Seigniorage and Political Instability

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The importance of seigniorage relative to other sources of government revenue differs markedly across countries. This paper tries to explain this regularity by studying a political model of tax reform. The model implies that countries with a more unstable and polarized political system will have more inefficient tax structures and, thus, will rely more heavily on seigniorage. This prediction of the model is tested on cross-sectional data for 79 countries. We find that, after controlling for other variables, political instability is positively associated with seigniorage. (*JEL* E52, E62, F41)

Over the years, economists and other social scientists have recurrently wondered why inflation rates and seigniorage have, over long periods of time, differed so markedly across countries. How can we explain, for example, that during the period 1971–1982 inflation in Chile was on average 147 percent per annum, in Indonesia 17 percent, in Burnundi 10 percent, and in Germany only 5 percent? Some of the more popular explanations have relied on the obvious, arguing that more inflationary countries have exhibited more lax fiscal and monetary policies than the more stable nations; but this begs the obvious question of *why* some countries are able to maintain fiscal and monetary discipline while others are unable (or unwilling) to do it. A different approach has focused on the characteristics of the tax system, arguing that for institutional or technological reasons the less developed countries are unable to build sophisticated tax systems and thus have to rely heavily on inflation to finance government expenditure. However, this line of thought fails to explain the significant inflation differentials in many countries with roughly the same level of development or the same economic structure. For instance, contrary to popular mythology, not all Latin American countries are highly inflationary (see Edwards, 1989).

In this paper, we accept the traditional explanation that seigniorage reflects high costs of administering and enforcing the collection of regular taxes. However, we argue that the evolution of the tax system of a country also depends on the features of its political system and not just on those of its economic structure.

The central idea of the paper can be stated as follows. An inefficient tax system (i.e., one that facilitates tax-evasion and imposes high tax-collection costs) acts as a constraint on the revenue-collecting policies of the government. This constraint may be welcome by those who disagree with the goals pursued by the current government. In particular, previous governments (or legislative majorities) may deliberately choose to maintain an inefficient tax system, so as

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to constrain the behavior of future governments (or majorities) with which they might disagree. Of course, this is more likely to happen in countries with more unstable and polarized political systems. This argument is formalized and made more precise in Section II of the paper.

This idea leads to an obvious empirical implication, namely that, after controlling for the stage of development and the structure of the economy, more unstable and polarized countries collect a larger fraction of their revenues through seigniorage, compared to more stable and homogeneous societies. This conjecture is tested in Section III of the paper.

I. Cross-Country Differentials in Inflation and Seigniorage

Table 1 shows average inflation and seigniorage over 1971–1982 for 79 countries for which data are available.[1] Inflation is defined as the rate of change of the consumer price index, while seigniorage is defined as the ratio of the increase in base money to total government revenues (the latter inclusive of seigniorage). This table points to a very wide range of inflationary experiences. While some countries, even some very poor ones, have been very stable, others have had extremely high rates of inflation. Also, the table shows that the extent to which countries use money creation to finance their expenditures varies quite widely, with some countries relying on seigniorage to cover over 25 percent of their revenues.[2]

How much of this cross-country variability can be explained by economic variables alone? To answer this question, we estimate some cross-country linear equations that re-

[1]For some countries, data on seigniorage are available only for a subinterval during 1971–1982. In this case, the average is taken over the longest time period within 1971–1982 for which data could be obtained.

[2]Alternative ways of measuring seigniorage basically provide us with the same picture. In addition to the measure used in the text we have defined seigniorage as $\Delta H/E$, $\pi H/Y$, $\pi H/E$, where H is high-powered money, E represents total government expenditures, π is inflation, and Y is nominal GNP.

TABLE 1—INFLATION AND SEIGNIORAGE: AVERAGE 1971–1982 (PERCENTAGE)

Country	Inflation	Seigniorage
Australia	10.4	3.0
Austria	6.2	2.7
Belgium	7.5	1.8
Bolivia	30.3	21.6
Botswana	11.4	3.6
Brazil	47.4	17.7
Burma	9.9	15.2
Burundi	12.1	6.4
Cameroon	10.8	5.1
Canada	8.6	3.0
Central African Republic	10.5	20.0
Chad	10.1	9.5
Chile	147.6	17.5
Colombia	22.0	17.1
Congo, Peoples Republic	9.7	4.6
Côte d'Ivoire	11.5	1.1
Denmark	10.0	0.7
Dominican Republic	10.0	6.7
Ecuador	13.2	14.4
El Salvador	11.2	11.4
Ethiopia	9.0	9.6
Finland	11.2	1.6
France	10.1	2.1
Gabon	12.0	3.6
Germany, Federal Republic	5.2	2.5
Ghana	47.8	28.0
Greece	15.8	14.6
Honduras	8.3	5.8
India	8.4	13.1
Indonesia	16.7	9.0
Iran	14.3	12.9
Ireland	14.5	5.8
Italy	14.7	12.4
Jamaica	17.0	4.7
Japan	8.2	8.3
Jordan	10.7	20.9
Kenya	12.7	4.5
Kuwait	8.9	2.6
Lesotho	0.1	2.4
Malaysia	6.2	7.3
Mauritania	0.1	3.0
Mauritius	14.6	10.6
Mexico	21.2	23.9
Morocco	9.0	7.3
Netherlands	7.1	1.1
New Zealand	13.0	1.6
Nicaragua	16.8	8.8
Niger	12.2	9.4
Nigeria	15.5	7.2
Norway	9.0	2.1
Oman	9.3	4.4
Pakistan	12.0	12.8
Papua New Guinea	8.6	0.4
Paraguay	12.8	15.4
Peru	38.2	20.7
Philippines	14.3	6.7
Portugal	18.8	16.6
Rwanda	12.5	10.3
South Africa	11.3	2.8

TABLE 1—CONTINUED

Country	Inflation	Seigniorage
Sierra Leone	13.7	9.5
Singapore	6.6	8.8
Somalia	18.8	15.4
Spain	14.9	9.1
Sri Lanka	9.8	7.1
Sudan	18.7	16.9
Sweden	9.4	2.2
Tanzania	16.4	9.3
Thailand	9.8	7.9
Togo	11.1	10.3
Trinidad and Tobago	13.0	4.2
Tunisia	6.9	4.9
Turkey	33.6	15.3
Uganda	34.3	24.8
United Kingdom	13.2	1.7
United States	7.9	2.3
Venezuela	9.2	5.7
Zaire	42.8	15.5
Zambia	11.5	2.6
Zimbabwe	8.3	4.0

Source: Computed from raw data obtained from *International Financial Statistics* (various issues).

late seigniorage to a set of structural variables suggested in the literature.[3] All variables are averaged over the period 1971–1982, except where otherwise noted. Seigniorage is the dependent variable. The independent variables fall into three categories:

(a) *The sectoral composition of gross domestic product, to account for differences in administering tax collection across sectors.*—We expect the agricultural sector to be the hardest to tax and, thus, to have a positive coefficient in the regressions. The mining and manufacturing sectors are generally regarded as the easiest to tax and, thus, are expected to have a negative coefficient. We also include the ratio of foreign trade to GNP, since in many developing countries imports and exports are a cheap tax base; hence, its coefficient is expected to be negative.

(b) *Two measures of economic development: GDP per capita, and a dummy variable taking a value of 1 for the industrialized countries and 0 otherwise.*—We expect both variables to have a negative coefficient, since the technology for enforcing tax collection is likely to be more inefficient in less-developed countries.

(c) *A measure of urbanization.*—Since tax collection costs are likely to be smaller in urban areas than in rural areas, this leads us to expect a negative coefficient.[4]

These variables are defined more precisely in the Data Appendix.

The results are reported in Table 2, for alternative specifications of the regressions. The first three columns refer to all the countries in the sample. The last two columns refer to developing countries only.[5] Most of the coefficients have the expected sign. One exception is the share of manufacturing and mining, which is positive in equation (v). Its coefficient is, however, insignificant. A second exception involves the coefficient of urbanization, which is always positive and significant. There are two possible ways of interpreting this result. First, a higher degree of urbanization may result in an increase in "underground" economic activities, encouraging the use of the inflation tax. Alternatively, it is possible to interpret this result as providing preliminary evidence in favor of a political explanation of seigniorage differentials. As noted by political scientists, political awareness and political conflicts are likely to be more prominent in urban areas than in rural societies. We will return to this point in Section III.

In column (iii) of Table 2, we added two dummies that group countries into continents. The Latin American dummy is positive and significant at the 5-percent level. We interpret this as providing further evi-

[3]On the relationship between inflation tax and structural variables, see, in particular, Harley Hinrichs (1966), Richard Musgrave (1969), and Joshua Aizenman (1987). Richard Goode (1984) presents a survey of the more recent literature.

[4]Urbanization is the average of two years: 1965 and 1985.

[5]The nondeveloping countries have been defined as those that the IMF classifies as industrialized, plus Greece, Portugal, and Turkey.

TABLE 2—SEIGNIORAGE AND STRUCTURAL VARIABLES

Explanatory variables	All countries			Developing countries only	
	(i)	(ii)	(iii)	(iv)	(v)
Intercept	0.0558 (0.0404)	0.1185** (0.0194)	0.0343 (0.0312)	0.0156 (0.0316)	−0.0167 (0.0696)
Agriculture	0.0014* (0.0006)	—	0.0017** (0.0006)	0.0020** (0.0006)	0.0024* (0.0011)
Mining and manufacturing	—	-5.0×10^{-3} (-6.8×10^{-2})	—	—	0.0007 (0.0013)
Foreign trade	−0.0514** (0.0184)	−0.0626** (0.0184)	−0.0418* (0.0192)	−0.0546* (0.0190)	−0.0512* (0.0203)
GDP per capita	-5.8×10^{-4} (2.5×10^{-4})	-7.2×10^{-4}* (3.0×10^{-4})	-5.7×10^{-4}* (2.5×10^{-4})	4.0×10^{-4} (2.5×10^{-4})	-5.5×10^{-4} (3.9×10^{-4})
Urbanization	0.0014** (0.0004)	0.0010** (0.0004)	0.0011* (0.0004)	0.0022** (0.0004)	0.0023** (0.0005)
Industrialized	−0.0467* (0.0190)	−0.0511* (0.0203)	—	—	—
Asia	—	—	0.0293 (0.0183)	—	—
Latin America	—	—	0.0430* (0.0210)	—	—
$\bar{R}^2$:	0.333	0.281	0.357	0.369	0.360
SE:	0.054	0.056	0.053	0.052	0.052

Notes: In all equations, the dependent variable is seigniorage. Numbers in parentheses are standard errors. The method of estimation is ordinary least squares. The number of countries is 79 for columns (i)–(iii) and 58 for columns (iv)–(v).

*Statistically significant at the 5-percent level; **Statistically significant at the 1-percent level.

dence that noneconomic variables play a role in explaining cross-country inflation differentials.

These regressions account for 33–42 percent of the variance in the data, irrespective of whether or not the industrialized countries are included. (These figures refer to the regressions R^2, rather than the $\bar{R}^2$ given in the table.) This result is not discouraging, given how different these countries are. However, it leaves a large margin for improvement. This is what we attempt to do in the remainder of the paper. In the next section, we analyze a simple model of tax reforms that has implications for cross-country differences in seigniorage. We then show, in Section III, that this theoretical explanation is consistent with the data.

II. A Political Model of Tax Reforms

The central feature of the model in this section is a distinction between fiscal policy and tax reforms. A fiscal policy is the choice of tax rates and of the level and composition of government spending. A tax reform is the broad design of a tax system that determines the available tax bases and the technology for collecting taxes. Even though in practice it may be difficult to decide where to draw the line, at a conceptual level this distinction has important implications. A tax reform that changes the tax system will typically take time and resources, since it requires investment in the acquisition of information and in infrastructure. A fiscal policy, on the other hand, can be imple-

mented more swiftly. Thus, at any given moment in time, the existing tax system acts as a constraint on the fiscal policy of the current government. This suggests that tax reforms are also determined by strategic considerations: a tax system is designed by taking into account how it will constrain the fiscal policies of future governments. The central idea of this section is that, if there is political instability and political polarization, these strategic considerations may induce the current government to leave an inefficient tax system to its successors.[6]

A. *The Model*

To focus the analysis on the political determinants of the tax system, the economy is described only by two simple equations: the budget constraint of the government [equation (1)] and of the private sector [equation (2)]:

$$(1) \qquad g_t + f_t \leq \tau_t(1-\theta_{t-1}) + s_t$$

$$(2) \qquad c_t \leq 1 - \tau_t - s_t - \delta(\tau_t) - \gamma(s_t).$$

Subscripts denote time periods. Each individual is endowed with one unit of output in each period. The variables g_t and f_t represent two different public goods in per capita terms, and c_t is private consumption, also per capita. The government collects from each individual an amount s_t, in the form of "seigniorage," and an amount τ_t of tax revenue. The main difference between taxes and seigniorage is that a fraction θ_{t-1} of the tax revenue is wasted due to tax-collection costs, whereas seigniorage carries no administrative costs. Both taxes and seigniorage impose deadweight losses on the private sector, equal to $\delta(\tau_t)$ and $\gamma(s_t)$, respectively. These distortions increase at an increasing rate.[7] Thus, $\delta'(\cdot) > 0$, $\delta''(\cdot) > 0$, $\gamma'(\cdot) > 0$, and $\gamma''(\cdot) > 0$.

In equation (1), θ_{t-1} is a rough measure of the efficiency of the tax system. A lower value of θ implies a more efficient tax system. Thus, in this model, a tax reform amounts to a choice of θ, whereas a fiscal policy is a choice of g, f, τ, and s. To capture the greater inertia in reforming the tax system than in changing fiscal policy, we assume that θ, but not the other policy variables, must be chosen one period in advance. Thus, θ_t is chosen at time t but exerts an influence on tax-collection costs only at time $t+1$ [cf. equation (1)].[8]

There are two possible policymaker types, L and R, who randomly alternate in office. The policymaker of type i, $i = \mathrm{L}, \mathrm{R}$ maximizes:

$$(3) \qquad W_t^i = E_t\left\{ \sum_{k=0}^{\infty} \beta^k [U(c_{t+k}) + H^i(g_{t+k}, f_{t+k})] \right\}$$

$$1 > \beta > 0$$

where $E_t(\cdot)$ denotes the expectation operator, $U(\cdot)$ is a concave and twice continuously differentiable utility function, and

[6]This same idea is at the core of some recent research that views public debt as a strategic variable used by the current government to influence its successors (see Torsten Persson and Tabellini, 1990 Ch. IX). Carol Rogers (1989) also studies tax reforms in this way.

[7]In a previous version of the paper, we generalized all the results to alternative ways of modeling the inertia of the tax system (such as with lump-sum costs). In the empirical analysis of Section III, we also allow θ to be partially determined by technological features of the economy, like those proxied by the variables of Table 2.

[8]This specification abstracts from two possible complications. First, it presumes that neither the government nor the private sector has access to a capital market. Second, by not explicitly modeling the distortionary effects of seigniorage and regular taxes, it abstracts from the time-inconsistency problems associated with both instruments. These two complications have already been extensively investigated in the literature, and their effects are well known (see Persson and Tabellini, 1990). Here, we neglect them in order to focus on the novel issue of how the political system of a country governs the evolution of its taxing institutions. However, in the empirical analysis reported in Section III we do consider the potential role of government borrowing.

$H^i(\cdot)$ is defined as follows: if $i = \mathrm{L}$,

$$(3') \quad H^{\mathrm{L}}(g,f) = \left(\frac{1}{\alpha(1-\alpha)}\right)\min[\alpha g,(1-\alpha)f] \qquad 1 > \alpha > 0$$

and if $i = R$, then $H^{\mathrm{R}}(\cdot)$ is defined as in (3'), but with α replaced by $(1-\alpha)$. Thus, these two policymakers differ only in the desired composition of the public good. For simplicity, their disagreement is parameterized by α. The more distant α is from $\frac{1}{2}$, the more they disagree. By construction, the overall weight given to private versus public consumption does not depend on α.

The political system is described as a Markov process with transition probabilities π and $1-\pi$: the government that is in office at time t has a fixed probability $1-\pi$ of being reappointed next period. With probability π, it is thrown out of office and the other policymaker type is appointed.

These simplifying assumptions can be extended in several ways. All the results continue to hold if the political process is modeled as in Alberto Alesina and Tabellini (1990), where rational voters elect the policymaker type at the beginning of each period. In a previous version of the model, we showed that, under appropriate conditions, the results generalize to a concave $H(\cdot)$ function in (3). Similarly, the symmetry of the model and the fact that both government types assign the same weight to private versus public consumption simplify the exposition but do not affect the nature of the results.

In this model, then, the political system has two important features: its *instability*, represented by the probability of losing office, π, and the degree of *polarization* between the alternating governments, represented by the disagreement parameter α. As we show below, these two features determine the equilibrium efficiency of the tax system.

B. *Economic Policy Within a Given Tax System*

This subsection characterizes the equilibrium choice of τ_t, s_t, g_t, and f_t for a given value of θ_{t-1}. The choice of θ is studied in the next subsection. Since θ is the only state variable, the equilibrium values of τ, s, g, and f as a function of θ are found by solving the static problem of maximizing $[U(c)+H^i(g,f)]$, subject to (1) and (2). Time subscripts are omitted when superfluous. We only describe the equilibrium when type L is in office; for concreteness, we assume $\alpha > \frac{1}{2}$. By symmetry, the opposite case of R in office is obtained by replacing g with f.

Let $x \equiv g + f$ denote the total amount of government spending. After some transformations, the first-order conditions of this problem are given by:[9]

$$(4a) \quad g^{\mathrm{L}} = (1-\alpha)x \qquad f^{\mathrm{L}} = \alpha x$$

$$(4b) \quad 1 = U'(c)[1+\gamma'(s)]$$

$$(4c) \quad [1+\gamma'(s)] = \frac{1+\delta'(\tau)}{1-\theta}.$$

Equation (4a) describes the optimal allocation of public consumption. The L superscripts serve as reminders that type L is in office. Equation (4b) compares the marginal utility of public and private consumption. With distortionary taxes, at an optimum the marginal utility of public consumption (unity) exceeds the marginal utility of private consumption. Equation (4c) is the Ramsey rule: it equates at the margin the distortions associated with the last dollar collected from each source of revenue. These three conditions underscore that the identity of the government only matters for the composition of public consumption. Both government types choose the same level of overall public spending and the same tax policy, irrespective of the value of α.

Together with (1) and (2), equations (4) implicitly define the equilibrium values of all variables as functions of the efficiency of

[9] Because of the concavity of $U(\cdot)$ and the convexity of $\delta(\cdot)$ and $\gamma(\cdot)$, the second-order conditions are always satisfied.

the tax system, θ:

$$(5)\qquad c^* = C(\theta)$$
$$x^* = X(\theta)$$
$$s^* = S(\theta)$$
$$\tau^* = T(\theta).$$

Applying the implicit function theorem to (1), (2), and (4) yields the following proposition (the proof is available from the authors upon request):

PROPOSITION 1:

$$X'(\theta) < 0$$
$$S'(\theta) > 0$$
$$C'(\theta) > 0$$
$$T'(\theta) < 0.$$

Thus, as suggested by intuition, a more inefficient tax system discourages public spending and forces the government to rely more on seigniorage and less on regular taxes as a source of revenue. Also, a more inefficient tax system raises private consumption.[10]

C. *Choosing the Efficiency of the Tax System*

We now turn to the question of how the efficiency of the tax system is determined in equilibrium. Since, by assumption, θ has to be set one period in advance and there is no cost in changing it, it is sufficient to look one period ahead in order to characterize the infinite-horizon equilibrium. With probability $1-\pi$, type L is reappointed in office tomorrow. In this case, by (4a) and (3), his utility is

$$(6a)\qquad U(C(\theta)) + X(\theta)$$

where $X(\theta_t)$ is total public spending. With probability π, type R is appointed tomorrow. By symmetry, $g^{\mathrm{R}} = f^{\mathrm{L}}$ and $f^{\mathrm{R}} = g^{\mathrm{L}}$. Hence, by (4a) and (3), and since $\alpha > \frac{1}{2}$, type-L utility, if out of office, is

$$(6b)\quad U(C(\theta)) + \frac{(1-\alpha)}{\alpha}X(\theta) \qquad \frac{1-\alpha}{\alpha} < 1.$$

Thus, θ is chosen so as to maximize the following expected-utility function (because of the symmetry of the model, this is also the utility function of type R, when in office):

$$(7)\quad (1-\pi)\left[U(C(\theta)) + X(\theta)\right] + \pi\left[U(C(\theta)) + \frac{(1-\alpha)}{\alpha}X(\theta)\right] \equiv U(C(\theta)) + \beta(\pi,\alpha)X(\theta)$$

where $\beta(\pi,\alpha) \equiv (1-\pi) + \pi(1-\alpha)/\alpha \leq 1$.

The equilibrium value of θ satisfies the first-order condition:[11]

$$(8)\quad U'(C(\theta))C'(\theta) + \beta(\pi,\alpha)X'(\theta) \leq 0$$

which holds with equality if $\theta > 0$. The first term on the left-hand side of (8) is the marginal gain of raising the inefficiency of the tax system; since $C'(\theta) > 0$, this gain takes the form of higher private consumption. The second term is the expected marginal cost of a more inefficient tax system, which takes the form of reduced public consumption [recall that $X'(\theta) < 0$].

According to (8), the magnitude of this expected marginal cost depends on $\beta(\alpha,\pi)$. The following facts about $\beta(\cdot)$ are worth noting:

$$(9)\qquad \beta_\pi(\pi,\alpha) < 0$$
$$\beta_\alpha(\pi,\alpha) < 0$$
$$\lim_{\substack{\alpha\to 1\\ \pi\to 1}} \beta(\pi,\alpha) = 0$$

[10]Because the $H^i(\cdot)$ function is linear, all the income effects of a more inefficient tax system fall on public consumption. If $H^i(\cdot)$ were concave, this would no longer be true, and we would need additional conditions to sign $C'(\theta)$ and $T'(\theta)$.

[11]We assume that the second-order conditions are satisfied. As in all optimal-taxation problems, this involves some assumption on the third derivatives of $U(\cdot)$ and $H(\cdot)$.

where a subscript denotes a partial derivative. Thus, the expected marginal cost of having an inefficient tax system is lower (i) the more unstable and (ii) the more polarized is the political system. In the limit, this marginal cost tends to zero as the political system becomes extremely unstable and polarized.

By equations (8) and (9), the equilibrium efficiency of the tax system, θ^*, is a function of the stability and polarization of the political system:

$$\theta^* = \Theta(\pi, \alpha).$$

Thus, we have the following proposition.

PROPOSITION 2:

(i) $\Theta(0, \alpha) = \Theta(\pi, \frac{1}{2}) = 0$.

(ii) *There exists a pair* $\pi_0 < 1$ *and* $\alpha_0 < 1$ *such that* $\Theta(\pi, \alpha) > 0$ *for any* $\pi > \pi_0$, $\alpha > \alpha_0$.

(iii) *If* $\theta^* > 0$, *then* $\Theta_\pi > 0$ *and* $\Theta_\alpha > 0$.

The first statement follows by combining equations (4) and (8) and by noting that $\beta(0, \alpha) = \beta(\pi, \frac{1}{2}) = 1$. The rest of the proof is obtained by applying the implicit function theorem to (8), and by invoking (9) and the second-order conditions.

Proposition 2 summarizes the central theoretical result of the paper. If the current government is certain of being reappointed or if there is no polarization, then it always brings about the most efficient tax system. However, with a sufficient degree of political instability or polarization, a more inefficient system may be preferred. More generally, the lower is the probability that the current government will remain in office and the greater is polarization, the more inefficient is the tax system left as a legacy to future governments. This happens for a purely strategic reason and even though it is costless to improve the efficiency of next period's tax system: a more inefficient tax-collection apparatus discourages future governments from collecting taxes and spending them on goods that are not valued by the incumbent policymaker. The equilibrium value of θ is chosen so as to equate the expected marginal benefit of constraining future governments to the marginal cost caused by inefficient taxation. When π decreases or α approaches $\frac{1}{2}$, the marginal cost of an inefficient tax system rises, since the current government is more likely to be reappointed, or if not reappointed, it does not care much since it is more similar to its opponent. As a result, θ^* decreases.[12]

Combining Propositions 1 and 2 yields the following central empirical implication: *countries with more unstable and polarized political systems rely more heavily on seigniorage as a source of revenue than do more stable and homogeneous societies.* In Section III, we test this positive implication.[13]

III. The Evidence

In this section, we extend the cross-sectional investigation of Table 2 by adding explanatory variables that refer to the political system. Each observation corresponds to a time average for a specific country. Our goal is to estimate an equation of the following general form:

$$(10) \qquad s_i = \alpha + \boldsymbol{\beta}\mathbf{z}_i + \boldsymbol{\gamma}\mathbf{p}_i + u_i$$

where the subscript refers to country i; s_i denotes the level of seigniorage as a fraction of total government revenues (including seigniorage); $\mathbf{z}_i$ is a vector of variables measuring the economic structure of country i; $\mathbf{p}_i$ is a vector of political variables designed to capture the degree of instability and of polarization of the political system; and u_i is an error term. We are interested

[12] In a previous version of this paper, we showed that having a positive value of θ is generally *ex ante* efficient (in the sense that it yields a higher expected utility for both government types and for voters). The intuition for this result is that a higher value of θ reduces the variance of public consumption and increases private consumption.

[13] The model yields the very strong prediction that the efficiency of the tax system *only* depends on political variables and not on the structural features of the economy. However, this extreme prediction of the theory can easily be modified by subtracting from equation (2) a term that captures the cost of maintaining a low θ_{t-1} and by making it dependent on the features of the economy.

in the signs of the estimated coefficients of γ.

The economic variables are the same as in Table 2. They account for economic and structural factors affecting the cost of administering and enforcing tax collection. The measurement of the political variables presents several difficulties. Even though the notions of political instability and polarization are conceptually well defined, they do not have an obvious measurable counterpart. We deal with this problem in the next subsection, where we estimate a probit model to obtain a measure of political instability. We defer the discussion on polarization to Subsection III-C.

A. *Measures of Political Instability and Polarization*

The theoretical model isolates a central feature of the political system: the degree of political instability, defined as the probability of a government change as perceived by the current government. This feature is unobservable. As a proxy, we construct a measure of political instability from the data of Charles L. Taylor and David A. Jodice (1983). These data contain yearly observations on regular and irregular (i.e., coups) government transfers, unsuccessful coup attempts, executive adjustments, and other political events.

First, we estimate a yearly probit model on time-series data, or on pooled time-series and cross-country data, over the period 1948–1982. At this stage, we do not discriminate between regular and irregular government changes, even though we do it below, in the cross-country regressions. The dependent variable takes a value of 0 for the years in which there is no government change (regular or irregular) and a value of 1 otherwise. Changes in the composition of the executive are not considered to be changes in government.[14] The explanatory variables in the probit model fall into three broad classes: economic variables designed to measure the recent economic performance of the government, political variables accounting for significant political events that may signal the imminence of a crisis, and structural variables accounting for institutional differences and country-specific factors that do not change or that change only slowly over time. These structural variables consist of three dummy variables that group countries according to their political institutions in (i) democracies, (ii) democracies in which the election date is determined by the constitution, and (iii) democracies ruled by a single majoritarian party. Even though these three groups are too broad to account for the variety of existing political institutions, at least they discriminate between very different constitutional environments. All these variables are defined in Table 3.

Table 4 reports the results of the probit regression when all countries are pooled and a country-specific dummy is included. Most variables have the expected sign, even though not all are statistically significant. In particular, government change is made more likely by unusual inflation in the previous year and by unusually low growth of private consumption over the current and previous two years. Moreover, riots, political repressions, adjustments in the composition of the executive, and unsuccessful attempts to change the government all signal the imminence of a political crisis. Two of the institutional dummies are significant. Democracies have more frequent government changes than nondemocratic regimes, and, coalition governments or minority governments are less stable than majoritarian governments. Several of the country-specific dummies (not reported in the table) are also statistically significant, indicating that there are additional factors contributing to instability of the political system which are not fully captured by our explanatory variables.

[14]Taylor and Jodice (1983) define a regular government change as a change in the office of national executive from one leader or ruling group to another that is accomplished through conventional legal or customary procedures. John A. Lott and David Reiffen (1986) have used this data set to analyze the economic value of dictators.

TABLE 3—VARIABLE DEFINITIONS

1. *Government Change*:
   Government change ≡ dummy variable taking a value of 1 for the years in which there is either a coup or a regular government transfer and taking a value of 0 otherwise [*Source:* Taylor and Jodice, 1983]

2. *Economic Performance*:
   Inflation ≡ annual rate of growth of GDP deflator [*Source:* constructed from Robert Summers and Alan Heston, 1988]
   Economic growth ≡ cumulative rate of growth of private consumption in the current and previous two years [*Source:* Summers and Heston, 1988]

3. *Political Events*:
   Riots ≡ violent riots [*Source:* Taylor and Jodice, 1983]
   Repressions ≡ Political executions and government-imposed sanctions [*Source:* Taylor and Jodice, 1983]
   Executive adjustments ≡ changes in the composition of the executive not resulting in government transfer [*Source:* Taylor and Jodice, 1983]
   Attempts ≡ unsuccessful attempts to change the government, taking the form of unsuccessful coups and unsuccessful government transfer [*Source:* Taylor and Jodice, 1983]
   Years ≡ years from previous government change

4. *Structural Variables*:
   GDP per capita in constant U.S. dollars of 1975 [*Source:* Summers and Heston, 1988]
   Democracy ≡ a dummy variable taking a value of 1 for democracies and taking a value of 0 otherwise [*Source:* Arthur Banks (various issues)]
   Elections ≡ a dummy variable taking a value of 1 if the election date is determined by the constitution and 0 otherwise [*Source:* Banks (various volumes)]
   Majority ≡ a dummy variable taking a value of 1 for presidential systems or for parliamentary governments supported by a single majority party and taking a value of 0 otherwise [*Source*: Banks (various volumes)]

The variables inflation, consumption growth, protests, riots, and repressions are all in the form of deviation from country-specific means.

These estimates are very robust to changes in the model specification. This same regression has been estimated on each country separately (except that the structural variables have been dropped and all lags of the same variables have been constrained to have the same coefficient, in order to save degrees of freedom).

Using the pooled time-series cross-country regressions and the country-specific probit regressions, we compute two estimated frequencies of government change in each country during the period 1971–1982. They are obtained by averaging the estimated probabilities of government change over that time period. These two estimated frequencies of government change provide two alternative measures of political instability. We label them P and P^S, respectively. A third measure of political instability is the *actual* frequency (F) of government change (including coups). As shown in our 1990 working paper, these three measures of political instability are highly correlated with each other. They are also correlated with other measures, estimated from alternative specifications of the probit model.

There are two possible sources of error in these estimates. First, they contain more information than was available to the governments at the time, since they are estimated from data through 1982. Second, they omit relevant information that was available to the governments but is not reflected in our explanatory variables. Presumably, the most important omitted information con-

TABLE 4—PROBIT ESTIMATES

Explanatory variable	Current	Lagged once	Lagged twice
Government change	—	−0.0793 (0.0822)	−0.0315 (0.0774)
Inflation	—	0.0020 (0.0012)	−0.0030 (0.0023)
Consumption growth	−0.3894 (0.2652)	—	—
Riots	0.0052 (0.0040)	−0.0016 (0.0040)	0.0060 (0.0037)
Repressions	0.0047** (0.0018)	−0.0013 (0.0009)	0.0019 (0.0013)
Executive adjustment	0.0828** (0.0242)	0.0493* (0.0234)	−0.0182 (0.0226)
Attempts	0.3995** (0.0670)	−0.0138 (0.0358)	−0.0232 (0.0357)
Years	−0.0004 (0.0113)	—	—
GDP per capita	1.3×10^{-3} (2.3×10^{-3})	—	—
Democracy	0.6195** (0.2010)	—	—
Election	−0.2436 (0.2259)	—	—
Majority	−0.3291* (0.1341)	—	—

Notes: The dependent variable is government change. Standard errors are in parentheses. The country-specific dummies have been omitted from the table but are included in the regression. There are 1,399 observations for change = 0 and 593 observations for no change = 1 (total number of observations = 1,992). The time period is 1948–1982. If a country became independent after 1948, only the years since independence have been included.

*Statistically significant at the 5-percent level; **Statistically significant at the 1-percent level.

cerns institutional detail not observable or not easy to quantify. We deal with both of these problems in Subsection III-D.

Besides political instability, the theoretical model of Section II emphasizes the importance of another political variable: the degree of polarization between the current government and its likely future contenders. Measuring this form of polarization is a considerably more difficult task. In Subsection III-C, we discuss the inclusion of variables that may proxy for it.

B. *Data Description*

The sample of countries, determined by data availability, is the same as in Tables 1 and 2. The data sources are described in the Data Appendix. The variables are averaged over the time period 1971–1982, except where otherwise noted. In Subsection III-D we report the results of experimenting with other periodizations. Summary statistics of the relevant variables can be found in our 1990 working paper.

TABLE 5—SEIGNIORAGE AND POLITICAL VARIABLES

Explanatory variables	All countries (i)	(ii)	(iii)	(iv)	(v)	Developing countries only (vi)
Intercept	0.0071 (0.0294)	0.0898** (0.0189)	−0.0015 (0.0301)	0.0158 (0.0290)	0.0340 (0.0281)	−0.0201 (0.0319)
Agriculture	0.0016** (0.0006)	—	0.0018** (0.0006)	0.0013* (0.0006)	0.0012* (0.0006)	0.0021** (0.0005)
Mining and manufacturing	—	−0.0007 (0.0168)	—	—	—	—
Foreign trade	−0.0430* (0.0166)	−0.0511 (0.0169)	−0.0350* (0.0177)	−0.0415* (0.0162)	−0.0474** (0.0166)	−0.0431* (0.0182)
GDP per capita	-5.2×10^{-4}* (2.2×10^{-4})	-5.3×10^{-4}* (2.7×10^{-4})	-4.6×10^{-4}* (2.3×10^{-4})	-5.2×10^{-4}* (2.2×10^{-4})	-5.1×10^{-4}* (2.2×10^{-4})	-4.4×10^{-4} (2.4×10^{-4})
Urbanization	0.0013** (0.0004)	0.0008* (0.0003)	0.0011* (0.0004)	0.0013** (0.0004)	0.0015** (0.0004)	0.0019** (0.0004)
Industrialized	−0.0746** (0.0182)	−0.0844** (0.0218)	—	−0.0694** (0.0180)	−0.0767** (0.0201)	—
Asia	—	—	0.0036 (0.0180)	—	—	—
Latin America	—	—	0.0268 (0.0196)	—	—	—
P	0.1840** (0.0421)	0.1849** (0.0456)	0.1759** (0.0458)	0.1468** (0.0449)	—	0.1583** (0.0539)
RF	—	—	—	—	0.0540** (0.200)	—
Coups	—	—	—	0.1326* (0.0623)	0.1865** (0.0593)	—
$\bar{R}^2$:	0.461	0.407	0.461	0.486	0.464	0.448
SE:	0.048	0.051	0.048	0.047	0.048	0.049
ρ:	0.1923 [0.0895]	0.2460 [0.0289]	0.2192 [0.0523]	0.1632 [0.1508]	0.1216 [0.2857]	0.2704 [0.0401]

Notes: The dependent variable is seigniorage, for all regressions. Standard errors are given in parentheses. All observations are yearly averages over the period 1971–1982. P is the estimated frequency of government change obtained from Table 3 for the 1971–1982 period. RF is the actual frequency of *regular* government transfers during 1971–1982. "Coups" is the average actual frequency of coups (during 1971–1982). The statistic ρ is the Spearman rank correlation coefficient between the estimated residuals and the index of totalitarianism (averaged over 1971–1982). The numbers inside the brackets below the ρ estimate give the significance probability of the estimate under the null hypothesis that $\rho = 0$. The number of observations is 79.

*Statistically significant at the 5-percent level; **Statistically significant at the 1-percent level.

C. *The Cross-Country Regressions*

Table 5 reports the estimates of equation (10) on the cross-country data. In the first three columns, the measure of political instability estimated in Table 4 (P) is added to seigniorage regressions. This variable is positive and has a highly significant estimated coefficient in every regression. It remains positive even after including dummy variables that group countries into continents. Compared to Table 2, the estimated coefficients of these dummies drop significantly and the $\bar{R}^2$'s improve considerably. The same results emerge if we replace P with the other two measures of political

instability discussed in Subsection III-A or if we estimate the equation on developing countries only [column (vi)].[15] These results then provide clear support for our view that, after controlling for structural variables, countries with a more unstable political system rely more heavily on seigniorage as a source of revenue.[16]

Our model suggests that the degree to which countries rely on seigniorage not only depends on political instability, but also on political polarization. A problem with this proposition at the empirical level is that it is not easy to find indexes of polarization. To tackle this issue, we consider a number of proxies for polarization. We first note that the variable P in equations (i)–(iii) in Table 5 does not discriminate between regular government changes and those originated by coups. However, this distinction may be important as an indicator of polarization: a government change taking the form of a coup is likely to be a much more radical change than one occurring through regular democratic procedures. Hence, according to our theory, seigniorage should be positively related to the expected frequency of coups, even after controlling for other measures of instability. This prediction is borne out by the regression analysis. In column (iv) of Table 5, the actual frequency of coups is included among the explanatory variables. Its estimated coefficient is positive and highly significant. In equation (v) in Table 5, we further refine the idea that the frequency of coups captures polarization. There, we include the actual frequency of regular government changes during 1971–1982 (RF) and the actual frequency of coups as separate variables. Both variables have a positive and significant estimated coefficient, but the estimated coefficient of coups is much larger than that of regular government changes, which is consistent with the view that, in addition to instability, the frequency of coups also proxies for polarization. This provides preliminary evidence that both instability and polarization positively affect the reliance on seigniorage.

Democracies are more likely to be viable in societies with a higher degree of internal cohesiveness (Daniel Usher, 1981). Thus, democracies are likely to have lower levels of polarization than totalitarian regimes. Hence, our theory suggests that, controlling for political instability, seigniorage should be larger in more totalitarian countries. To test this conjecture, we replaced the coups variable in column (iv) of Table 5 by a dummy taking a value of 1 in democratic regimes and 0 otherwise; its estimated coefficient (not reported in the table) is negative and highly significant; it remains negative (even though it becomes barely significant) if the coups variable is also included. In addition to this dummy variable, we also used a ranking of totalitarianism compiled by Freedom House (with higher numbers corresponding to more totalitarian regimes; see the Data Appendix for details). This index of totalitarianism is qualitative, and it does not make much sense to include it in the regressions as an explanatory variable.[17] To overcome this difficulty, we compute the Spearman rank correlation coefficient between this index of totalitarianism and the estimated residuals of each of the equations in Table 5. This coefficient, denoted by ρ at the bottom of Table 5, is always positive, but it is almost never significant.[18]

[15]The variable P is a generated regressor. As such, our estimates of the standard errors may be biased in general. However, this problem does not invalidate the t statistics for the null hypothesis that the estimated coefficient of P is zero, since under the null the standard errors are unbiased (see Adrian Pagan, 1984). Since we are interested in testing precisely this hypothesis, we do not attempt any correction. However, this may be a problem in interpreting the t statistics of the remaining variables.

[16]Of course, there is a possibility of reverse causation, from inflation to instability. We deal with this issue in Table 6.

[17]Doing so results in a positive and barely significant coefficient in most regressions.

[18]As an alternative way to capture the role of polarization, we incorporated in our analysis an index of income distribution. To the extent that societies with more unequal income distribution are more polarized, we would expect them to have higher seigniorage. Unfortunately, since data on income distribution are

Finally, as we noted above, the positive and significant estimated coefficient of urbanization can also be regarded as an indication that seigniorage is higher in more polarized countries. As remarked by several political scientists, political conflicts are generally more intense and disruptive in urban areas than in rural societies.[19]

A possible objection to the results presented in Table 5 is that they could be due to reverse causation: governments that create excessive inflation lose popular support and are more likely to be thrown out of office. Hence, inflation can lead to political instability, rather than the other way around. However, we think that this is unlikely. Political stability also reflects other, permanent or slowly changing features of a political system. Political institutions, culture, tradition, underlying conflicts, cleavage of the population into organized groups, and the extent of political participation and involvement of the citizens are all semipermanent features of a country that affect its political stability. However, the problem deserves careful scrutiny. Indeed, the probit estimates of Table 4 indicate that previous inflation, although not significant, reduces the probability of reappointment.

In order to cope with this problem we reestimated equation (10) by means of instrumental variables. The economic variables are used as instruments for themselves. As an instrument for political instability we use the expected frequency of government change in the previous decade, estimated by truncating the probit regressions of Table 4 in 1970 and computing the expected frequency in the decade 1960–1970. This variable is highly positively correlated with the estimated frequency for the period 1971–1982 used in Table 5, confirming that political instability is a semipermanent feature of a country. In the appendix of our 1990 working paper, we discuss the conditions under which this instrument is uncorrelated with the error term of (10), for the 1971–1982 period. Essentially, these conditions require that the error term of (10) not be highly correlated across different decades.

This instrumental-variable procedure is also likely to correct for measurement errors. As noted previously, our estimate of P incorporates more information than was available to the governments at the time. Now, this error is corrected because the instrument is based on probit estimates up to 1970 and thus excludes any information incorporated in P but not available to the governments.

The results from the instrumental-variable estimation are reported in Table 6. The first three columns are the analogues of the first three columns in Table 5. The results are very similar to those of the previous table. The fourth column adds the dummy variable for democracies (in place of the frequency of coups, which may also be correlated with the error term). The results confirm those of Table 5. Finally, the fifth column replaces the estimated probability from Table 4 with that estimated for each country separately; the same procedure is used to obtain an instrument. The results are, again, very similar to those obtained in Table 5.

To evaluate the *relative* importance of the different independent variables, we computed the standardized estimates of each coefficient. The results suggest that political instability is one of the most important variables affecting seigniorage. For example, in equation (i) of Table 5, the following standardized estimates were obtained: agriculture, 0.415; foreign trade, −0.206; GDP per capita, −0.287; urbanization, 0.466; industrialization dummy, −0.571; political instability, 0.593.

Summarizing, the data are strongly consistent with the predictions of the theory: more unstable countries collect a larger fraction of their revenue in the form of seigniorage. Moreover, the evidence is not inconsistent with the view that political polarization also leads to more seigniorage.

limited, an index of income distribution could be constructed for 37 countries only. As expected, for this limited sample the coefficient of income inequality turned out to be positive, although not significant at conventional levels. For an example of the type of result obtained, see our 1990 working paper.

[19]This point of view is stressed for instance in Samuel Huntington (1968) and Andrew Berg and Jeffrey Sachs (1988).

TABLE 6—INSTRUMENTAL-VARIABLE ESTIMATION

Explanatory variable	All countries (i)	(ii)	(iii)	(iv)	(v)	Developing countries only (vi)
Intercept	−0.0084 (0.0339)	0.0857** (0.0219)	−0.0183 (0.0340)	0.0070 (0.0335)	−0.0160 (0.0505)	−0.0541 (0.0395)
Agriculture	0.0017** (0.0006)	—	0.0019** (0.0006)	0.0015** (0.0006)	0.0015* (0.0007)	0.0021** (0.0006)
Mining and manufacturing	—	−0.0009 (0.0007)	—	—	—	—
Foreign trade	−0.0370* (0.0171)	−0.0501** (0.0172)	−0.0287 (0.0182)	−0.0359* (0.0167)	−0.0272 (0.0246)	−0.0278 (0.0209)
GDP per capita	-4.8×10^{-4}* (2.2×10^{-4})	-4.5×10^{-4} (2.8×10^{-4})	-4.1×10^{-4} (2.4×10^{-4})	-5.5×10^{-4} (2.2×10^{-4})	-5.9×10^{-4}* (2.9×10^{-4})	-4.6×10^{-4} (2.6×10^{-4})
Urbanization	0.0012** (0.0004)	0.0007* (0.0003)	0.0010* (0.0004)	0.0013** (0.0004)	0.0009 (0.0005)	0.0016** (0.0005)
Industrialized	−0.0836** (0.0206)	−0.0922** (0.0239)	−0.0707* (0.0323)	−0.0724** (0.0206)	−0.1228** (0.0431)	—
Asia	—	—	−0.0011 (0.0220)	—	—	—
Latin America	—	—	0.0232 (0.0217)	—	—	—
P	0.2508** (0.0759)	0.2327** (0.0857)	0.2562** (0.0887)	0.2430** (0.0737)	—	0.3220** (0.1052)
P^S	—	—	—	—	0.3881* (0.1840)	—
Democracy	—	—	—	−0.0307* (0.0148)	—	—
$\bar{R}^2$:	0.425	0.361	0.437	0.448	0.264	0.409
SE:	0.048	0.0504	0.048	0.0472	0.0646	0.0523
ρ:	0.1783 (0.1158)	0.2289 (0.0424)	0.2072 (0.0669)	0.0567 (0.0698)	0.1648 (0.1467)	0.3279 (0.0120)

Notes: The dependent variable is seigniorage for all regressions. Standard errors are given in parentheses. The method of estimation is instrumental variables. The instrument for P is the estimated frequency of government change for the period 1960–1970, estimated by truncating the probit model in 1970. The instrument for F is the actual frequency of government change during the period 1960–1970. P is the estimated frequency of government change obtained from Table 3 for the 1971–1982 period; P^S is the estimated frequency of government change using country-specific probit regressions for the same period. Democracy is defined as in Table 3. The statistic ρ is the Spearman rank correlation coefficient between the estimated residuals and the index of totalitarianism (averaged over 1971–1982). The number of observations is 78 (Papua New Guinea became independent after 1970 and hence is omitted from this sample).

*Statistically significant at the 5-percent level; **Statistically significant at the 1-percent level.

D. *Sensitivity Analysis*

Perhaps the single most important question is whether the previous findings are robust to possible measurement errors. Three variables in particular are likely to be measured with error: political instability, GDP per capita, and urbanization. To answer this question, we compute consistent bounds on the coefficient of the variable of interest, political instability.

We use Stephen Klepper and Edward Leamer's (1984) direct- and reversed-regressions procedure to obtain the bounds for the estimated coefficients. For equations (i), (iv), and (vi) in Table 5 the bounds for

the political-instability coefficient turned out to be positive in all cases: (0.107, 0.888), (0.080, 1.123), and (0.047, 1.113). Similar results are obtained for urbanization and GDP per capita. We infer from these results that the findings of the previous subsection are robust to the possibility of measurement error in political instability, urbanization, and per capita income.[20]

A second important question is whether the results are robust to alternative specifications of the model. We already commented on the fact that other specifications of the probit model all yield results similar to those reported in Tables 5 and 6. In addition, we tried several alternative specifications of the cross-country regressions, again with no influence on the result that seigniorage is positively related to political instability. Specifically, adding other sectors of the economy (manufacturing and mining in isolation) or dropping some variables did not alter the essence of the results reported in Tables 5 and 6.

A possible limitation of the results reported above is that the regressions do not include government debt as a potential determinant of seigniorage. In principle, however, it is possible to think that governments use both the efficiency of the tax system and the stock of debt as ways to constrain their (potential) opponents' ability to spend. To the extent that our regressions are interpreted as reduced forms, where variables such as debt and seigniorage are expressed in terms of their exogenous determinants, the average value of debt should not be considered in the estimation of the seigniorage equation.[21] There may be components of debt that are exogenous to the framework just sketched, however. For example, debt may be constrained by the availability of funds to the government. In that case, debt is at least partially exogenous, and its level may affect seigniorage even in the reduced form. The reason is that the size of domestic debt influences the desirability of using inflation to reduce the real value of the debt. Therefore, it may be argued that *initial* debt:GNP ratios should be included in the reduced form for seigniorage, as a way of controlling for the different constraints (and temptations) faced by the countries in our sample.

In order to investigate the robustness of our results, we added the initial debt ratios to a number of regressions. Since for a large number of developing nations there are no data on domestic debt, our analysis was restricted to 48 of the original 79 countries. The domestic-debt variable was taken from the data reported in table F of the International Monetary Fund's *Government Financial Statistics* (various issues) and was defined as total domestic debt minus debt held by the monetary authorities. The domestic debt:GNP ratio (DDGNP) corresponds to 1970 or the closest available observation to 1970. The following equation is an example of the type of results obtained when the domestic debt:GNP ratio is added to the analysis (as before, standard deviations are in parentheses):[22]

$$\begin{aligned}\text{seigniorage} = {} & 0.027 + 0.0016^{**}[\text{agriculture}] \\ & (0.045)\quad (0.0008) \\ & -0.040[\text{trade}] \\ & (0.035) \\ & -5.77\times10^{-4}[\text{per capita, GDP}] \\ & (4.79\times10^{-4})\end{aligned}$$

[20] Edwards and Tabellini (1991b) run a regression similar to Table 5, but with a different measure of political instability. This alternative measure only considers those government changes that result in a transfer of power from one political party or leading group to another. The results of Table 5 are confirmed, thus providing a further check of their robustness.

[21] In a general model of strategic government behavior, both the efficiency of the tax system and the stock of debt can be used as ways to constrain the future administration's policy set. In such a general model, seigniorage, the efficiency of the tax system, and the stock of debt are all determined jointly as functions of the exogenous variables considered in this study, including political instability.

[22] This equation was estimated using ordinary least squares. When instrumental variables were used, the results obtained were not altered in any significant way. In particular, the coefficient of the debt ratio remained negative and insignificant, while that of political instability was significantly positive. The list of the countries used in this regression is available from the authors upon request.

$$+0.001^{**}[\text{urban}] \quad (0.0004)$$

$$-0.039[\text{industrialized}] \quad (0.033)$$

$$+0.128^{**}[\text{political instability}] \quad (0.054)$$

$$-0.040[\text{DDGNP}] \quad (0.062)$$

($\bar{R}^2 = 0.420$, $N = 48$; two asterisks indicate statistical significance at the 1-percent level). As can be seen, the main conclusions obtained from Table 5 still hold. In particular, higher political instability has a positive effect on seigniorage. Alternative specifications, including the use of domestic and foreign debt ratios, yield similar results, indicating that our previous conclusions are robust to the inclusion of debt variables as possible determinants of seigniorage.

We also replaced the dependent variable (change in reserve money scaled by total government revenue) by two alternative measures of seigniorage: (a) inflation times reserve money at the beginning of the period divided by total government revenue (including inflation times reserve money) of the central government and (b) change in reserve money divided by GNP. All measures yielded the same qualitative results as those described in the previous subsections (see Edwards and Tabellini, 1991a).[23]

Halbert White's (1980) test on the covariance matrix of the residuals rejects the hypothesis that there is no heteroscedasticity. However, when the covariance matrix of Table 5 is estimated using White's (1980) consistent estimator, the t statistics are not substantially different from those reported in the table, and all the political variables remain significant.[24] In addition, when the equations in Table 5 are reestimated weighting each observation with per capita income, the results are virtually unchanged (except for agriculture, which becomes insignificant), and the regression fit improves.

IV. Conclusions

Seigniorage is a relatively inexpensive source of government revenue if there is widespread tax evasion or if there are large tax-collection costs. In the existing literature, the nature of these costs is left unspecified, or it is postulated to depend exclusively on exogenous features of a country, such as its stage of development or the structure of the economy. In this paper, we argue that the efficiency of the tax system also reflects deliberate political decisions. In particular, the equilibrium efficiency of the tax system and, hence, seigniorage also depend on political stability and polarization. The evidence supports this implication: more unstable countries rely relatively more on seigniorage to finance the government budget than do stable and homogeneous societies.

This empirical finding could have other explanations besides that advanced in this paper. Political instability, for instance, could reflect a collective decision process that is temporarily blocked. Seigniorage would then reflect the inability to reach any policy decision, rather than being due to costs of enforcing and administering tax collections. Alesina and Allan Drazen (1989) have recently studied a theoretical model with this property. However, their model implies that, after the identity of the weaker party in the struggle over shares is revealed, the use of seigniorage should subside. Therefore, it seem that their framework is more appropriate for explaining temporary bursts of seigniorage, whereas our framework is better suited for explaining persistent cross-country differences in seigniorage of the type illustrated by the data in Table 1. Aizenman (1989) and Pablo Sanguinetti

[23] The results are also robust to alternative specifications of the sample of countries. No qualitative change occurs if the industrialized countries are dropped from the sample [see column (vi) in Tables 5 and 6]. When outliers identified through an influence analysis are dropped from the sample, the results are virtually unchanged. Also, similar results emerge if we reestimate the model by averaging the data over time periods shorter than the 1971–1982 interval.

[24] White's (1980) estimator does not rely on a formal model of the structure of heteroscedasticity.

(1990) have recently proposed other explanations of why countries rely on seigniorage, emphasizing the importance of decentralized decision-making in the policy-formation process.[25] Discriminating between these alternative political explanations is important, since they are likely to have different normative implications.

It is generally believed that the lower the independence of the central bank the higher is inflation and therefore seigniorage. This, in conjunction with our findings, suggests that central-bank independence should be negatively related to political instability. Recent evidence from a sample of middle-income countries suggests that central-bank independence is lower the higher is the degree of regime instability, measured as democratic versus authoritarian (see Cukierman et al., 1991). Thus, high seigniorage, low central-bank independence, and high regime instability are likely to appear together. Further investigation of these issues promises to be an exciting task for future research.

Data Appendix

Data Source and Definitions

In addition to the variables defined in Table 3, we used the following variables:

Seigniorage ≡ change in reserve money divided by total revenue of central government, including seigniorage [*Sources*: *International Financial Statistics and Government Financial Statistics* (various issues)]

Agricultural product ≡ share of GDP produced in the agricultural sector [*Source*: World Bank, 1980]

Mining and manufacturing product ≡ share of GDP produced in the mining and manufacturing sectors [*Source*: World Bank, 1980]

Foreign trade ≡ imports plus exports as fraction of GDP [*Sources*: *International Financial Statistics* and *Government Financial Statistics* (various issues)]

Urbanization ≡ urban population as a percentage of total population (average of data for 1965 and 1985) [*Source*: World Bank, 1988]

Inflation (Table 1) ≡ rate of change of CPI [*Source*: *International Financial Statistics* (various issues)]

Inflation (Table 3) ≡ rate of change of GDP deflator [*Source*: reconstructed from Summers and Heston (1988)]

Index of totalitarianism [*Source*: *Freedom House* (various issues)].

[25] Edwards and Tabellini (1991b), and Vittorio Grilli et al. (1991) have further investigated the empirical validity of alternative positive theories of seigniorage.

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