revenue volatility is intimately linked to the polarization of preferences. Moreover, maybe paradoxically, for policy inefficiency to increase with revenue volatility, it has to be the case that the group that values public provision *the most* holds power.

We can also find the effect on total expected aggregate income over the two periods, $Y_1 + Y_2$, given by $Y_1 + Y_2 = 2H + Z_1 + \bar{Z}_2 -$

$(1+\Pi)L_1^A H$. Taking into account that Π is determined by Eq. (9), an increase in the volatility gives

$$\frac{\partial\left(Y_1+Y_2\right)}{\partial\sigma^2}=-\left(1+\Pi+\Pi'_L L_1^A\right)H\frac{\partial L_1^A}{\partial\sigma^2}-L_1^A H\Pi'_{\sigma^2}. \tag{15}$$

Thus there are two effects from increased volatility on the net present value of expected aggregate income. First, as above, if volatility stimulates patronage this pulls in the direction of decreased total income. Second, since higher volatility reduces the reelection probability of the incumbent, it decreases the likelihood that there is patronage employment in the second period, pulling in the direction of increased expected total income.[10]

2.6. Extension: public investment

A possible concern with our basic model is that we assumed the policy space to be restricted to targeted public goods and inefficient patronage employment. We did not allow for the possibility of efficient policies that benefit the society at large. A key question is if the presence of such policies means that inefficient policy no longer prevails, or the incentives for it are weakened in political equilibrium. In the online appendix we extend to model to discuss this question.

When public investments increase private sector productivity, then the gain by receiving patronage employment is smaller. Thus, other things equal, public investments decrease the probability of political survival. In the online appendix we show, paradoxically, that in exactly the circumstances where increased volatility reduced policy efficiency in the basic model, extending the policy space to allow for general public investments that benefit a broad cross section of society actually makes the problem *worse*.

3. Application: volatility and the resource curse

We now extend and apply our approach to study a particular form of public sector income volatility, namely that related to the extraction of natural resources. We study how price volatility affects resource extraction, compare this to the social efficient extraction path, and discuss the interplay between resource extraction, political patronage and price volatility. To highlight the new effects coming from resource extraction, we first analyze the model without patronage. We then extend the analysis to include patronage, and show that in such a case volatility may produce a resource curse both as a result of higher overextraction and more patronage employment.

3.1. Introducing resource extraction

The physical quantity of the resource extracted in the first period is denoted e. In the period after the election there is $r(e)$ left of the resource, with $r'<0$ and $r''<0$. The latter property is standard and could be due to, e.g., increasing marginal costs in resource extraction. The intertemporal path of prices (p_1,p_2) is determined on world markets and taken as given by our small open economy. Thus we now have public revenue in period 1 given by $Z_1=p_1e$, and public revenue in period 2 given by $Z_2=p_2r(e)$. We shall assume that $p_1=\bar{p_1}>0$ is deterministic and that p_2 is stochastic and such that $p_2=\bar{p_2}+\epsilon_p$ with $\bar{p_2}>0$ and ϵ_p a random variable defined on $[-a_p,a_p]$ such that $E(\epsilon_p)=0$ and $var(\epsilon_p)=\sigma^2$. Before the election the incumbent now faces the problem of choosing the same variables as in the basic model, but in addition has to choose the path of resource extraction.

Taking into account that $Z_2=p_2r(e)$, the reelection probability of the incumbent is now given by:

$$\Pi=\frac{1}{2}+h\left(\left(\gamma^A-\gamma^B\right)\frac{1}{4}\left(\left(\overline{G}\right)^2+\frac{1}{\gamma^A\gamma^B}-\sigma^2r(e)^2\right)+(W-H)L_1^A\right). \tag{16}$$

Simple inspection shows that $\Pi'_e>0$ if $\gamma^A>\gamma^B$, while $\Pi'_e<0$ if the opposite holds. To see the intuition, consider the case of $\gamma^A>\gamma^B$. Conditional on having the incumbent in power, voters of type A suffer a utility cost of the fiscal volatility associated with the resource price volatility (that exceeds the cost faced by voters of type B). This cost is positively related to the stock of the resource in the second period. As a consequence, quicker extraction in the first period leaves the voters less exposed to price volatility, and therefore promotes political support for the incumbent. Specifically, one has

$$\Pi'_e=-h\left(\gamma^A-\gamma^B\right)\frac{1}{2}\sigma^2r(e)r'(e),$$

and

$$\Pi''_{e\sigma^2}=-h\left(\gamma^A-\gamma^B\right)\frac{1}{2}r(e)r'(e),$$

showing that this effect is stronger when the volatility parameter σ^2 is larger.

It should be noted, however, that when $\gamma^A>\gamma^B$ volatility still negatively affects the capacity of the incumbent to stay in power, since

$$\Pi'_{\sigma^2}=-h\left(\gamma^A-\gamma^B\right)\frac{1}{4}r(e)^2.$$

The first period program of the incumbent can now be formulated to be

$$\max_{R_1^A,G_1^A,L_1^A,e} R_1^A-\gamma^A\frac{\left(\overline{G}-G_1^A\right)^2}{2}+\Pi\left[\overline{p_2}r(e)-WL_1^A+\frac{1}{2\gamma^A}-\overline{G}-\gamma^A\frac{\sigma^2}{2}r(e)^2\right]+(1-\Pi)\left[-\frac{\gamma^A}{2}\left(\overline{G}\right)^2\right] \tag{17}$$

subject to Π being given by Eq. (16), and the budget constraint

$$G_1^A+R_1^A=p_1e-WL_1^A. \tag{18}$$

To provide a better intuition for the different effects introduced when resource extraction is endogenous, we study two versions of this model. First we assume that patronage employment is not possible, so that $L_1^A=0$. Next we study the case where the incumbent can also use patronage employment.

3.2. Resource extraction without patronage employment

When $L_1^A=0$ we can, as before, readily compute the optimal interior levels of the incumbent's rent $R_1^A=p_1e+\frac{1}{\gamma^A}-\bar{G}$ and group specific public good $G_1^A=\bar{G}-\frac{1}{\gamma^A}$. More interestingly, we can now compare the extraction path in the political equilibrium with the

[10] Again the effect on income is more likely to be negative when the wage gap between the private and public sector is not too large, since by inserting for Π'_L, $\frac{\partial L_1^A}{\partial\sigma^2}$, and Π'_{σ^2} in Eq. (15) the condition for this reduces to

$$-\left(\frac{3}{2}+h\left(\gamma^A-\gamma^B\right)\frac{1}{4}\left[\left(\bar{G}\right)^2+\frac{1}{\gamma^A\gamma^B}-\sigma^2\right]\right)\left(\gamma^AH-\frac{W}{2}\left(\gamma^A+\gamma^B\right)\right)+2\gamma^AhL_1^A(W-H)^2<0,$$

which is more likely to be fulfilled when $\gamma^A>\gamma^B$ and $W-H$ is sufficiently small.

socially efficient extraction path. We first state the main proposition, before we turn to four corollaries that trace out and explain the reasons why the two paths differ.

Proposition 2. *(i) The political equilibrium path of resource extraction, e^*, is given by*

$$p_1 + \overline{p_2} r'(e^*) - (1-\Pi)\overline{p_2} r'(e^*) - \Pi\gamma^A \sigma^2 r(e^*) r'(e^*) + \Pi_e\left(V_{\text{power}}\right) = 0, \tag{19}$$

with the net utility value of staying in power for the incumbent

$$V_{\text{power}} = \bar{p_2} r(e^*) + \frac{1}{2\gamma^A} - \bar{G} - \gamma^A \frac{\sigma^2}{2} r(e^*)^2 + \frac{\gamma^A}{2}\left(\bar{G}\right)^2.$$

(ii) The socially efficient path of resource extraction is given by

$$p_1 + \bar{p_2} r'(e^f) - \frac{\gamma^A \gamma^B}{2\left(\gamma^A + \gamma^B\right)} \sigma^2 r(e^f) r'(e^f) = 0. \tag{20}$$

Proof. See online appendix.■

A first corollary to Proposition 2 is that in the political equilibrium the politician in power discounts the future too much:

Corollary 3. *Assume there is no resource price volatility ($\sigma^2 = 0$). Then the political equilibrium features overextraction of resources compared to the socially efficient extraction path, i.e. $e^* > e^f$.*

Proof. When $\sigma = 0$ Eqs. (19) and (20), respectively, can be rewritten as:

$$p_1 + \bar{p_2} r'(e*) = (1-\Pi)\bar{p_2} r'(e^*) < 0$$

and

$$p_1 + \bar{p_2} r'(e^f) = 0.$$

Since $\Pi < 1$ the corollary follows.■

This corollary shows that political uncertainty makes the politician bias the extraction path towards the present. It replicates the result of Robinson et al. (2006, 2014) highlighting the idea that there is overextraction of natural resources in the political equilibrium. This is of course a simple consequence of the fact that the presence of elections induces political incumbents to discount the future too highly.

A second corollary to Proposition 2 is that:

Corollary 4. *When there is resource price volatility ($\sigma^2 > 0$), the socially efficient extraction path is tilted towards the present.*

Proof. This follows by noting that when $\sigma^2 > 0$ we have from Eq. (20) that

$$p_1 + \bar{p_2} r'(e^f) = \frac{\gamma^A \gamma^B}{2\left(\gamma^A + \gamma^B\right)} \sigma^2 r(e^f) r'(e^f) < 0.$$

■

This corollary resembles the van der Ploeg (2010) effect, which shows how the optimal Hotelling rule of resource extraction needs to be modified when the future resource price is volatile. In particular, he finds that price volatility should bring forward the efficient resource extraction path, and Corollary 4 is a version of this result. We note that the higher the volatility, and the stronger the preference for the provision of public goods, γ^A and γ^B, the more tilted towards the present the socially efficient extraction path is.

To see how we extend the previous literature when we have both elections and price volatility, we now move on to the next corollaries, which compare the extraction path in the political equilibrium with the socially optimal extraction path. The following corollary introduces a first main insight:

Corollary 5. *Consider the case of symmetric preferences, i.e. $\gamma^A = \gamma^B \equiv \gamma$. Then when $r(e)r''(e) + r'(e)^2 \leq 0$ the extent of overextraction is higher the higher is price volatility, i.e. the higher is σ^2.*

Proof. When $\gamma^A = \gamma^B$, this immediately implies that $\Pi_e = 0$ and that $\Pi = \frac{1}{2}$. Inserting this and $\gamma^A = \gamma^B \equiv \gamma$, Eqs. (19) and (20) can be written, respectively, as

$$p_1 + \bar{p_2} r'(e^*) - \frac{1}{2}\bar{p_2} r'(e^*) - \frac{1}{2}\gamma\sigma^2 r(e^*) r'(e^*) = 0,$$

and

$$p_1 + \bar{p_2} r'(e^f) - \frac{1}{4}\gamma\sigma^2 r(e^f) r'(e^f) = 0.$$

Thus the condition for resource extraction in the political equilibrium to increase more than the social optimal extraction reduces to

$$-2r(e^*)r'(e^*) > -r(e^f)r'(e^f). \tag{21}$$

Thus this will always hold provided e^* is not too high compared to e^f. Moreover, if $r(e)r''(e) + r'(e)^2 \leq 0$ this always holds since in this case we have that $|r(e^*)r'(e^*)| \geq |r(e^f)r'(e^f)|$. ■

To see the main intuition behind this corollary, note that a social planner will smooth future price volatility between the two groups of voters since they both will have positive provision of public goods. In a political equilibrium, by contrast, only one of the groups will receive the public good, and thus price volatility generates higher volatility in provision for the group that happens to be in power. As a consequence, since volatility is not smoothed across groups, future volatility is more costly. Thus, when volatility increases, resource extraction is tilted towards the present by a greater amount than is socially optimal. This effect is captured by the second term on the left hand side of Eq. (21).

But there are also two additional effects. On the one hand, as captured by the terms $r(e^*) < r(e^f)$ in Eq. (21), the fact that resource extraction is higher in the political equilibrium than in the social optimum means that less than the socially optimal amount of resources are left for the future by the incumbent politician. Thus a smaller resource stock is exposed to volatility along the political equilibrium path, and increased volatility is less costly than along the socially optimal path. As a consequence, higher volatility increases extraction less today than in the socially efficient extraction path.

On the other hand, there is an effect captured by the terms $-r'(e^*) > -r'(e^f)$. The marginal amount of resources gained in the future when extraction today is reduced is higher along the political equilibrium path than along the socially optimal path. As a consequence when volatility increases, the marginal value of future resources decreases more along the political equilibrium path. This in

turn pushes up extraction today by more in the political equilibrium than in the solution to the social planning problem. In the special case where $r(e)r''(e) + r'(e)^2 = 0$, the two last effects cancel, and only the first positive effect remains, which explains why in this case a higher volatility of the resource price always increases overextraction.

Turning finally to the case of asymmetric preferences, i.e. $\gamma^A \neq \gamma^B$, we have:

Corollary 6. Consider the case of asymmetric preferences, and let $\gamma^A > \gamma^B$. Then from Eq. (19) the term $\Pi_e(V_{\text{power}})$ becomes positive.

(i) This increases overextraction in political equilibrium even more.

(ii) Provided σ^2 is not too high initially, this increase in overextraction is increasing in σ^2.

Proof. Part (i) follows directly as the left hand side of Eq. (19) has now become higher.

To see part (ii), note that the derivative of the term $\Pi_e(V_{\text{power}})$ with respect to σ^2 is given by

$$\Pi_{e\sigma^2}(V_{\text{power}}) + \Pi_e \gamma^A \frac{1}{2} r(e^*)^2,$$

which by substituting for $\Pi_{e\sigma^2}$ and Π_e exceeds zero if

$$\bar{p_2} r(e^*) + \frac{1}{2\gamma^A} - \bar{G} - \gamma^A \sigma^2 r(e^*)^2 + \frac{\gamma^A}{2}\left(\bar{G}\right)^2 > 0,$$

which is always satisfied provided that σ^2 is not too high. ■

The intuition for part (i) is the following. When the group that values public goods the most is in power, then greater resource extraction in the present increases the probability of holding future political power, since this implies a lower volatility cost for the voters (stronger for group A voters than for group B voters). This increases overextraction even more as compared to the symmetric case.

The intuition for part (ii) stems from the fact that, on the one hand, higher resource price volatility decreases the value for the politician of future political power. Since winning power has lower stakes, the incentive to extract more today to secure such political power also becomes weaker. On the other hand, however, higher volatility also means that voters become more responsive: higher extraction today increases the probability of reelection by more when volatility is higher. This pulls in the direction of higher extraction. When the rents of power are sufficiently large (which they are if σ^2 is sufficiently low), this effect always dominates. In that case, the increase in overextraction is increasing in σ^2, as stated in part (ii) of the corollary.

Thus, even in the absence of political patronage a political economy model of price volatility brings novel and interesting effects for resource extraction. Further interesting implications follow when we also allow resource extraction to interact with political patronage, an issue to which we now turn.

3.3. Extension: resource extraction with patronage employment

In this extension, to focus on the most interesting interactions between resource extraction and patronage employment, we investigate the case of asymmetric preferences, and thus again assume that $\gamma^A > \gamma^B$.

With patronage $L_1^A > 0$ the corresponding first order conditions for L_1^A and e are:

$$-(1+\Pi) W + \Pi'_L(V_{\text{power}}) = 0, \tag{22}$$

$$p_1 + \Pi_e(V_{\text{power}}) + \Pi\left(\bar{p_2} - \gamma^A \sigma^2 r(e)\right) r'(e) = 0, \tag{23}$$

with

$$V_{\text{power}} = \overline{p_2} r(e) - W L_1^A + \frac{1}{2\gamma^A} - \overline{G} - \gamma^A \frac{\sigma^2}{2} r(e)^2 + \frac{\gamma^A}{2}\left(\overline{G}\right)^2.$$

Eq. (22) defines a political patronage curve $L_1^A(e)$. As shown in the online appendix, the effect of the resource extraction rate e on L_P involves two effects. First, it increases the probability of reelection and therefore increases the expected resource cost of political patronage. Second, it reduces the net value of staying in power for the incumbent. For both reasons the incentives of the incumbent to offer public jobs are reduced, and political patronage is consequently a decreasing function of the extraction rate. This relationship is depicted as the solid curve $L_1^A(e)$ in Fig. 1.

Similarly, Eq. (23) defines the extraction rate curve $e(L_1^A)$. An increase in L_1^A has also two effects. First, a higher value of L_1^A reduces the incumbent's value of staying in power (as the wage bill to be paid from the public budget is increased). This in turn weakens the incentive to push resource extraction up to increase the election probability, and therefore reduces e. Second, more political patronage increases the time horizon of the incumbent and therefore makes him more likely to keep resources for the next period. Hence, the effect of political patronage on the extraction rate is negative. This relationship is depicted as the solid curve $e(L_1^A)$ in Fig. 1.

The equilibrium policies can be represented in the space (e, L_1^A) in Fig. 1, at point E where the two solid curves intersect.

3.3.1. Price volatility and the resource curse

The effect of price volatility on the equilibrium values of e and L_1^A is obtained through differentiation of Eqs. (22) and (23). In the online appendix we show that (for given extraction) volatility increases patronage when the public wage gap is not too large, and the $L_1^A(e)$-curve then shifts to the right. The effect of volatility on extraction (for given patronage) makes the $e(L_1^A)$ -curve shifts upwards provided the volatility is not too high. As drawn in Fig. 1, note the similarity in the effect of volatility on the two variables. Increased volatility makes it more attractive to employ voters at the same time as it makes it less attractive to leave more resources for the future. A main reason for both of these effects is that higher volatility decreases the reelection probability, in effect making the horizon of the politician shorter.

The induced effect of σ^2 on the equilibrium policies are described by the dotted curves in Fig. 1. Inspection shows immediately that at least one of the variables increases, and quite possibly (as drawn in the figure) they both increase. In that case extraction and patronage employment both increase with higher price volatility.

It is straightforward to verify that in the case where both extraction and patronage employment increase, total income decreases

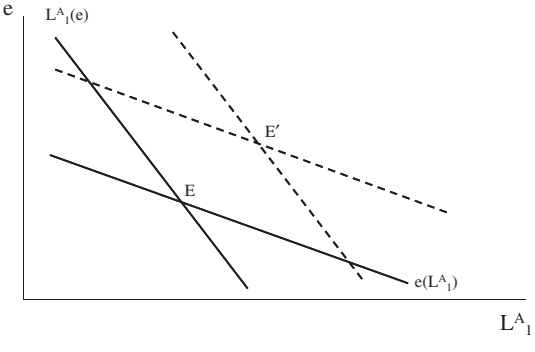

Fig. 1. Resource extraction and patronage.

both as a result of a worse extraction path and as a result of increased patronage employment. Thus in this case we may have a resource curse for both reasons. In the case where only one of the variables decreases, the total effect on income is however uncertain (see the online appendix).

4. Concluding remarks

In this paper we have developed a model of the political consequences of public income volatility which to our knowledge has not previously been researched. As is standard, political incentives create inefficient public policies in our model, but we also show that making income uncertain creates specific new effects. Future volatility reduces the benefit of being in power, making policy more efficient. Yet at the same time, it also reduces the re-election probability of an incumbent. Since some of the policy inefficiencies are concentrated in the future, this makes inefficient policy less costly. This model therefore identifies a potential new connection between volatility and economic growth working through the political economy of public policy.

Our framework also contributes to the recent literature on the political economy of the resource curse. Specifically, when volatility comes from volatile natural resource prices, a first-order problem for many developing countries, we also highlight that volatility in itself can be a source of inefficient resource extraction, accompanied by increased political patronage in the economy. These results are in addition and complementary to those of van der Ploeg (2010) who showed how future uncertainty about natural resource wealth increases the socially efficient extraction rate.

Our analysis is only a first step towards an understanding of the interactions between economic volatility and the political economy of public policies. Our framework opens up scope for several extensions and issues. First, one may think about other public policy dimensions than public goods provision, such as for instance the design of factor markets or good markets regulations. Another interesting extension would be to consider how the nature of political competition and different types of political regimes (democracies or authoritarian regimes) differentially affect the connections between volatility and economic outcomes. From a normative point of view, it would be also useful to discuss more systematically how different sources of volatility matter for the political economy of policy making, and which kind of institution building may socially improve the allocations obtained along the political equilibrium path. Assessing empirically the relative importance of the political mechanisms highlighted here for the connection between volatility and growth remains obviously an important avenue for future research in this area. While beyond the scope of this paper, we hope that our framework can be a stepping stone for such developments.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jpubeco.2016.11.014.

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