

# Political Accountability and the Size of Government: Theory and Cross-Country Evidence\*

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## Abstract

This paper explores the effect of political accountability on the size of the public sector in a principal-agent model of democratic government. Political accountability is the degree to which the electorate can control politicians through elections, and emphasis is put on the roles of transparency and political contestability. Increasing transparency and political contestability increases the control of politicians, which makes public goods provision more attractive to voters, increasing the size of government. The prediction of the model is strongly supported by robust empirical evidence from a cross section of 62 democratic countries in 1995.

Keywords: political accountability, control of politicians, size of government

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*“Where the control of officials is weak, one would not expect citizens to allow officials to command many resources.”*<sup>1</sup>

## 1 Introduction

At the end of the twentieth century, the size of government differed greatly across countries. In 1995, tax revenue as percent of GDP was 7.7 percent in Guatemala, and 49.5 percent in Sweden.<sup>2</sup> At the same time, political rights differed greatly. In 1995 there were, according to the classification by Freedom House, 76 “free” countries, while 62 were “partly free”, and 53 were “not free”.<sup>3</sup> This paper explores the link between political democracy and the size of government.

The goal of the paper is to help explain cross-country differences in the size of government by differences in political accountability. Political accountability is interpreted as the degree to which voters can control elected leaders in a principal-agent relationship. Two central features of political accountability is transparency and political contestability.

Ferejohn (1999) finds, in a principal-agent model of government, that greater transparency in public decision-making increases voter control over political agents which, in turn, increases the size of government demanded by voters in a democracy, and he uses this insight to gain an understanding of the increase in the size of government in the United States through the last two centuries.

We modify Ferejohn’s theoretical model to include a degree of political contestability, or, interpreted more broadly, a degree of democracy.<sup>4</sup> For electoral control of politicians to be effective, it must be possible for voters to vote for other politicians or parties in free and fair elections. If political competition is constrained, the electoral threat of voting politicians out of office is muted and, therefore, voter control of politicians is impaired. Thus, the prediction is that greater political contestability increases the size of government.

The predictions of the model find strong and robust support in empirical evidence

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<sup>1</sup>Ferejohn (1990, p. 8).

<sup>2</sup>Data from this paper; see appendix B.

<sup>3</sup>Karatnycky (1996, p. 3)

<sup>4</sup>Perhaps the term *polyarchy* should be used instead of democracy in order to “maintain the distinction between democracy as an ideal system and the institutional arrangements that have come to be regarded as a kind of imperfect approximation of an ideal.” Dahl (1971, p. 9).

from 62 democratic countries in 1995. Political accountability is measured by an index based on subjective indicators constructed by Kaufmann, Kraay and Zoido-Lobaton (1999a,1999b).

The paper is organized as follows: The next two subsections introduces the modelling approach and discusses related literature. In section 2 the theoretical model is presented. Section 3 sets up the empirical specification, instruments and data, and section 4 presents the main results and their robustness. Section 5 concludes.

## 1.1 The Theoretical Framework

The approach taken in this paper is to recognize that government is representative and to focus on how the nature of the relationship between citizens and their leaders is shaped by the selection process of such leaders. Starting with Barro (1973), but recognized already in the Federalist Papers, the relationship between citizens and their leaders can be seen as a principal-agent relationship. Voters, the principals, choose leaders, the agents, who in turn rule the principals. Barro, and later Ferejohn (1986), examined the possibilities for voters to control elected politicians.<sup>5</sup> Compared to the elaborate incentive schemes found in standard economic principal-agent problems, the main instrument available to voters for controlling their leaders is somewhat blunt: Elections. If performance is “unsatisfactory”, voters can vote for someone else.

Thus, one central feature of elections is to provide a check on elected leaders by holding them accountable for their decisions and the outcomes resulting from these decisions. If the possibilities for holding leaders accountable through elections are limited, voters lose control over their leaders and, as suggested by Ferejohn (1990, 1999), this can influence the degree to which citizens are willing to entrust their leaders with authority and resources.

In the model set up below, the political agent uses resources from voters to finance public goods provision. The interests of the voters and the politicians are not perfectly aligned; indeed, this is what gives rise to a principal-agent problem. Further, there is asymmetric information. The politician privately observes the realization of a stochastic variable which influences the rate of transformation from tax revenue to public goods. Come election day, voters evaluate the outcome and reelect the politician if the outcome is “satisfactory.”

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<sup>5</sup>See Pitkin (1967, chapter 2) for a discussion of accountable representation.

Two features of the model set it apart from generic principal-agent models of government: First, voters have an outside option; they want also to consume private goods. Therefore, the agent – the government – is constrained in its actions, as the outside option creates competition for funds. Second, it is voters, not politicians, who decide the size of government. This is in line with the classification of political regimes by Przeworski and Limongi (1993, p. 58). They classify political regimes along two dimensions: Who decides the size of government, and who has the rights to the fiscal residuum that is left after public expenditures have been paid for, and they define a *democracy* as a regime in which “citizens both decide the size of government and have a right to the fiscal residuum.”

That voters, and not politicians, determine the size of government may appear special; however, in most models in which voters appoint a politician who then chooses policy, the choice of policy (or at least the politician’s platform) is responsive to the wishes of the median voter and, furthermore, the politically salient dimension of policy is often thought to be the size of government or, termed more broadly, state vs. markets (see, e.g., Besley and Coate, 2000)

Thus, the theory developed in this paper applies only to democratic regimes, but argues that transparency and contestability differ *within* the group of democratic regimes.

## 1.2 Relation to the Literature

There exists a large literature seeking to explain the growth of government over time as well as cross-country differences in the size of government from economic, political and cultural factors; see Holsey and Borcharding (1997) for a recent survey.

A number of empirical studies, e.g. Peltzman (1980), Easterly and Rebelo (1993), Becker and Mulligan (1998), have found no effect of whether a country is democratic on the size of government. As noted above, the model set up in this paper is concerned only with democratic regimes, but suggests that, given that a country is democratic, different *degrees* of political accountability can help explain differences in the size of government.

Meltzer and Richard (1981) explain the growth in government by focusing on changes in the franchise. They argue that the expansion of the franchise that took place in many Western countries in the early twentieth century decreased the median voter’s income relative to that of the average voter, with more redistribution as a direct result.

La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999) examine the determinants of

“the quality of government” understood as “good-for-capitalist-development” and they find “consistently ... that the better performing governments are also larger, and collect higher taxes. Poorly performing governments, in contrast, are smaller and collect fewer taxes ... [This] tells us that identifying big government with bad government can be highly misleading.” [p. 266]. The present paper can be seen as attempting to provide an explanation for this phenomenon.

Becker and Mulligan (1998) find that tax systems that are more efficient, i.e. induce less economic distortions, lead to larger government. The results in this paper can be seen as extending this argument to political efficiency: Political regimes that are more efficient, i.e. reduce agency costs, lead to larger government.

Most related to this paper are the papers by Persson, Roland and Tabellini (1997, 2000) and Persson and Tabellini (1999). They argue that presidential regimes with clear separation of powers and a system of checks and balances provide more political accountability than parliamentary systems. In their model, this implies that presidential regimes have *smaller* governments than parliamentary systems, a finding supported by empirical evidence in Persson and Tabellini (1999). The model in this paper, based on Ferejohn (1999), predicts that more accountability instead leads to *larger* government.

In both models, more accountability leads to less rents being diverted by the politician, which increases voters’ “virtual income.” Then, the question becomes what voters do when their income increases and this, of course, depends on their preferences. In Persson and Tabellini (1999) and Persson et al. (2000), the income elasticity of public goods is less than one, while the opposite is true of Ferejohn (1999) and the model put forward in this paper.

The phenomenon of an income elasticity of public goods in excess of one is known as Wagner’s Law. Whether this holds empirically is still an open question. Mueller (1989) reports that many studies fail to find an income elasticity significantly greater than one, but notes that these estimates may be biased downward. Studies that find support in international data for Wagner’s Law on both cross-section and panel data include Oates (1985), Easterly and Rebelo (1993), Becker and Mulligan (1998) and La Porta et al. (1999).

The theoretical prediction of Persson et al. (1997, 2000) that presidential regimes, *ceteris paribus*, have smaller governments than parliamentary regimes, is, as noted above,

based on a presidential system exhibiting greater political accountability.<sup>6</sup> This prediction relies crucially on an effective system of checks and balances being in place. It is not clear, however, that this is generally the case for the countries included in the sample of Persson and Tabellini (1999); a large part of the presidential countries in their sample are Latin American, and in many Latin American countries ruling by presidential decree has been (and to some extent still is) commonplace, undermining the formal checks and balances system.<sup>7</sup>

In the sample of countries considered in this paper, the simple correlation between the measure of political accountability and presidentialism is  $-.45$ , which is significant at .2 percentage level. Thus, the empirical finding of Persson and Tabellini (1999) that presidential systems tend to have smaller public sectors can be explained within the modelling framework of this paper in the following way: As presidential regimes *empirically* are associated with *less* political accountability, voters have *less* control of politicians, leading to *smaller* government in presidential regimes.

## 2 The Model

A simple principal-agent model of electoral control of government is considered. Voters get utility from a private and a public good. All voters have the same income, but differ in their relative weights of public vs. private consumption. Tax revenue is transformed into public goods by the politician. There is asymmetric information about a shock that affects this transformation: the politician can observe the shock while voters cannot. Using this asymmetry of information as a veil, the politician can appropriate rents to be used for the politician's own benefit. The relationship between politicians and voters continues indefinitely.

The model is one of purely retrospective voting: politicians can make no credible commitments to platforms or honesty, but are judged solely by their performance in the

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<sup>6</sup>The main argument is that in a parliamentary regime, the executive is accountable to the legislature, which is then accountable to voters, while in a pure presidential regime with checks and balances both the executive and the legislature are directly accountable to voters. See Laver and Shepsle (1999) for an analysis of accountability in parliamentary regimes.

<sup>7</sup>See the country reports in Freedom House's "Freedom in the World", various years. Based on the experience of Latin American democracy, a literature in political science, associated primarily with Juan Linz (see Linz (1994)), has argued that presidential systems are more conducive to inferior outcomes than are parliamentary systems; in particular, presidential systems are more prone to instability.

current term.<sup>8</sup>

## 2.1 Voters and Politicians

A voter  $i$  gets utility in each period from a public good  $x$  and a private good  $c$  according to the per period preferences<sup>9</sup>

$$U^i = x + \mu_i H(c)$$

It is assumed that  $H$  is increasing and strictly concave, and that  $\lim_{c \rightarrow 0} H'(c) = \infty$ . The parameter  $\mu_i > 0$  represents voter  $i$ 's relative weight on private goods. The higher  $\mu_i$ , the greater the preference for private relative to public goods. Each voter has income  $I$  in each period and pays taxes  $\tau$ , leaving  $c = I - \tau$  to be used for private consumption.<sup>10</sup> In any period, expected utility can be written as current utility plus future utility

$$EU^i = x^e + \mu_i H(c) + \delta V^i \quad (1)$$

where  $\delta V^i$  is the discounted expected continuation value and  $x^e$  is the expected amount of public goods provided. In a stationary state,  $EU^i = V^i$ . There is a continuum of voters distributed on an interval  $[\underline{\mu}, \bar{\mu}]$ ,  $\underline{\mu} \geq 0$ , normalized to one, according to a distribution function  $G$ .

Tax revenue is transformed into the public good according to the public budget constraint

$$x = \theta(\tau - r)$$

where  $\theta$  is a stochastic variable distributed according to a distribution function  $F$ , and  $r$  denotes rents appropriated by the politician. The shock  $\theta$  captures the fact that voters are not always able to thoroughly monitor the public machinery and that politicians can use this leeway for their own benefit. The politician observes  $\theta$  before choosing rents; rents, therefore, are a function of  $\theta$ ,  $r(\theta)$ . Voters observing a low realization of  $x$

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<sup>8</sup>There is no adverse selection in the model – potential politicians are all equally good at providing public goods. See Fearon (1999) for a discussion of moral hazard vs. adverse selection in political agency models; and Besley and Case (1995) for evidence that term limits alter gubernatorial behavior in the US, consistent with the presence of moral hazard.

<sup>9</sup>The results do not depend on preferences being quasi linear – only on the income elasticity of public goods being greater than one (as noted in the previous section).

<sup>10</sup>Alternatively, voters could have identical utility functions but different incomes or abilities. This approach would yield a similar one-dimensional heterogeneity; see Meltzer and Richard (1981).

cannot determine whether this is due to a bad shock (low  $\theta$ ) or a high amount of rents appropriated (high  $r$ ). The expected amount of public good provided is

$$x^e = \int \theta (\tau - r(\theta)) dF(\theta).$$

The politician's preferences are given by

$$EU^A = Wr + p(x) \delta V^A$$

where  $p(x) \in [0, 1]$  is the probability that the politician is reelected and can enjoy the discounted expected continuation value,  $\delta V^A$ , and  $W \in [0, 1]$  is the fraction of rents appropriated by the politician that can actually be used for consumption; this suggests that there is a "leaky bucket" in transferring public funds to be used for the politician's own consumption. In the model, voters and politicians have conflicting interests over rents, capturing the real world phenomenon that preferences of politicians and voters are not perfectly aligned. Rents should be thought of broadly as representing the loss to voters (consumers) from policies enacted by politicians for their own self-interest.<sup>11</sup>

<< Figure 1 >>

The timing of the model is shown in Figure 1. First, voters vote on the size of government by majority vote. Then, the politician observes the shock  $\theta$  and chooses a level of rents  $r(\theta)$ . Thereafter, payoffs are realized for both voters and politician and, finally, elections take place on whether to replace the politician.

## 2.2 Voting

Aiming for a stationary subgame perfect Nash equilibrium, the model is solved backwards. At election day, voters choose whether to vote for the incumbent politician or an opponent. Since voters cannot observe neither  $r$  nor  $\theta$ , they cannot condition their vote on these variables. As is standard in the literature (see, e.g., Banks and Sundaram (1998)), we assume that voters employ a cut-off rule when deciding whether to vote for

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<sup>11</sup>In this simple model, rents drive a wedge between taxes paid and public goods received. However, trade protection, e.g. import quotas, enacted to receive campaign funds from protected industries – see Grossman and Helpman (1994) – increases rents to the politician by affecting consumer prices. In this case, abolishing trade protection would benefit consumers, increasing income and increasing consumption of both private and public goods in a model with general preferences. A famous example is the U.S. sugar industry, see Dixit (1996) for this and other examples.



the incumbent or not, voting for the incumbent if public goods provision  $x$  is above some threshold  $x_i^*$ .<sup>12</sup> The probability that voter  $i$  votes for the incumbent politician is given by

$$p(x) = \begin{cases} 1 & \text{if } x \geq x_i^* \\ 0 & \text{if } x < x_i^*. \end{cases}$$

However, in this formulation it is implicitly assumed that voters can costlessly vote for an identical opponent. To capture that this is not always the case, we posit the following voting rule:

$$p(x) = \begin{cases} 1 & \text{if } x \geq x_i^* \\ \xi(E) & \text{if } x < x_i^*. \end{cases}$$

If the incumbent politician satisfies the threshold level set by voters, he is reelected. If, however, he does not satisfy this threshold, he may be reelected anyway, depending on the degree of *political contestability*, or, more broadly, degree of democracy, denoted  $E$ . Formally,  $\xi(E) \in [0, 1]$  is the probability that there is no change of power even though voters vote *against* the incumbent.  $E$  can take on values in  $[0, \infty)$ , from no democracy to full democracy, and it is assumed that  $\xi(0) = 1$ ,  $\xi'(E) < 0$  and  $\lim_{E \rightarrow \infty} \xi(E) = 0$ .

The probability should not necessarily be interpreted as the probability that the incumbent will nullify the election should he lose, but rather that, for example if political competition is low, it may not be possible for voters always to find viable alternatives to the incumbent, in which case the incumbent stays in power.

Examples of less than ideal elections in democracies abound. For example, Przeworski and Limongi (1993, p. 58) note that “[p]arty competition must be easily the most protected industry in the United States.” In the US Presidential Election 2000, the Libertarian Party sued the Federal Election Commission, contending “that rules for participation in presidential debates are so restrictive that they unfairly exclude minor-party candidates and independents.” [The Campaign Trail, New York Times, May 9, 2000].

In the Mexican presidential contest in 2000, which was thought to be the fairest and most open yet, pro-government media executives banned opposition commercials for

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<sup>12</sup>Here, the threshold is in terms of public goods  $x$ . Alternatively, voters could have a reservation utility as threshold. Given the assumption of additively separable preferences, the two formulations are equivalent.

weeks, visas for foreign election observers were delayed, and campaign finance control was stymied. It was the first election with voting booths that had curtains and that fit only one person. [Dillon and Preston, New York Times, May 9, 2000]. In the 2000 presidential election in Yugoslavia, the official election result of the first round was such that the incumbent, president Milosevic, was to have a run-off against the main opponent, Vojislav Kostunica, despite reports that the opposition had won by a clear majority. In the end, however, the opposition leader took office without a second round run-off.

The de facto voting rule can perhaps be thought of in terms of barriers to entry in the political market. In the Besley-Coate model of representative democracy (Besley and Coate, 1997), citizen-candidates can enter the political market at some utility cost. Obviously, the higher is this cost, the fewer will contemplate candidacy. Further, the cost is presumably lower for incumbents (see Tullock (1965) and Crain (1977)). Entry costs are influenced by the degree of political rights and civil liberties. In societies with infringements of such rights and liberties, either de jure or de facto, the costs of entering the political markets can be high, perhaps prohibitively so, leading to limited political contestability.<sup>13</sup>

Given this voting rule, the politician must choose between diverting all tax revenue as rents and winning with probability  $\xi(E)$  and diverting an amount  $r^*$  and being reelected with probability 1.

## 2.3 Equilibrium

Consider first the case of symmetric information. In this case, voters observe, *before* they decide on the size of government, the realization  $\theta$  along with the politician, and we have<sup>14</sup>

**Result 1** Assume that the realization  $\theta$  of the stochastic shock is observed by both voters and the politician. In a stationary equilibrium, the politician diverts

$$r^{sym} = \frac{(1 - \delta)}{1 - \xi\delta} \tau > 0 \quad \text{for } \tau > 0.$$

and is reelected with probability 1.

Even under complete information, the politician is able to divert some rents. This was also the message of Persson et al. (1997, Proposition 1). Note, however, that the

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<sup>13</sup>See Le Borgne and Lockwood (2000) for a formal modelling of this.

<sup>14</sup>All proofs and derivations are provided in appendix A.

presence of imperfect electoral contestability ( $\xi > 0$ ) increases equilibrium rents; the threat that the politician can divert all tax revenue and still be reelected with positive probability increases the politician's expected utility from not providing, which increases the amount that voters must give up to obtain a positive supply of public goods.

Consider now to the case of asymmetric information, where the realization  $\theta$  is observed only by the politician. Let  $\theta_i^*$  be the threshold of the realization of the shock such that the public budget constraint is satisfied with equality given  $x_i^*$  and  $r_i^*$ ,

$$r_i^* = \tau - x_i^*/\theta_i^*. \quad (2)$$

Thus, it is possible for each voter to have a different threshold  $x_i^*$ , which will induce different thresholds for the shock  $\theta_i^*$  and, therefore, different "acceptable" rents  $r_i^*$ . However, as will be shown below, the optimal thresholds  $x_i^*$  (and therefore  $\theta_i^*$  and  $r_i^*$ ) will be the same for all voters ( $x_i^* = x^*$ ,  $\theta_i^* = \theta^*$ ,  $r_i^* = r^* \forall i$ ). Therefore, subscripts can be dropped to simplify notation.

The politician will choose to go for  $r^*$  and be reelected with certainty if

$$Wr^* + \delta V^A \geq W\tau + \xi\delta V^A$$

which, using (2), translates into a threshold value for the stochastic shock

$$\theta^* = \frac{x^*}{\delta V^A (1 - \xi) / W} \quad (3)$$

If the realization of the shock is greater than  $\theta^*$  the politician diverts  $r^*$  and stays in power with certainty. If the realization is less than  $\theta^*$ , the politician diverts all tax revenue and stays in power with probability  $\xi$ .

A choice of a threshold  $x^*$  thus corresponds to a choice of a threshold value for the shock,  $\theta^*$ . Given the politician's behavior, voter  $i$  chooses  $x_i^*$  to maximize current period utility: If the threshold is set too high, the politician will divert the maximum amount of rents and forego election in most cases. If the threshold is too low, the politician will be able to capture rents from asymmetric information and still be elected in most cases. For any voter  $i$ , the optimal threshold maximizes

$$EU^i = \frac{1}{1 - \delta} [x^* \text{Prob} \{\theta \geq \theta^*\} + 0 \cdot \text{Prob} \{\theta \leq \theta^*\} + \mu_i H(I - \tau)]$$

which, using (3), yields the first order condition (again, see appendix A)

$$\theta^* = \frac{1 - F(\theta^*)}{f(\theta^*)}.$$

From this expression it is obvious that the threshold  $\theta^*$  (or, equivalently using (3),  $x^*$ ), does not depend on  $\mu$ , which is the only source of heterogeneity among voters. This substantiates the claim made above for dropping the subscripts.<sup>15</sup> The right hand side of this expression is the inverse of the “hazard rate” of the distribution function  $F$ . The inverse hazard rate is decreasing monotonically in  $\theta^*$  for a number of common distributions, including the normal and the uniform, and, therefore, this expression has a unique solution  $\theta^*$  and, therefore, a unique threshold  $x^*$ .

For the remainder of the paper, we will, to get an explicit solution, assume that  $\theta$  is uniformly distributed on  $[0, 1]$ . This yields

$$\theta^* = \frac{1}{2}$$

and, using (3) again, this provides an expression for the optimal threshold level of the public good,

$$x^* = \frac{\delta V^A (1 - \xi) / W}{2}. \quad (4)$$

Invoking stationarity ( $EU^A = V^A$ ), the incumbent’s utility  $V^A$  is given by

$$V^A = \int_0^{\frac{1}{2}} [W\tau + \xi\delta V^A] dF(\theta) + \int_{\frac{1}{2}}^1 \left[ W\tau - W\frac{x^*}{\theta} + \delta V^A \right] dF(\theta)$$

which reduces to

$$V^A = \frac{2W\tau}{2 - \delta [1 - \ln 2 + \xi (1 + \ln 2)]}. \quad (5)$$

Invoking stationarity once again ( $EU^i = V^i$ ), we find, using (1) and (4), voter  $i$ ’s utility function to be

$$EU^i = \frac{1}{1 - \delta} \left[ \frac{\delta (1 - \xi) \tau}{4 - 2\delta [1 - \ln 2 + \xi (1 + \ln 2)]} + \mu_i H(I - \tau) \right]. \quad (6)$$

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<sup>15</sup>This is due to the additive separability of the utility function. If preferences were not additively separable, the optimal threshold  $x_i^*$  would in general depend on  $\mu_i$ . However,  $x_i^*$  would be a monotone function of  $\mu_i$ , such that a politician satisfying the median voter’s threshold would satisfy the threshold of a majority of voters.

That voters are able to control the politician at all hinges on the policy space being one-dimensional. If the policy space has two or more dimensions, problems akin to those of applications of the median voter theorem in multiple dimensions arise, since the politician, using personalized transfers, can effectively pit the voters against each other, leaving the voters with no or very little control of the politician (see Ferejohn, 1986). Empirical research, however, suggests that people vote on the basis of aggregate variables (the state of the economy, say) rather than pure “pocketbook” considerations. See Lewis-Beck (1988).

Note that aggregate tax revenue  $\tau$  is used interchangeably with voter  $i$ 's preferred tax rate  $\tau_i$ ; this is possible due to the convenient normalization of voters to an interval of size one. Voter  $i$  chooses  $\tau_i$  to maximize utility in a stationary equilibrium. The first order condition is

$$\frac{\delta(1-\xi)}{4-2\delta[1-\ln 2+\xi(1+\ln 2)]} = \mu_i H'(I-\tau). \quad (7)$$

The interpretation of this is completely standard: at an optimum, the marginal utility of public goods must equal the marginal utility of private goods. Voters differ in their view of the optimal ratio of private to public goods only through  $\mu_i$ . Solving for  $\tau$  we find

$$\tau = I - h \left( \frac{\delta(1-\xi(E))}{\mu_i(4-2\delta[1-\ln 2+\xi(E)(1+\ln 2)])} \right). \quad (8)$$

where  $h \equiv (H')^{-1}$ .

## 2.4 Comparative statics

Voters differ in their preferences for public goods. As noted in the introduction, we assume that this conflict is resolved by majority voting. Voter preferences are ordered in  $\mu$  and, therefore, the voter with the median  $\mu$  is decisive, and the median voter's preferred tax rate  $\tau_m$  will be implemented in equilibrium.<sup>16</sup> The comparative statics of  $\tau$  can be summarized as follows:

**Proposition 1** The amount  $\tau$  that a voter wishes to invest in the public sector increases as (i)  $\mu$  decreases; (ii)  $\delta$  increases; and (iii)  $E$  increases.

Not surprisingly, less weight put on private goods consumption in the utility function increases the demand for public goods relative to private goods. Further, as the discount factor  $\delta$  increases (the politician becomes more patient), future benefits from office is valued higher, which decreases rents diverted in the current period to increase the likelihood of remaining in office. This increases control of the politician and, thus, the willingness to invest in government. Finally, the greater is electoral contestation (the degree of democracy), the greater is the electoral threat and, hence, the control of politicians. This, in turn, leads to larger government.

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<sup>16</sup>Formally, voter preferences (6) are *single crossing* in  $\mu_i$ . By Theorem 1 in Gans and Smart (1996), this ensures that the median voter  $m$ , implicitly defined by  $\int_{\mu}^{\mu_m} dG(\mu) = \frac{1}{2}$ , is a Condorcet winner.

Note that it is not necessarily the case that the problem has an interior solution (i.e.  $\tau, c > 0$ ). From the assumption on the shape of the  $H$  function, voters will always want to consume private goods. However, they will not always want to consume public goods. Only if

$$\frac{\delta(1-\xi)}{4-2\delta[1-\ln 2+\xi(1+\ln 2)]} > \mu_i H'(I), \quad (9)$$

that is, if the marginal utility of public goods is greater than the marginal utility of private goods at  $c = I$ , will voter  $i$  wish to consume a positive amount of public goods. Only if (9) is satisfied for  $\mu_i = \mu_m$  will the public good be provided at all.

Ferejohn (1999) models transparency as the accuracy (the variance) of a signal of the action taken by the politician, and finds, in a model closely related to the one put forward here, that increasing public sector transparency increases the size of the public sector, again by increasing control of the political agent. Taken together, the hypothesis to be tested empirically is that higher political accountability, interpreted as the degree of political contestability and transparency, increases the size of the public sector in democracies.

### 3 The Econometric Model

This section sets up a cross-country econometric model to test the hypothesis of Proposition 1: In democracies, greater political accountability increases the size of government.

#### 3.1 Specification, Identification, and Estimation

The relationship between the size of government and political accountability is given by

$$SIZEGOV = \alpha_S + \beta_S \cdot POL + \gamma_S X_S + \varepsilon, \quad (10)$$

where  $POL$  is a measure of political accountability and  $X_S$  denotes other, exogenous variables affecting the size of government (see below).

There are two reasons why a simple OLS specification could be inappropriate in this case. First, there is the problem of measurement error: as will become clear below, the index measuring accountability is a composite of several general and expert opinion surveys. Both surveys in themselves as well as the aggregation procedure give rise to imprecision in the independent variable; letting  $POL^*$  be the observed measure of political

accountability, what we observe is

$$POL^* = POL + u \tag{11}$$

where  $u$  is a random measurement error. It is well known that measurement errors in an independent variable lead to attenuation bias, a downward bias of the OLS estimate of that variable.

Second, there could be a problem of endogeneity or feed-back. In the theory outlined above, the causal mechanism is from accountability to the size of government. If there is a feed-back effect from the size of government to accountability, however, OLS estimates will be inconsistent (the simultaneous-equations bias). Such a feed-back could, perceptibly, be both positive and negative. If the government suddenly expands its mode of operation to issues it had not influenced before, a demand for greater electoral control could arise.<sup>17</sup> On the other hand, an increase in the “volume” of government operations to new issues could in itself decrease accountability, as the dimension of the issue space would increase (cf. footnote 15). In the case of endogeneity, the model (10) and (11) must be extended with

$$POL = \alpha_P + \beta_P \cdot SIZEGOV + \gamma_P X_P + e. \tag{12}$$

In addition to the size of government, other factors affect political accountability as well; these are captured in  $X_P$ , and will be discussed below.

Using (10) and (11) together, we obtain

$$SIZEGOV = \alpha_S + \beta_S \cdot POL^* + \gamma_S X_S + \nu, \quad \nu \equiv \varepsilon - \beta_S \cdot u \tag{13}$$

which together with (12) constitutes the econometric model.

This simultaneous equations model is identified by assuming that the composite error term  $\nu$  in (13) is uncorrelated with the other determinants of political accountability captured in  $X_P$ , i.e. that  $E[X_P \cdot \varepsilon] = E[X_P \cdot u] = 0$ . Under this assumption, which will be tested, any subset of  $X_P$  can be used as instruments for the true accountability measure  $POL$  when estimating (13). The identifying assumption imposes the restriction that the subset of  $X_P$  used as instruments does not affect the size of government directly,

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<sup>17</sup>For example, it has been claimed that the ratification of the Maastricht Treaty of the European Union, which increased the power of the European Commission (the executive branch of the EU) significantly, resulted in a “democratic deficit” as the Commission is only very indirectly accountable to citizens of the EU. See, e.g., Featherstone (1994).

but only through its effect on political accountability ( $E[X_P \cdot \varepsilon] = 0$ ), and that the instruments are uncorrelated with the measurement error ( $E[X_P \cdot u] = 0$ ). This will be taken up in the discussion of the instruments below.

The system is then estimated by two-stage least squares, correcting for heteroscedasticity in the errors.<sup>18</sup> The identifying assumption is tested by a specification test for overidentifying restrictions.

## 3.2 Controls

The agency model set up in the previous section is a very bare-bones one. Estimating the model controlling only for variables included in the theoretical model would imply excluding a number of other factors outside the model that potentially influence the size of government. Therefore, when estimating the model, a number of variables suggested in the literature is included: Openness of the economy (Cameron, 1978, and Rodrik, 1998), population size (Alesina and Wacziarg, 1998), the dependency ratio to control for demographic structure (Rodrik, 1998), and the degree of urbanization (e.g. Oates, 1985, and North, 1985).

## 3.3 Instruments

The requirement for the instruments are that they are (i) correlated with the measure of political accountability, and (ii) uncorrelated with the disturbance term  $\nu$ . The instruments used are (1) distance from the equator, (2) a measure of ethnolinguistic fractionalization, and (3) a binary variable for presidential as opposed to parliamentary political systems.

These instruments are correlated with political accountability. As argued by Hall and Jones (1999), Western European influence is correlated with distance from the equator: Western European colonization was likely to take place in sparsely populated regions and in regions where the climate was similar to that of Western Europe, both of which points to regions away from the equator. There seems to be no reason why distance from the equator, in itself, would influence the size of government.

A measure of ethnolinguistic fractionalization is included as a measure of population heterogeneity, as there is some evidence that a more heterogenous population makes it more difficult to sustain democracy (Barro, 1999; Easterly and Levine, 1997)

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<sup>18</sup>Note that we will not estimate (12) of the structural model.



Finally, to the extent that the political system (presidential or parliamentary) influences the size of government, it does so through its effect on political accountability. As discussed in the introduction, Persson, Roland and Tabellini (1997, 2000) argue that presidential and parliamentary regimes differ through their effect on political accountability. In addition, when using subjective indicators, the various assessments made by respondents and experts are made within the context of the actual political sphere; therefore, if political accountability is influenced by the political system, this should be reflected in the indices.

The arguments above imply that the instruments influence the size of government *only* through the effect on political accountability. Due to the overidentifying restrictions in the model, this hypothesis can be tested and, it turns out, cannot be rejected. As the measurement errors are taken to be random, the composite disturbance term  $\nu$  is therefore uncorrelated with the instruments.

## 3.4 Data

### 3.4.1 Measuring accountability

Most aspects of political accountability, including the concepts of transparency and electoral contestability considered in this paper, are difficult to measure. Political accountability is measured by an index of “political accountability and voice”, constructed by Kaufman et al. (1999a,1999b). This index is constructed by combining a number of subjective surveys of concepts closely related to political accountability. It is cross-country only and based on data for 1997 and 1998.

The construction of their index is grounded in the idea that although various subjective measures of accountability do not focus on the exact same characteristics of the political regimes surveyed, they can be seen as reflecting variations in an underlying, fundamental concept of accountability. Aggregating different measures in this way, using an unobserved components model, allows for (i) constructing a larger data set and (ii) assessing the precision of the various measures of governance.<sup>19</sup>

The accountability index captures two of the fundamental concepts addressed in my model: electoral contestation and information to the public. The subjective measures

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<sup>19</sup>Kaufman et al. (1999b) also construct indices of Political Instability and Violence; Government Effectiveness; Regulatory Burden; Rule of Law; and Graft. See Bollen (1980, 1993) for a thorough discussion of such models and their statistical properties in the context of political democracy.

that the index is constructed from are: Orderly political transfers, Transparency and Fairness of the Legal System (The Economist Intelligence Unit); Civil Liberties, Political Rights, Free Press (Freedom House); Military in Politics, Democratic Accountability (Political Risk Services); and Information to Business about Government Policies; Voice to Business to express concerns about policies (World Development Report). These subjective measures are constructed from polls of experts and surveys of entrepreneurs and citizens. The accountability measure is normalized such that, for the entire sample, it can take on values from -2.5 to 2.5, it has a mean of zero and a standard deviation of one.

Three of the components, Free Press, Information to Business about Government Policies, and Voice to Business, measure if and how information about government actions and policies are made available to the public.<sup>20</sup> Rose-Ackerman (1999, p. 162) argues that “[t]he public can be an important check on the arbitrary exercise of power by government. [...] [T]his check can operate only if the government provides information on its actions.” Information will only be efficient in controlling public officials, however, if individuals or the media is able to convey this information to the public without fear of reprisal. Thus, “a free press is an essential check, [...] [a]nd if elections are important, the media is also crucial.” (op.cit., p. 166).

The components Orderly Political Transfers, Civil Liberties, Political Rights, Military in Politics and Democratic Accountability concern what we have tried to capture in the  $\xi$  parameter in the model. Finally, Transparency and Fairness in the Legal System is important for electoral control of politicians as “a corrupt judiciary is costly for democracy because it cannot credibly play the role of watchdog on constitutional values or monitor the honesty of the other branches of government.” (op.cit., p. 156).

The advantage of subjective measures like these is twofold: First, as noted above, objective measures for electoral contestability and transparency may be difficult, if at all possible, to obtain.<sup>21</sup> Second, economic and political decisions are taken based on subjective opinions of people involved – and these opinions may differ from objective measures of political and economic institutions, although they are certainly framed by such institutions. The flip side is that subjective measures, by definition, fail to meet

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<sup>20</sup>See Rose-Ackerman (1999, chapter 9) for a discussion of such openness in government and how it helps control politicians.

<sup>21</sup>See, though, Ferree and Singh (1999) on the construction of a (panel) index of executive contestability for Sub-Saharan countries.

standards of “reproducibility”, and further are imprecise, due to the polling and survey nature of the data. The latter problem of measurement errors is addressed below using an instrumental variables approach.

The main problem in using the accountability index is that several different effects “work as one”, and therefore it can be difficult to disentangle exactly what the index is measuring. To address this problem, robustness checks are performed using single components of the aggregate index. On the other hand, it may be the case that it is exactly the *interaction* between transparency and political competition that is essential: Examining the role of media in government responsiveness in India, Besley and Burgess (2000, p. 22) conclude that their results “underline the importance of media development to an effective functioning democracy. The formal institutions of political competition (such as open elections) are not sufficient to deliver a responsive government unless voters have the real authority to discipline poorly functioning incumbents. This requires voters to have the necessary information.”

### **3.4.2 Democratic countries**

The model is developed within the context of democratic countries. To operationalize “democracy”, the classification suggested by Freedom House is used. On their scale of political rights and civil liberties, countries are assigned a value between 1 (the most free) and 7 (the most authoritarian); further, Freedom House classifies countries with a value greater than 5 as “not free”. Hence, in the present study a country is classified as “democratic” if in the period 1990-1995 it did not take on a value greater than 5 in neither the political rights nor the civil liberties index at any time. The selection of countries from that pool of democratic countries was based entirely on data availability; in particular, public finance data are often difficult to obtain. This procedure results in a sample of 62 democratic regimes.

### **3.4.3 The size of government and other variables**

The size of government is defined as tax revenue of all levels of government to GDP in 1995.<sup>22</sup> The revenue data is from *Government Finance Statistics Yearbook* (1999), the

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<sup>22</sup>In results not reported, the size of government was defined as government expenditures and transfers for all levels of government. This definition excludes capital expenditure and interest payments, so as to better capture current spending, but all results are qualitatively unchanged. Results available upon request.

most detailed source of public finance data available for a large number of countries. A problem with these data, however, is that for many countries regional and local government finances are not reported, and due to the presentation of the data it is not possible to see whether this is due to the fact that they are of insignificant size (in which case they are not reported), or whether the data simply does not exist.

The problem is potentially serious as the lack of reported regional and local government finances is not evenly spread across the sample but concentrated among the countries with low accountability. Failing to take into account local government finances underestimates the size of government in these countries, and could therefore bias the results in favor of the hypothesis.

Two factors, however, mitigate this bias. First, there is a tendency for less democratic regimes to be more fiscally centralized (Manor, 1999); this suggests that leaving out regional and local government tax revenues for the less accountable regimes may not be that serious. Second, the size of the informal sector is inversely related to political accountability. Friedman, Johnson, Kaufman and Zoido-Lobaton (2000) find that the size of the informal sector is positively related to the level of corruption in a sample of 69 countries. A simple regression of Friedman et al.'s measure of the informal sector on the index of political accountability reveals a significant negative relationship.<sup>23</sup> Thus, an estimate of the size of government as resources controlled by the state relative to economic activity will be (more) overestimated in less accountable countries.

Given the incomplete nature of the general government data, below are also presented results for central government only, which is readily comparable across countries. As will be clear, the empirical results are unchanged.<sup>24</sup>

GDP per capita (1995) is taken at PPP, and openness of the economy is defined as the volume of trade to GDP in 1995. The dependency ratio is the population aged 0-14 and 65+ to the population aged 15-64, and the degree of urbanization is defined as the fraction of the population living in urban areas. These variables are from

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<sup>23</sup>The resulting equation is

$$INFSEC = \underset{(4.090)}{39.781} - \underset{(2.858)}{16.721} \cdot POL$$

with  $N = 45$ ,  $R^2 = .43$  (robust standard errors in parentheses).

<sup>24</sup>In results not reported, we imputed the missing data on size of local governments by methods of multiple imputation, using the program *Amelia* (Honacker et al. (1999)). This strengthened the results even further.

World Development Indicators, as is population in 1995. Data on latitude is from the Global Demography Project, used by Hall and Jones (1999). To measure ethnolinguistic fractionalization, I use an average of five indices of linguistic fractionalization (La Porta et al. 1999). I use this averaged index, rather than the commonly used ELF index for reasons of data availability. Finally, the classification of political regimes into presidential and parliamentary systems is based on Beck et al. (2000) and Lane and Ersson (2000). For further information about the data, including sources and descriptive statistics, see the appendix.

## 4 Results

### 4.1 Main results

Figure 2 plots the size of government against the measure of political accountability for the 62 countries in the sample. The simple correlation between the political accountability index and the size of general government is .79.

<< Figure 2 >>

Table 1 presents the main results.<sup>25</sup> In the simple OLS case with no other exogenous variables, political accountability (*POL*) has a coefficient of 13.308 and is significant at the .1 percent level (the *t*-statistic is 10.789), and explains 63 percent of the variation in the size of government. Robust standard errors are reported in parentheses. Including (the log of) per capita income *LNINC* as a control variable, the OLS estimate of *POL* drops to 10.300, but is still significant at the .1 percent level. *LNINC* has a positive coefficient and is significant almost at the 1 percent level.

<< Table 1 >>

The results of the two-stage least squares (TSLS) regression are also reported in table 1. TSLS yields an estimated coefficient of 18.885, increasing to 22.940 when controlling for per capita income. Both are estimated with considerable precision, being significant

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<sup>25</sup>In all regressions, the dependent variable is the ratio of tax revenue to GDP. As this is constrained to be between zero and one, a more correct econometric specification would employ the logistic transformation  $\log(\text{tax}/(1-\text{tax}))$  as used by, e.g., Oates (1985). However, the statistical results are unaffected by this transformation, so the standard formulation has been used to facilitate interpretation of the results. Results available upon request.

at the .1 percent level. The coefficient of per capita income changes sign, but is not significant. These results suggest that when the index of political accountability increases by 1, say, from the level of Nicaragua to that of Greece, the size of the public sector relative to GDP increases by approximately 20 percentage points. We see that the coefficient of *POL* is considerably larger when estimating by TSLS; when controls are included, it more than doubles.

Also reported in table 1 are the *F*-test statistics from the first stage of the two-stage least squares estimation. Many standard results in instrumental variables regression rely on the instruments not being “weak”, that is, the partial correlation between instruments and the included endogenous variable *POL* should not be too low. As a rule of thumb, Staiger and Stock (1997) suggest that the *F*-statistic of the first stage regression should be greater than 10 for standard results to apply; in the table, the *F*-statistic from the first stage regression is 16.84, suggesting that the instruments are sufficiently strong for the TSLS estimates to be reliable.

Finally, table 1 reports for each of the instrumental variables regressions the *p*-value associated with the test of the no overidentification hypothesis.<sup>26</sup> As argued above, the effect of the instruments is not directly on the size of government, but rather through political accountability. Since the number of instruments (3) is greater than the number of endogenous variables (1), the equation is overidentified. If the test for overidentification fails, one or more of the instruments should be included as an exogenous variable directly in the estimated equation. As the *p*-values are all high, the hypothesis of no overidentification cannot be rejected.

One thing to note about the instrumental variables regressions: the coefficient of income is negative (though insignificant), although the simple correlation between income per capita and the size of general government is .68. This may be due to multicollinearity (see below), as the correlation between income per capita and the political accountability index is .70.

<< Figure 3 >>

Figure 3 plots the size of central, rather than general, government against the political accountability index. In the discussion of the data above it was mentioned that for

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<sup>26</sup>This is carried out using the procedure of Hausman (1983, p. 433). A more correct specification test would take into account the presence of heteroscedastic errors, using the GMM-methodology of Hansen (1982), but the sample size falls somewhat short of GMM standards. Estimation and testing carried out using GMM yields very similar quantitative and qualitative results. Results available upon request.

some countries, the measure of the size of government fails to include tax revenues from regional and local governments, and, therefore, a comparison based only on central government expenditures could be more appropriate. The right hand side of table 1 reports the estimates: The qualitative results are unchanged. Political accountability is still significant at the .1 percent level in all specifications.

<< Figure 4 >>

The results hold up when the full set of controls is included. Figure 4 shows the partial regression plot of size of general government on political accountability. Even after separating out the full set of controls, a strong positive relationship is clearly visible. The regression results are reported in table 2. In both the general government and the central government cases, the coefficient of the political accountability index remains positive and statistically significant at the .1 percent level.

<< Table 2 >>

Again, note that the estimated coefficient of political accountability using TSLS is more than twice that estimated using OLS. Further, the results in table 2 confirm the finding by Rodrik (1998) that more open countries have significantly larger governments. In particular, when the dependent variable is the size of central government – which was also Rodrik’s object of analysis – the coefficient on openness is statistically significant at the .1 percent level. The coefficient on income, however, is not significantly different from zero. Population size and urbanization both enter positively, significant at the 5 percent level, while the dependency ratio is never significant. Surprisingly, (the log of) population size enters positively – this is in contrast to Alesina and Wacziarg (1998) where population size enters with a negative sign and is significant in most specifications; however, the positive effect found in this paper may be due to a different, and smaller, sample.

The partial correlation plot has the advantage of revealing outliers in the (political accountability, size of government)-space. Singapore, and to some degree Turkey, can be characterized as outliers. Removing Singapore from the sample weakens the results slightly in one case, while removing either Turkey or both Singapore and Turkey strengthens the results.<sup>27</sup>

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<sup>27</sup>Results available upon request.

## 4.2 Robustness

To ensure that the results reported above are robust, a number of different specifications were used. First, the political accountability index is replaced with the civil liberties and political rights indicators from Freedom House. These indicators are a part of the political accountability index, and therefore necessarily correlated with it, but, as these indices are often used on their own (see, e.g., Barro, 1999, and La Porta et al., 1999), it would be interesting to see whether the results hold also in this case. The average of each index over the period 1990-1995, which is the period in which the countries should be democratic to be included in the sample, is used.

The results of the regressions are shown in table 3.<sup>28</sup> The civil liberties average, *CL9095*, is significant at the .1 and the 1 percent level in the OLS and the TSLS cases, respectively, and the political rights average *PR9095* is significant at the 1 percent level in both cases, including the full set of controls for both general government and central government tax revenue. The first stage *F*-statistic is sufficient and the hypothesis of no overidentification cannot be rejected in any of the specifications.

Also, as is standard in econometric analyses of the size of government, per capita income has been treated as an exogenous variable; however, numerous studies have investigated the effect of political variables on economic growth; in fact, the political accountability index used in this analysis was constructed for an analysis of the impact of governance on economic growth, and Kaufman et al. (1999b) find that the coefficient on the political accountability index is positive and significant when investigating differences in income levels across 173 countries. Similarly, Hall and Jones (1999) find that a measure of “social infrastructure”, based in part on Political Risk Services indices, explains cross-country differences in output per worker very well. Barro (1999) investigates the reverse causal explanation, where higher income leads to more democracy.

Table 4 presents TSLS estimates when the level of income (*LNINC*) is included as an *endogenous* variable, instrumented in the same way as *POL* (the OLS estimates are the same as those reported in table 2). In both the general government and the central government cases, *POL* is significant at the .1 percent level, while the coefficient on income is insignificant. In both cases openness and the size of the population enter significantly with a positive sign, while urbanization and the dependency ratio are insignificant.

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<sup>28</sup>Note that the sign on the indices was reversed, such that in the regression a *higher* value of *CL9095* and *PR9095* corresponds to *more* civil liberties and political rights, respectively.



Finally, the issue of multicollinearity should be addressed. As noted above, the coefficient on income is insignificant and in the instrumental variables regressions has the wrong sign. This, together with high and positive partial correlations between income and the size of government (.68) and income and the level of political accountability (.70), is a sure sign of the presence of multicollinearity in the data. Excluding income from the regressions does not change neither coefficients nor significance of the remaining variables including political accountability, while excluding political accountability makes the coefficient on income positive and significant at the 1 per cent level.

Overall, the coefficient on political accountability is significant at least at the 1 per cent level in all specifications, is robust to including a number of controls, measuring political accountability differently, and taking account for the fact that income is endogenously determined.

## 5 Concluding remarks

This paper has investigated the effect of political accountability on the size of government in a democracy. In a principal-agent model of government it was shown that increases in political accountability, i.e. increases in government transparency and the regime's degree of political democracy, leads to increases in the size of government. This, perhaps surprising, claim was investigated empirically on a cross section of 62 democratic countries using a recent index of political accountability, and was found to have strong and robust support in the data.

While the empirical results are indeed promising – the political accountability index is significant at the .1 percent level in almost all specifications – they should be interpreted with some caution. As discussed in the description of the data, the various measures of political accountability that underlies the composite index are subjective, and therefore fail to meet standards of reproducibility. Further, the aggregation procedure makes it difficult to disentangle empirically specific effects of political accountability; however, the idea behind the construction of the index was that the measures included are in fact different realizations of the same underlying concept of political accountability.

These problems notwithstanding, we think that the informational content of these subjective indices, based on reports by agents within the economic and political environments, is non-negligible. Future work should look at alternative measures of transparency

and electoral contestability in more detail, and examine their impact on fiscal outcomes. Along these lines, Alt, Lassen and Skilling (2000) investigate the transparency of state government budget processes in the US.

## A Derivations and Proofs

The optimal threshold maximizes

$$EU^i = \frac{1}{1-\delta} [x_i^* \text{Prob}\{\theta \geq \theta^*\} + 0 \cdot \text{Prob}\{\theta \leq \theta^*\} + \mu_i H(I - \tau)]$$

which yields the first order condition

$$(1 - F(\theta^*)) = \theta^* \delta V^A (1 - \xi) / W \cdot f(\theta^*) \frac{1}{\delta V^A (1 - \xi) / W}$$

and, rearranging,

$$\theta^* = \frac{1 - F(\theta^*)}{f(\theta^*)}.$$

Assuming that  $\theta$  is uniformly distributed (in which case  $F(\theta^*) = \theta^*$  and  $f(\theta^*) = 1$ ) on  $[0, 1]$  yields

$$\theta^* = 1 - \theta^* \Leftrightarrow \theta^* = \frac{1}{2}$$

which, using (3), provides an expression for the optimal threshold level of the public good,

$$x^* = \frac{\delta V^A (1 - \xi) / W}{2}.$$

The politicians's utility is given by

$$\begin{aligned} V^A &= \int_0^{\frac{1}{2}} [W\tau + \xi \delta V^A] dF(\theta) + \int_{\frac{1}{2}}^1 \left[ W\tau - W \frac{x^*}{\theta} + \delta V^A \right] dF(\theta) \quad \Leftrightarrow \\ V^A &= W\tau + \xi \delta V^A F(\theta^*) + (1 - F(\theta^*)) \delta V^A - \frac{\delta V^A (1 - \xi)}{2} [\ln \theta]_{\frac{1}{2}} \end{aligned}$$

and, rearranging,

$$V^A = \frac{2W\tau}{2 - \delta [1 - \ln 2 + \xi (1 + \ln 2)]}.$$

Inserting this expression into the utility function directly yields (6) in the text, and from this straightforward maximization yields equations (7) and (8) in the text.

## A.1 Result 1

In the case of symmetric information, voters know the utility of the politician,  $V^A$ . Hence, the politician must be allowed to divert rents  $r^s$  such that

$$\begin{aligned} W r^s + \delta V^A &= W \tau + \xi \delta V^A \Leftrightarrow \\ W r^s + \delta (1 - \xi) V^A &= W \tau \end{aligned}$$

where (in stationary equilibrium)

$$\begin{aligned} V^A &= W r^s + \delta V^A \Leftrightarrow \\ V^A &= \frac{1}{1 - \delta} W r^s \end{aligned}$$

since the politician is reelected with certainty if  $r = r^s$ . Inserted above, we have

$$W r^s + \frac{\delta (1 - \xi)}{1 - \delta} W r^s = W \tau$$

which, rearranging, gives Result 1.

## A.2 Proposition 1

The comparative statics of this expression follows directly from (8) in the text, noting that  $h' < 0$  since  $H$  is strictly concave, that  $\lim_{z \rightarrow 0} h(z) = \infty$  and that  $(4 - 2\delta [1 - \ln 2 + \xi (1 + \ln 2)]) > 0$ .<sup>29</sup> Differentiating partially and rearranging yields

$$\begin{aligned} \frac{\partial \tau}{\partial \mu_i} &= h' \cdot \frac{\delta (1 - \xi)}{\mu_i^2 (4 - 2\delta [1 - \ln 2 + \xi (1 + \ln 2)])} < 0 \\ \frac{\partial \tau}{\partial \delta} &= -h' \cdot \frac{2(1 - \xi) \mu_i}{(\mu_i (4 - 2\delta [1 - \ln 2 + \xi (1 + \ln 2)]))^2} > 0 \\ \frac{\partial \tau}{\partial \xi} &= -h' \cdot \left( \frac{2\delta \mu_i (\delta - 1)}{(\mu_i (4 - 2\delta [1 - \ln 2 + \xi (1 + \ln 2)]))^2} \right) < 0. \end{aligned}$$

The sign in the last equation is determined by observing that the numerator within the brackets is negative as  $\delta < 1$ . Relating the last equation to the underlying electoral contestation parameter  $E$  we find that

$$\frac{\partial \tau}{\partial E} = \frac{\partial \tau}{\partial \xi} \xi'(E) > 0.$$

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<sup>29</sup>The squared parenthesis obviously is monotonically increasing in  $\xi$ . At  $\xi = 1$ , the whole expression becomes  $4 - 4\delta > 0$  as  $\delta < 1$ .

## B Data

To ensure that 1995 is not an exceptional year regarding public finances, one could have taken averages of several years. However, in the democratic regimes focused on here, tax revenues to GDP are relatively stable. Further, averaging over countries in the 1990s would be difficult due to a “wave of standardization” of national accounts that has created structural breaks in the time series of many countries. All figures, except where noted, are for 1995. The discrepancy between the dating of public finance data and accountability data is entirely due to data availability. Also, the selection among democratic countries is entirely due to data availability. Missing data excludes, e.g., Honduras, Jamaica and PNG.

- Countries included are: Argentina, Australia, Austria, Belgium, Bulgaria, Belize, Bolivia, Brazil,<sup>a</sup> Botswana, Canada,<sup>a</sup> Switzerland, Chile, Colombia,<sup>a</sup> Costa Rica, Denmark, Germany, Dominican Republic, Ecuador,<sup>a</sup> Spain, Finland, France, Great Britain, Greece, Guatemala, Hungary, India, Ireland, Iceland,<sup>b</sup> Israel, Italy, Jordan, Japan,<sup>b</sup> South Korea, Sri Lanka, Luxembourg, Madagascar, Mexico, Malta, Mongolia, Mauritius, Malaysia, Nicaragua, Netherlands, Norway, Nepal, New Zealand, Pakistan, Panama, Philippines, Poland, Portugal, Paraguay<sup>b</sup>, Singapore, El Salvador, Sweden, Thailand, Trinidad and Tobago, Turkey, Uruguay, United States, Venezuela, South Africa. (Superscripts *a* and *b* indicate that data are from 1994 and 1993, respectively).
- Sources of the aggregate political accountability index (source: Kaufmann et al. 1999a, 1999b):
  1. Orderly Political Transfers (EIU)
  2. Transparency and fairness of the legal system (EIU)
  3. Political rights (FH)
  4. Civil liberties (FH)
  5. Freedom of the Press (FH)
  6. Military in Politics (PRS)
  7. Democratic Accountability (PRS)

8. Information to Business about Government Policies (WDR)

9. Voice to Business to express concerns about policies (WDR)

(EIU: Economist Intelligence Unit; FH: Freedom House; PRS: Political Risk Services; WDR: World Development Report).

| Variable | Description  | Source(s)                |
|----------|--|--------------------------|
| SIZEGOV  | Tax revenue of general/central government to GDP at market prices                  | GFS*, WDI**              |
| LNINC    | Log of income per capita (at PPP in international \$)                              | WDI                      |
| LNOPEN   | Log of volume of trade (imports + exports) to GDP                                  | WDI                      |
| LAT      | Latitude of the center of the county or province with the largest number of people | Hall and Jones (1999)*** |
| ETHFR    | Degree of ethnolinguistic fractionalization  | La Porta et al. (1999)   |
| PRES     | Dummy = 1 if presidential system   | Beck et al. (2000)****   |
| CL9095   | Average of Civil Liberties index, 1990-1995  | www.freedomhouse.org     |
| PR9095   | Average of Political Rights index, 1990-1995                                       | www.freedomhouse.org     |
| URBAN    | Fraction of midyear population living in areas defined as urban in each country    | WDI                      |
| DEPEND   | Age dependency ratio<br>= (population < 15 and > 64) / (population 15-64)          | WDI                      |
| LNPOP95  | Log of population  | WDI                      |

\* *Government Finance Statistics Yearbook* (1999).

\*\* World Development Indicators, 1970-1995.

\*\*\* From the Global Demography Project at University of California, Santa Barbara, used by Hall and Jones (1999). Normalized to [0,1].

\*\*\*\* Based on the classification in Beck et al. (2000).

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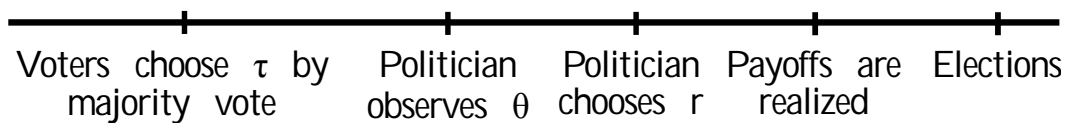


Figure 1: The structure of a period

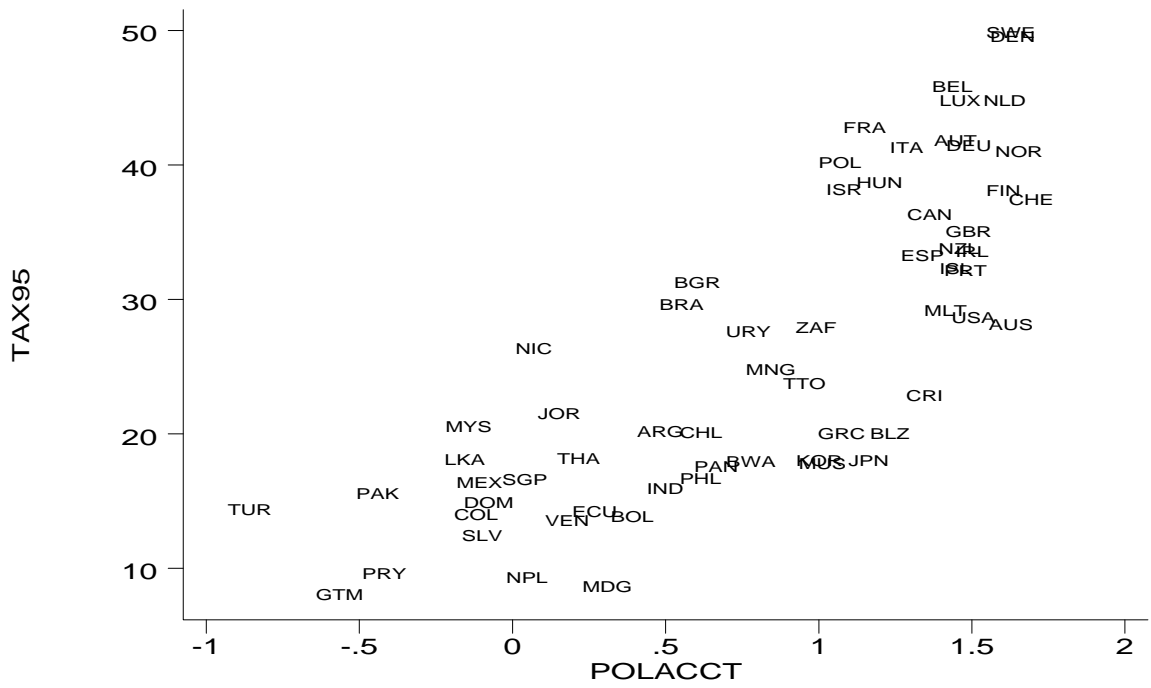


Figure 2: Political accountability and the size of general government

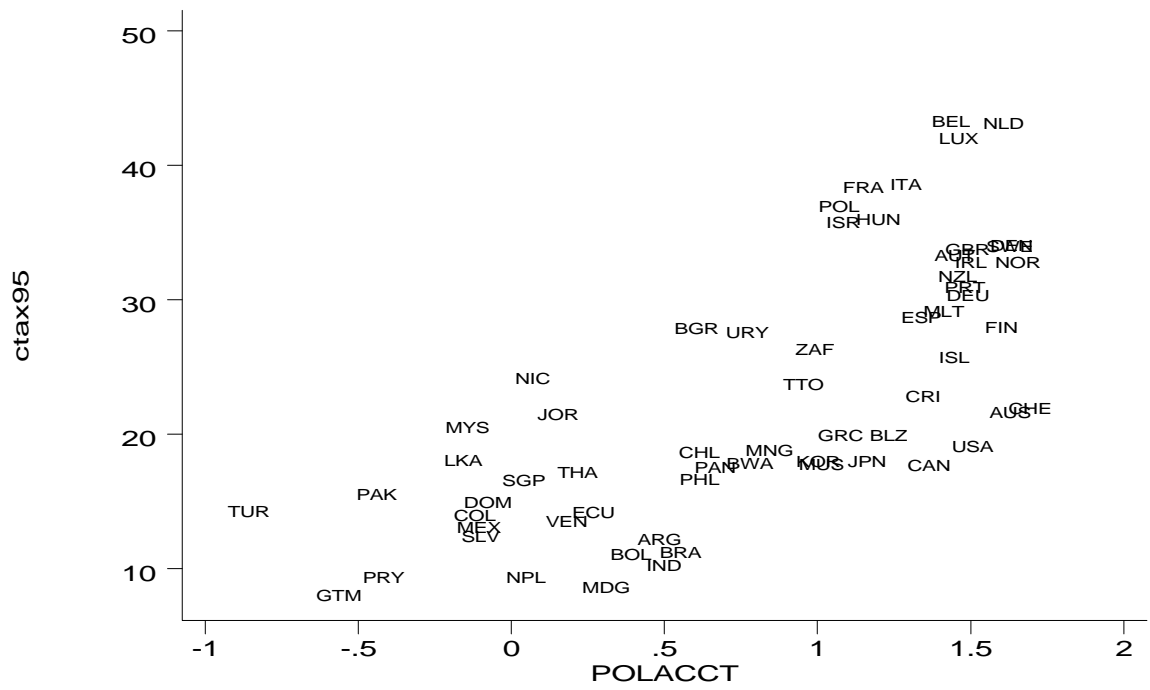


Figure 3: Political accountability and the size of central government

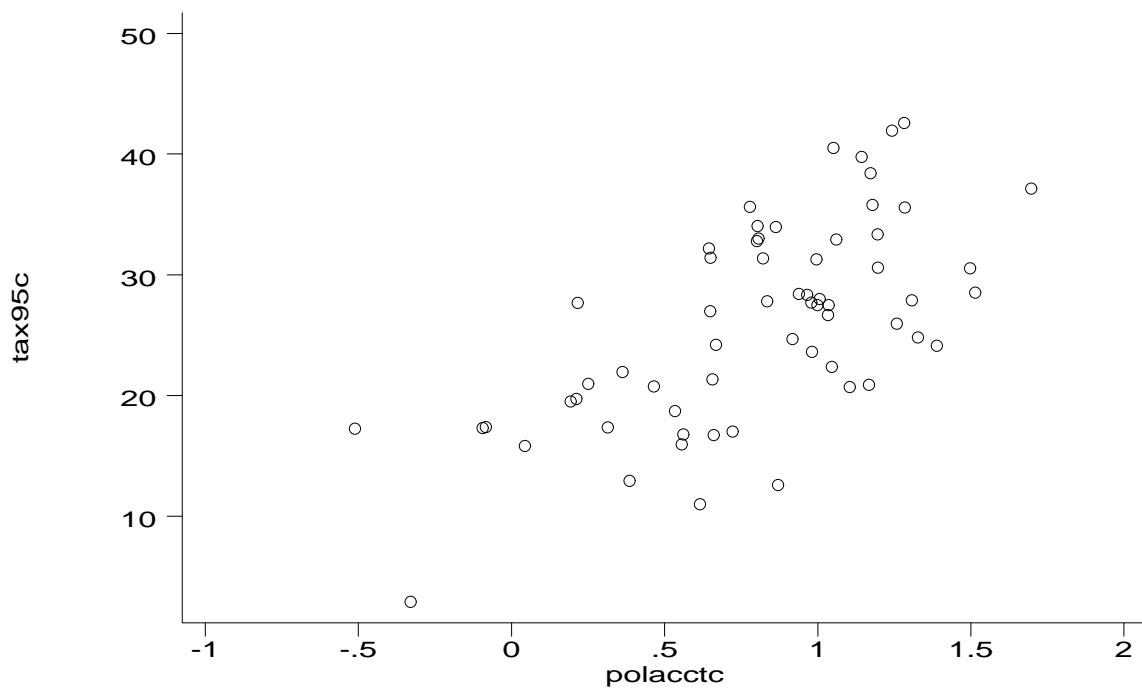


Figure 4: Controlling for other variables

Table 1: Size of Government and Political Accountability

| $N = 62$         | <i>GTAX</i>          |                      |                      |                      | <i>CTAX</i>          |                      |                     |                      |
|------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|
|                  | OLS                  | TSLs                 | OLS                  | TSLs                 | OLS                  | TSLs                 | OLS                 | TSLs                 |
| <i>POL</i>       | 13.308***<br>(1.233) | 18.900***<br>(2.006) | 10.300***<br>(1.469) | 22.837***<br>(5.296) | 10.001***<br>(1.158) | 14.786***<br>(1.762) | 7.694***<br>(1.240) | 17.869***<br>(4.698) |
| <i>LNINC</i>     |                      |                      | 3.255*<br>(1.236)    | -3.348<br>(3.372)    |                      |                      | 2.495*<br>(1.147)   | -2.864<br>(3.151)    |
| $R^2$            | .63                  |                      | .66                  |                      | .51                  |                      | .54                 |                      |
| $F$ (1st ST)     | 16.84                |                      | 16.84                |                      | 16.84                |                      | 16.84               |                      |
| $p(\text{OVER})$ | .626                 |                      | .810                 |                      | .973                 |                      | .850                |                      |

Estimated using STATA 6.0. A constant term (not reported) was included in all regressions. Robust standard errors are in parentheses, \*\*\*, \*\*, \* and § denote significance at the .1%, 1%, 5% and 10 % levels, respectively.  $F$  (1st ST) is the  $F$ -statistic from the first stage of the TSLs regression.  $p(\text{OVER})$  is the  $p$ -value associated with the null hypothesis of “no overidentification”.

Table 2: Size of Government and Political Accountability, incl. controls

| $N = 62$         | <i>GTAX</i>          |                      | <i>CTAX</i>         |                      |
|------------------|----------------------|----------------------|---------------------|----------------------|
|                  | OLS                  | TOLS                 | OLS                 | TOLS                 |
| <i>POL</i>       | 11.759***<br>(1.782) | 25.102***<br>(5.103) | 8.472***<br>(1.732) | 19.683***<br>(4.673) |
| <i>LNINC</i>     | 1.230<br>(1.879)     | -5.124<br>(4.011)    | .544<br>(1.931)     | -4.794<br>(3.940)    |
| <i>LNOPEN</i>    | 3.812§<br>(1.883)    | 6.286*<br>(2.567)    | 5.328**<br>(1.894)  | 7.407***<br>(2.123)  |
| <i>DEPEND</i>    | 3.206<br>(11.415)    | 17.740<br>(16.441)   | -.568<br>(9.879)    | 11.644<br>(13.686)   |
| <i>URBAN</i>     | .105*<br>(.048)      | .183*<br>(.081)      | .082§<br>(.047)     | .148*<br>(.074)      |
| <i>LNPOP</i>     | 1.402*<br>(.611)     | 2.987*<br>(1.211)    | .851<br>(.623)      | 2.182*<br>(1.081)    |
| $R^2$            | .70                  |                      | .61                 |                      |
| $F$ (1st ST)     | 16.17                |                      | 16.17               |                      |
| $p(\text{OVER})$ | .888                 |                      | .723                |                      |

Estimated using STATA 6.0. A constant term (not reported) was included in all regressions. Robust standard errors are in parentheses, \*\*\*, \*\*, \* and § denote significance at the .1%, 1%, 5% and 10 % levels, respectively.  $F$  (1st ST) is the  $F$ -statistic from the first stage of the TOLS regression.  $p(\text{OVER})$  is the  $p$ -value associated with the null hypothesis of “no overidentification”.



Table 3: Size of Government, civil liberties and political rights

| $N = 62$      | <i>GTAX</i>         |                      |                     |                     | <i>CTAX</i>                  |                      |                     |                      |
|---------------|---------------------|----------------------|---------------------|---------------------|------------------------------|----------------------|---------------------|----------------------|
|               | OLS                 | TSLs                 | OLS                 | TSLs                | OLS                          | TSLs                 | OLS                 | TSLs                 |
| <i>CL9095</i> | 5.872***<br>(1.226) | 16.968***<br>(4.694) |                     |                     | 4.245**<br>(1.285)           | 13.393***<br>(3.639) |                     |                      |
| <i>PR9095</i> |                     |                      | 5.697***<br>(1.654) | 15.900**<br>(4.789) |                              |                      | 4.629**<br>(1.623)  | 13.364***<br>(4.465) |
| <i>LNINC</i>  | 2.073<br>(2.122)    | -6.913<br>(4.687)    | 3.493<br>(2.501)    | -2.482<br>(4.333)   | 1.140<br>(1.984)             | -6.268<br>(4.145)    | 1.868<br>(2.201)    | -3.247<br>(4.080)    |
| <i>LNOPEN</i> | 5.639**<br>(2.053)  | 13.209**<br>(4.314)  | 7.768**<br>(2.455)  | 18.758**<br>(5.673) | 6.654**<br>(1.830)           | 12.895***<br>(3.277) | 8.743***<br>(2.186) | 18.151***<br>(4.693) |
| <i>DEPEND</i> | .692<br>(13.018)    | 20.146<br>(24.360)   | 4.562<br>(13.828)   | 29.933<br>(22.041)  | -2.353<br>(11.162)           | 13.685<br>(19.891)   | 1.714<br>(11.722)   | 23.434<br>(18.025)   |
| <i>URBAN</i>  | .071<br>(.055)      | .137<br>(.099)       | .070<br>(.063)      | .130<br>(.099)      | .058<br>(.048)               | .112<br>(.081)       | .060<br>(.054)      | .111<br>(.084)       |
| <i>LNPOP</i>  | 2.310**<br>(.760)   | 6.665**<br>(2.057)   | 2.266**<br>(.750)   | 6.314**<br>(1.961)  | 1.511 <sup>§</sup><br>(.826) | 5.101**<br>(1.722)   | 1.681*<br>(.791)    | 5.146**<br>(1.660)   |
| $R^2$         | .63                 |                      | .60                 |                     | .56                          |                      | .56                 |                      |
| $F$ (1st ST)  | 15.01               |                      | 16.30               |                     | 15.01                        |                      | 16.30               |                      |
| $p$ (OVER)    | .980                |                      | .221                |                     | .904                         |                      | .543                |                      |

Estimated using STATA 6.0. A constant term (not reported) was included in all regressions. Robust standard errors are in parentheses, \*\*\*, \*\*, \* and § denote significance at the .1%, 1%, 5% and 10 % levels, respectively.  $F$  (1st ST) is the  $F$ -statistic from the first stage of the TSLs regression.  $p$ (OVER) is the  $p$ -value associated with the null hypothesis of “no overidentification”.

Table 4: Size of Government and Political Accountability, income per capita endogenous

| $N = 62$         | <i>GTAX</i>          | <i>CTAX</i>          |
|------------------|----------------------|----------------------|
|                  | TOLS                 | TOLS                 |
| <i>POL</i>       | 26.124***<br>(5.536) | 19.441***<br>(4.787) |
| <i>LNINC</i>     | -7.816<br>(9.796)    | -4.157<br>(8.658)    |
| <i>LNOPEN</i>    | 6.459*<br>(2.664)    | 7.366***<br>(2.062)  |
| <i>DEPEND</i>    | 10.343<br>(34.247)   | 13.396<br>(29.912)   |
| <i>URBAN</i>     | .224<br>(.163)       | .138<br>(.139)       |
| <i>LNPOP</i>     | 2.994*<br>(1.258)    | 2.181*<br>(1.064)    |
| $R^2$            |                      |                      |
| $p(\text{OVER})$ | .701                 | .422                 |

Estimated using STATA 6.0. A constant term (not reported) was included in all regressions. Robust standard errors are in parentheses, \*\*\*, \*\*, \* and § denote significance at the .1%, 1%, 5% and 10 % levels, respectively.  $F$  (1st ST) is the  $F$ -statistic from the first stage of the TOLS regression.  $p(\text{OVER})$  is the  $p$ -value associated with the null hypothesis of “no overidentification”.

Table B.1: Descriptive statistics

| <i>N</i> = 62 | Mean   | Std.dev. | Min    | Max     |
|---------------|--------|----------|--------|---------|
| <i>TAX95</i>  | 26.000 | 11.500   | 7.71   | 49.510  |
| <i>CTAX95</i> | 22.600 | 9.576    | 7.71   | 42.980  |
| <i>POL</i>    | .805   | .683     | -.859  | 1.694   |
| <i>LAT</i>    | .347   | .186     | .015   | .710    |
| <i>ETHFR</i>  | .218   | .214     | 0      | .831    |
| <i>PRES</i>   | .435   | .500     | 0      | 1       |
| <i>LNINC</i>  | 9.031  | .905     | 6.835  | 10.289  |
| <i>LNOPEN</i> | 4.179  | .585     | 2.831  | 5.879   |
| <i>DEPEND</i> | .602   | .142     | .413   | 1.005   |
| <i>URBAN</i>  | 65.487 | 21.096   | 21.096 | 100.050 |
| <i>LNPOP</i>  | 16.269 | 1.671    | 12.283 | 20.650  |
| <i>CL9095</i> | -2.442 | 1.246    | -5     | -1      |
| <i>PR9095</i> | -2.019 | 1.140    | -4.6   | -1      |

```

*****
*****
*****
***** Political Accountability and the Size of Government: Additional
***** David Dreyer Lassen
*****
*****
***** 18 Nov 2000 14:42:12
*****
*****

```

```

/* Gen. gov. expenditures + Transfers (excl. capital and interest payments) */
/* ref. to p. 26 */
/* Tables 1 and 2 */
> reg tot polacct, robust;

```

```

Regression with robust standard errors
Number of obs = 62
F( 1, 60) = 93.75
Prob > F = 0.0000
R-squared = 0.5796
Root MSE = 8.7323

```

| tot     | Coef.    | Robust Std. Err. | t     | P> t  | [95% Conf. Interval] |          |
|---------|----------|------------------|-------|-------|----------------------|----------|
| polacct | 14.88115 | 1.536953         | 9.682 | 0.000 | 11.80679             | 17.95552 |
| _cons   | 14.11797 | 1.427549         | 9.890 | 0.000 | 11.26245             | 16.9735  |

```

. ivreg tot (polacct = lat pres ethfr), robust;

```

```

IV (2SLS) regression with robust standard errors
Number of obs = 62
F( 1, 60) = 79.58
Prob > F = 0.0000
R-squared = 0.4743
Root MSE = 9.7647

```

| tot     | Coef.    | Robust Std. Err. | t     | P> t  | [95% Conf. Interval] |          |
|---------|----------|------------------|-------|-------|----------------------|----------|
| polacct | 21.22324 | 2.379022         | 8.921 | 0.000 | 16.46448             | 25.98199 |
| _cons   | 9.010344 | 2.154091         | 4.183 | 0.000 | 4.70152              | 13.31917 |

```

Instrumented: polacct
Instruments: lat pres ethfr

```

```

. reg tot polacct lninc, robust;

```

```

Regression with robust standard errors
Number of obs = 62
F( 2, 59) = 58.12
Prob > F = 0.0000
R-squared = 0.6159
Root MSE = 8.4175

```

| tot     | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|---------|-----------|------------------|--------|-------|----------------------|----------|
| polacct | 11.25488  | 2.014373         | 5.587  | 0.000 | 7.224134             | 15.28563 |
| lninc   | 3.922801  | 1.492727         | 2.628  | 0.011 | .9358612             | 6.909742 |
| _cons   | -18.38832 | 12.16386         | -1.512 | 0.136 | -42.72815            | 5.951516 |

```

. ivreg tot (polacct = lat pres ethfr) lninc, robust;

```

```

IV (2SLS) regression with robust standard errors
Number of obs = 62
F( 2, 59) = 37.82
Prob > F = 0.0000
R-squared = 0.3589
Root MSE = 10.874

```

| tot     | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|---------|-----------|------------------|--------|-------|----------------------|----------|
| polacct | 25.08669  | 5.869587         | 4.274  | 0.000 | 13.34167             | 36.8317  |
| lninc   | -3.362201 | 3.636213         | -0.925 | 0.359 | -10.63825            | 3.913843 |
| _cons   | 36.26285  | 28.78451         | 1.260  | 0.213 | -21.33481            | 93.86051 |

```
-----
Instrumented: polacct
Instruments: lninc lat pres ethfr
-----
```

```
. reg tot polacct lnopen lninc depend urban logpop95, robust;
```

```
Regression with robust standard errors      Number of obs =      62
                                             F( 6, 55) =    19.84
                                             Prob > F      =    0.0000
                                             R-squared    =    0.6332
                                             Root MSE    =    8.5193
```

```
-----
```

| tot      | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 12.61463  | 2.276376         | 5.542  | 0.000 | 8.052669             | 17.17659 |
| lnopen   | 2.368202  | 2.499648         | 0.947  | 0.348 | -2.641205            | 7.377608 |
| lninc    | 3.721791  | 2.402466         | 1.549  | 0.127 | -1.092859            | 8.536441 |
| depend   | 8.988059  | 13.912           | 0.646  | 0.521 | -18.8922             | 36.86832 |
| urban    | .0435219  | .0701197         | 0.621  | 0.537 | -.097001             | .1840449 |
| logpop95 | 1.429005  | .7885925         | 1.812  | 0.075 | -.15137              | 3.009379 |
| _cons    | -59.07317 | 33.24294         | -1.777 | 0.081 | -125.6935            | 7.547173 |

```
-----
```

```
. ivreg tot (polacct = lat pres ethfr) lnopen lninc urban depend logpop95, robu
> st;
```

```
IV (2SLS) regression with robust standard errors      Number of obs =      62
                                             F( 6, 55) =    11.65
                                             Prob > F      =    0.0000
                                             R-squared    =    0.3867
                                             Root MSE    =    11.017
```

```
-----
```

| tot      | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 27.17385  | 5.864127         | 4.634  | 0.000 | 15.42188             | 38.92582 |
| lnopen   | 5.067925  | 2.967995         | 1.708  | 0.093 | -.8800699            | 11.01592 |
| lninc    | -3.211241 | 4.595133         | -0.699 | 0.488 | -12.42009            | 5.997611 |
| urban    | .1284833  | .0978709         | 1.313  | 0.195 | -.0676544            | .3246209 |
| depend   | 24.84762  | 19.75074         | 1.258  | 0.214 | -14.73375            | 64.42898 |
| logpop95 | 3.158381  | 1.44883          | 2.180  | 0.034 | .2548601             | 6.061902 |
| _cons    | -62.71334 | 45.55474         | -1.377 | 0.174 | -154.0071            | 28.58039 |

```
-----
```

```
Instrumented: polacct
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr
-----
```

```
. /* Table 3 */
> reg tot cl9095m lnopen lninc depend urban logpop95, robust;
```

```
Regression with robust standard errors      Number of obs =      62
                                             F( 6, 55) =    18.37
                                             Prob > F      =    0.0000
                                             R-squared    =    0.5875
                                             Root MSE    =    9.0343
```

```
-----
```

| tot      | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| cl9095m  | 6.633833  | 1.540899         | 4.305  | 0.000 | 3.545803             | 9.721863 |
| lnopen   | 4.555511  | 2.391052         | 1.905  | 0.062 | -.2362636            | 9.347285 |
| lninc    | 4.356162  | 2.647933         | 1.645  | 0.106 | -.9504156            | 9.662739 |
| depend   | 6.877871  | 14.86129         | 0.463  | 0.645 | -22.90482            | 36.66057 |
| urban    | .0092228  | .0744053         | 0.124  | 0.902 | -.1398888            | .1583343 |
| logpop95 | 2.534048  | .9314718         | 2.720  | 0.009 | .6673364             | 4.400759 |
| _cons    | -62.04594 | 37.07545         | -1.674 | 0.100 | -136.3468            | 12.25492 |

```
-----
```

```
. ivreg tot (cl9095m = lat pres ethfr) lnopen lninc urban depend logpop95, robu
> st;
```

```
IV (2SLS) regression with robust standard errors      Number of obs =      62
                                             F( 6, 55) =     8.43
                                             Prob > F      =    0.0000
                                             R-squared    =    0.1439
                                             Root MSE    =    13.015
```

```
-----
```

| tot      | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| cl9095m  | 18.46768  | 5.271688         | 3.503  | 0.001 | 7.902983             | 29.03238 |
| lnopen   | 12.63007  | 5.149122         | 2.453  | 0.017 | 2.310996             | 22.94914 |
| lninc    | -5.227919 | 5.229017         | -1.000 | 0.322 | -15.7071             | 5.251265 |
| urban    | .0793542  | .1153153         | 0.688  | 0.494 | -.1517429            | .3104512 |
| depend   | 27.62615  | 27.61688         | 1.000  | 0.322 | -27.71931            | 82.97161 |
| logpop95 | 7.178221  | 2.494524         | 2.878  | 0.006 | 2.179082             | 12.17736 |
| _cons    | -72.97523 | 63.43982         | -1.150 | 0.255 | -200.1115            | 54.16101 |

```
-----
```

```
Instrumented: cl9095m
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr
-----
```

```
. reg tot pr9095m lnopen lninc depend urban logpop95, robust;
```

```
Regression with robust standard errors
```

|                 |        |
|-----------------|--------|
| Number of obs = | 62     |
| F( 6, 55) =     | 17.27  |
| Prob > F =      | 0.0000 |
| R-squared =     | 0.5805 |
| Root MSE =      | 9.1106 |

```
-----
```

| tot      | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|----------|-----------|------------------|--------|-------|----------------------|-----------|
| pr9095m  | 7.027046  | 1.734479         | 4.051  | 0.000 | 3.551072             | 10.50302  |
| lnopen   | 7.59812   | 2.811867         | 2.702  | 0.009 | 1.963013             | 13.23323  |
| lninc    | 5.613545  | 2.608872         | 2.152  | 0.036 | .3852497             | 10.84184  |
| depend   | 12.72061  | 15.40408         | 0.826  | 0.412 | -18.14986            | 43.59108  |
| urban    | .0110873  | .074985          | 0.148  | 0.883 | -.1391859            | .1613605  |
| logpop95 | 2.718587  | .878204          | 3.096  | 0.003 | .9586267             | 4.478547  |
| _cons    | -94.76708 | 38.04865         | -2.491 | 0.016 | -171.0183            | -18.51588 |

```
-----
```

```
. ivreg tot (pr9095m = lat pres ethfr) lnopen lninc urban depend logpop95, robu
> st;
```

```
IV (2SLS) regression with robust standard errors
```

|                 |        |
|-----------------|--------|
| Number of obs = | 62     |
| F( 6, 55) =     | 8.29   |
| Prob > F =      | 0.0000 |
| R-squared =     | 0.2657 |
| Root MSE =      | 12.054 |

```
-----
```

| tot      | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| pr9095m  | 17.86238  | 5.283389         | 3.381  | 0.001 | 7.27423              | 28.45053 |
| lnopen   | 19.2692   | 6.629344         | 2.907  | 0.005 | 5.983696             | 32.5547  |
| lninc    | -.7319854 | 4.327742         | -0.169 | 0.866 | -9.404975            | 7.941004 |
| urban    | .0745829  | .1049924         | 0.710  | 0.480 | -.1358266            | .2849924 |
| depend   | 39.66434  | 25.37174         | 1.563  | 0.124 | -11.18175            | 90.51044 |
| logpop95 | 7.017497  | 2.315143         | 3.031  | 0.004 | 2.377847             | 11.65715 |
| _cons    | -154.6685 | 66.61871         | -2.322 | 0.024 | -288.1753            | -21.1616 |

```
-----
```

```
Instrumented: pr9095m
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr
-----
```

```
. /* Table 4 */
```

```
> ivreg tot (polacct lninc = lat pres ethfr) lnopen urban depend logpop95, robu
> st;
```

```
IV (2SLS) regression with robust standard errors
```

|                 |        |
|-----------------|--------|
| Number of obs = | 62     |
| F( 6, 55) =     | 10.49  |
| Prob > F =      | 0.0000 |
| R-squared =     | 0.3670 |
| Root MSE =      | 11.192 |

```
-----
```

| tot      | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 27.69944  | 6.549952         | 4.229  | 0.000 | 14.57304             | 40.82584 |
| lninc    | -4.595821 | 11.60322         | -0.396 | 0.694 | -27.84919            | 18.65755 |
| lnopen   | 5.156773  | 3.084015         | 1.672  | 0.100 | -1.023732            | 11.33728 |
| urban    | .1497322  | .1922857         | 0.779  | 0.439 | -.2356169            | .5350814 |
| depend   | 21.04218  | 39.76143         | 0.529  | 0.599 | -58.6415             | 100.7259 |
| logpop95 | 3.161632  | 1.471748         | 2.148  | 0.036 | .2121832             | 6.111081 |

```
-----
```

```

      _cons | -50.15779   112.8249   -0.445   0.658   -276.264   175.9484
-----+-----
Instrumented:  polacct lninc
Instruments:  lnopen urban depend logpop95 lat pres ethfr
-----+-----

```

```

/* Logistic transformation */
/* ref. to p. 29 */
> /* Table 1 */
> reg logtax polacct, robust;

```

```

Regression with robust standard errors
Number of obs =      62
F( 1, 60) = 118.59
Prob > F = 0.0000
R-squared = 0.6540
Root MSE = .37797

```

```

-----+-----
logtax |          Coef.      Robust
      |          Std. Err.      t    P>|t|      [95% Conf. Interval]
-----+-----
polacct |   .7541611   .0692546   10.890   0.000   .6156313   .892691
_cons   |  -1.746771   .0767255  -22.766   0.000  -1.900245  -1.593297
-----+-----

```

```

. ivreg logtax (polacct = lat pres ethfr), robust;

```

```

IV (2SLS) regression with robust standard errors
Number of obs =      62
F( 1, 60) = 103.00
Prob > F = 0.0000
R-squared = 0.5754
Root MSE = .41869

```

```

-----+-----
logtax |          Coef.      Robust
      |          Std. Err.      t    P>|t|      [95% Conf. Interval]
-----+-----
polacct |   1.015545   .1000635   10.149   0.000   .8153885   1.215702
_cons   |  -1.957278   .1018116  -19.225   0.000  -2.160932  -1.753625
-----+-----

```

```

Instrumented:  polacct
Instruments:  lat pres ethfr
-----+-----

```

```

. reg logctax polacct, robust;

```

```

Regression with robust standard errors
Number of obs =      62
F( 1, 60) = 75.34
Prob > F = 0.0000
R-squared = 0.5407
Root MSE = .39181

```

```

-----+-----
logctax |          Coef.      Robust
      |          Std. Err.      t    P>|t|      [95% Conf. Interval]
-----+-----
polacct |   .6169357   .0710777   8.680   0.000   .4747592   .7591122
_cons   |  -1.814104   .0771286  -23.521   0.000  -1.968384  -1.659824
-----+-----

```

```

. ivreg logctax (polacct = lat pres ethfr), robust;

```

```

IV (2SLS) regression with robust standard errors
Number of obs =      62
F( 1, 60) = 77.93
Prob > F = 0.0000
R-squared = 0.4553
Root MSE = .42668

```

```

-----+-----
logctax |          Coef.      Robust
      |          Std. Err.      t    P>|t|      [95% Conf. Interval]
-----+-----
polacct |   .8621453   .0976644   8.828   0.000   .6667874   1.057503
_cons   |  -2.011585   .0972723  -20.680   0.000  -2.206159  -1.817011
-----+-----

```

```

Instrumented:  polacct
Instruments:  lat pres ethfr
-----+-----

```

```

. /* Table 2 */
> reg logtax polacct lnopen lninc urban depend logpop95, robust;

```

Regression with robust standard errors

Number of obs = 62  
F( 6, 55) = 31.02  
Prob > F = 0.0000  
R-squared = 0.7323  
Root MSE = .34721

| logtax   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|----------|-----------|------------------|--------|-------|----------------------|-----------|
| polacct  | .6629992  | .0978606         | 6.775  | 0.000 | .4668823             | .8591162  |
| lnopen   | .2182143  | .1062339         | 2.054  | 0.045 | .0053167             | .4311118  |
| lninc    | .026431   | .0997801         | 0.265  | 0.792 | -.1735328            | .2263948  |
| urban    | .0065813  | .0026443         | 2.489  | 0.016 | .001282              | .0118806  |
| depend   | -.0862318 | .6636803         | -0.130 | 0.897 | -1.416277            | 1.243813  |
| logpop95 | .0759304  | .0304605         | 2.493  | 0.016 | .0148863             | .1369745  |
| _cons    | -4.438374 | 1.423096         | -3.119 | 0.003 | -7.290321            | -1.586426 |

. ivreg logtax (polacct = lat pres ethfr) lnopen lninc urban depend logpop95, r > obust;

IV (2SLS) regression with robust standard errors

Number of obs = 62  
F( 6, 55) = 16.68  
Prob > F = 0.0000  
R-squared = 0.5500  
Root MSE = .45018

| logtax   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|----------|-----------|------------------|--------|-------|----------------------|-----------|
| polacct  | 1.260286  | .24472           | 5.150  | 0.000 | .7698562             | 1.750716  |
| lnopen   | .3289694  | .1273068         | 2.584  | 0.012 | .0738409             | .5840979  |
| lninc    | -.2579941 | .1850034         | -1.395 | 0.169 | -.6287492            | .1127609  |
| urban    | .0100668  | .0038731         | 2.599  | 0.012 | .0023049             | .0178287  |
| depend   | .5644006  | .8417548         | 0.671  | 0.505 | -1.122514            | 2.251315  |
| logpop95 | .1468774  | .0580716         | 2.529  | 0.014 | .0304993             | .2632556  |
| _cons    | -4.587711 | 1.939916         | -2.365 | 0.022 | -8.47539             | -.7000314 |

Instrumented: polacct  
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

. reg logctax polacct lnopen lninc urban depend logpop95, robust;

Regression with robust standard errors

Number of obs = 62  
F( 6, 55) = 20.23  
Prob > F = 0.0000  
R-squared = 0.6572  
Root MSE = .3535

| logctax  | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|----------|-----------|------------------|--------|-------|----------------------|-----------|
| polacct  | .5037761  | .1039725         | 4.845  | 0.000 | .2954106             | .7121416  |
| lnopen   | .328555   | .1069425         | 3.072  | 0.003 | .1142374             | .5428725  |
| lninc    | .0293633  | .1087007         | 0.270  | 0.788 | -.1884777            | .2472043  |
| urban    | .0047778  | .0026806         | 1.782  | 0.080 | -.0005943            | .0101499  |
| depend   | -.2059868 | .6247663         | -0.330 | 0.743 | -1.458046            | 1.046073  |
| logpop95 | .0434061  | .0342442         | 1.268  | 0.210 | -.0252208            | .112033   |
| _cons    | -4.256284 | 1.56973          | -2.711 | 0.009 | -7.402094            | -1.110475 |

. ivreg logctax (polacct = lat pres ethfr) lnopen lninc urban depend logpop95, > robust;

IV (2SLS) regression with robust standard errors

Number of obs = 62  
F( 6, 55) = 13.48  
Prob > F = 0.0000  
R-squared = 0.4640  
Root MSE = .44204

| logctax | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|---------|-----------|------------------|--------|-------|----------------------|----------|
| polacct | 1.056987  | .2502925         | 4.223  | 0.000 | .5553898             | 1.558585 |
| lnopen  | .4311371  | .1124733         | 3.833  | 0.000 | .2057357             | .6565386 |
| lninc   | -.2340732 | .2022491         | -1.157 | 0.252 | -.6393894            | .171243  |
| urban   | .0080061  | .0038387         | 2.086  | 0.042 | .0003131             | .0156991 |



```

depend | .3966335 .7751797 0.512 0.611 -1.156861 1.950128
logpop95 | .1091178 .0588371 1.855 0.069 -.0087944 .2270299
_cons | -4.394601 1.938559 -2.267 0.027 -8.27956 -1.5096431

```

```

-----
Instrumented: polacct
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr
-----

```

```

. /* Table 3 */
> reg logtax cl9095m lnopen lninc depend urban logpop95, robust;

```

```

Regression with robust standard errors
Number of obs = 62
F( 6, 55) = 17.69
Prob > F = 0.0000
R-squared = 0.6476
Root MSE = .39843

```

```

-----
logtax | Coef. Robust Std. Err. t P>|t| [95% Conf. Interval]
-----+-----
cl9095m | .3169738 .0682284 4.646 0.000 .1802411 .4537065
lnopen | .3115539 .114384 2.724 0.009 .0823231 .5407846
lninc | .0854351 .1196996 0.714 0.478 -.1544481 .3253184
depend | -.2526959 .7521479 -0.336 0.738 -1.760034 1.254642
urban | .0045908 .0031224 1.470 0.147 -.0016667 .0108483
logpop95 | .1215737 .0391957 3.102 0.003 .0430238 .2001236
_cons | -4.565352 1.72029 -2.654 0.010 -8.01289 -1.117814
-----

```

```

. ivreg logtax (cl9095m = lat pres ethfr) lnopen lninc urban depend logpop95, r
> obust;

```

```

IV (2SLS) regression with robust standard errors
Number of obs = 62
F( 6, 55) = 9.64
Prob > F = 0.0000
R-squared = 0.2526
Root MSE = .58019

```

```

-----
logtax | Coef. Robust Std. Err. t P>|t| [95% Conf. Interval]
-----+-----
cl9095m | .8496663 .2299031 3.696 0.001 .3889301 1.310402
lnopen | .6750244 .2235755 3.019 0.004 .2269691 1.12308
lninc | -.3459856 .2273115 -1.522 0.134 -.8015281 .1095569
urban | .0077477 .0050366 1.538 0.130 -.0023458 .0178412
depend | .6812734 1.235372 0.551 0.584 -1.794467 3.157013
logpop95 | .3306279 .1022683 3.233 0.002 .1256777 .5355782
_cons | -5.057326 2.89783 -1.745 0.087 -10.86471 .7500539
-----

```

```

Instrumented: cl9095m
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr
-----

```

```

. reg logtax pr9095m lnopen lninc depend urban logpop95, robust;

```

```

Regression with robust standard errors
Number of obs = 62
F( 6, 55) = 15.73
Prob > F = 0.0000
R-squared = 0.6135
Root MSE = .41724

```

```

-----
logtax | Coef. Robust Std. Err. t P>|t| [95% Conf. Interval]
-----+-----
pr9095m | .2996251 .0978314 3.063 0.003 .1035666 .4956836
lnopen | .4180097 .1397643 2.991 0.004 .1379158 .6981035
lninc | .1666777 .1457672 1.143 0.258 -.1254463 .4588017
depend | -.0633817 .7990514 -0.079 0.937 -1.664716 1.537953
urban | .0044681 .0035976 1.242 0.220 -.0027417 .011678
logpop95 | .1160539 .0405611 2.861 0.006 .0347676 .1973402
_cons | -5.929036 1.722457 -3.442 0.001 -9.380916 -2.477156
-----

```

```

. ivreg logtax (pr9095m = lat pres ethfr) lnopen lninc urban depend logpop95, r
> obust;

```

```

IV (2SLS) regression with robust standard errors
Number of obs = 62
F( 6, 55) = 8.48
Prob > F = 0.0000

```

R-squared = 0.3288  
 Root MSE = .54984

| logtax   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|----------|-----------|------------------|--------|-------|----------------------|-----------|
| pr9095m  | .7912276  | .2519057         | 3.141  | 0.003 | .2863973             | 1.296058  |
| lnopen   | .9475303  | .3019922         | 3.138  | 0.003 | .3423243             | 1.552736  |
| lninc    | -.1212211 | .2279314         | -0.532 | 0.597 | -.5780057            | .3355636  |
| urban    | .007349   | .005139          | 1.430  | 0.158 | -.0029498            | .0176477  |
| depend   | 1.159064  | 1.182009         | 0.981  | 0.331 | -1.209734            | 3.527862  |
| logpop95 | .3110969  | .1014536         | 3.066  | 0.003 | .1077793             | .5144144  |
| _cons    | -8.646782 | 2.933969         | -2.947 | 0.005 | -14.52659            | -2.766976 |

Instrumented: pr9095m  
 Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

```
. /* Table 4 */
> ivreg logtax (polacct lninc = lat pres ethfr) lnopen urban depend logpop95, r
> obust;
```

IV (2SLS) regression with robust standard errors      Number of obs =      62  
 F( 6, 55) = 14.76  
 Prob > F = 0.0000  
 R-squared = 0.5104  
 Root MSE = .4696

| logtax   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 1.312091  | .2589602         | 5.067  | 0.000 | .7931236             | 1.831059 |
| lninc    | -.394466  | .4838991         | -0.815 | 0.418 | -1.364222            | .5752895 |
| lnopen   | .3377268  | .1315754         | 2.567  | 0.013 | .0740439             | .6014097 |
| urban    | .0121612  | .008168          | 1.489  | 0.142 | -.0042079            | .0285303 |
| depend   | .1893159  | 1.788622         | 0.106  | 0.916 | -3.395163            | 3.773795 |
| logpop95 | .1471979  | .0604553         | 2.435  | 0.018 | .0260427             | .2683531 |
| _cons    | -3.350165 | 5.108596         | -0.656 | 0.515 | -13.58802            | 6.88769  |

Instrumented: polacct lninc  
 Instruments: lnopen urban depend logpop95 lat pres ethfr

```
/* GMM heteroscedasticity correction */
/* ref. to p. 30 */
> /* Table 1 */
> ivgmm0 tax95 (polacct = lat pres ethfr);
```

Instrumental Variables Estimation via GMM      Number of obs =      62  
 Root MSE = 8.0042  
 Hansen J = 1.0108  
 Chi-sq( 2) P-val = 0.60327

| tax95   | Coef.    | GMM Std. Err. | z     | P> z  | [95% Conf. Interval] |          |
|---------|----------|---------------|-------|-------|----------------------|----------|
| polacct | 18.88485 | 1.960428      | 9.633 | 0.000 | 15.04248             | 22.72722 |
| _cons   | 11.05177 | 1.863331      | 5.931 | 0.000 | 7.399713             | 14.70384 |

Instrumented: polacct  
 Instruments: lat pres ethfr

```
. ivgmm0 tax95 (polacct = lat pres ethfr) lninc;
```

Instrumental Variables Estimation via GMM      Number of obs =      62  
 Root MSE = 9.1317  
 Hansen J = 0.3341  
 Chi-sq( 2) P-val = 0.84617

| tax95   | Coef.     | GMM Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|---------|-----------|---------------|--------|-------|----------------------|----------|
| polacct | 22.93986  | 5.152832      | 4.452  | 0.000 | 12.8405              | 33.03923 |
| lninc   | -3.535584 | 3.275447      | -1.079 | 0.280 | -9.955342            | 2.884174 |
| _cons   | 39.67077  | 25.84209      | 1.535  | 0.125 | -10.9788             | 90.32033 |

Instrumented: polacct  
 Instruments: lninc lat pres ethfr

```
. ivgmm0 ctax95 (polacct = lat pres ethfr);
```

```
Instrumental Variables Estimation via GMM      Number of obs =      62
Root MSE =      7.4796
Hansen J =      0.0617
Chi-sq( 2) P-val = 0.96961
```

| ctax95  | Coef.    | GMM<br>Std. Err. | z     | P> z  | [95% Conf. Interval] |          |
|---------|----------|------------------|-------|-------|----------------------|----------|
| polacct | 14.84358 | 1.720086         | 8.630 | 0.000 | 11.47228             | 18.21489 |
| _cons   | 10.68424 | 1.591905         | 6.712 | 0.000 | 7.564162             | 13.80431 |

```
Instrumented: polacct
Instruments: lat pres ethfr
```

```
. ivgmm0 ctax95 (polacct = lat pres ethfr) lninc;
```

```
Instrumental Variables Estimation via GMM      Number of obs =      62
Root MSE =      8.1450
Hansen J =      0.3433
Chi-sq( 2) P-val = 0.84229
```

| ctax95  | Coef.     | GMM<br>Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|---------|-----------|------------------|--------|-------|----------------------|----------|
| polacct | 17.68754  | 4.492842         | 3.937  | 0.000 | 8.881731             | 26.49335 |
| lninc   | -2.557482 | 2.957956         | -0.865 | 0.387 | -8.354968            | 3.240005 |
| _cons   | 31.48939  | 23.5107          | 1.339  | 0.180 | -14.59073            | 77.56951 |

```
Instrumented: polacct
Instruments: lninc lat pres ethfr
```

```
. /* Table 2 */
```

```
> ivgmm0 tax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95;
```

```
Instrumental Variables Estimation via GMM      Number of obs =      62
Root MSE =      8.8680
Hansen J =      0.2953
Chi-sq( 2) P-val = 0.86271
```

| tax95    | Coef.     | GMM<br>Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 25.38165  | 4.468795         | 5.680  | 0.000 | 16.62297             | 34.14033 |
| lnopen   | 6.519197  | 2.393043         | 2.724  | 0.006 | 1.828918             | 11.20947 |
| lninc    | -5.276974 | 3.643255         | -1.448 | 0.147 | -12.41762            | 1.863675 |
| urban    | .1858478  | .0746851         | 2.488  | 0.013 | .0394676             | .3322279 |
| depend   | 18.65198  | 15.2891          | 1.220  | 0.222 | -11.3141             | 48.61806 |
| logpop95 | 3.141054  | 1.082524         | 2.902  | 0.004 | 1.019346             | 5.262762 |
| _cons    | -48.51824 | 36.6766          | -1.323 | 0.186 | -120.403             | 23.36656 |

```
Instrumented: polacct
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr
```

```
. ivgmm0 ctax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95;
```

```
Instrumental Variables Estimation via GMM      Number of obs =      62
Root MSE =      7.7484
Hansen J =      0.7191
Chi-sq( 2) P-val = 0.69798
```

| ctax95   | Coef.     | GMM<br>Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 19.3304   | 4.08654          | 4.730  | 0.000 | 11.32093             | 27.33987 |
| lnopen   | 7.528461  | 1.921093         | 3.919  | 0.000 | 3.763188             | 11.29373 |
| lninc    | -4.385263 | 3.487823         | -1.257 | 0.209 | -11.22127            | 2.450744 |
| urban    | .141353   | .065804          | 2.148  | 0.032 | .0123795             | .2703264 |
| depend   | 11.47479  | 12.51068         | 0.917  | 0.359 | -13.04569            | 35.99528 |
| logpop95 | 2.224058  | .9313515         | 2.388  | 0.017 | .3986425             | 4.049473 |
| _cons    | -37.12404 | 32.72307         | -1.134 | 0.257 | -101.2601            | 27.01199 |

```
Instrumented: polacct
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr
```

```
. /* Table 3 */
```

> ivgmm0 tax95 (cl9095m = lat pres ethfr) lnopen lninc urban depend logpop95;

Instrumental Variables Estimation via GMM  
 Number of obs = 62  
 Root MSE = 10.8288  
 Hansen J = 0.0485  
 Chi-sq( 2) P-val = 0.97602

| tax95    | Coef.     | GMM Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|----------|-----------|---------------|--------|-------|----------------------|----------|
| cl9095m  | 16.83687  | 4.340008      | 3.879  | 0.000 | 8.33061              | 25.34313 |
| lnopen   | 13.00613  | 3.88337       | 3.349  | 0.001 | 5.394869             | 20.6174  |
| lninc    | -6.907493 | 4.273764      | -1.616 | 0.106 | -15.28392            | 1.46893  |
| urban    | .1350532  | .0867215      | 1.557  | 0.119 | -.0349179            | .3050242 |
| depend   | 18.94547  | 21.8834       | 0.866  | 0.387 | -23.9452             | 61.83614 |
| logpop95 | 6.562811  | 1.864535      | 3.520  | 0.000 | 2.90839              | 10.21723 |
| _cons    | -51.91078 | 50.61118      | -1.026 | 0.305 | -151.1069            | 47.28532 |

Instrumented: cl9095m  
 Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

. ivgmm0 tax95 (pr9095m = lat pres ethfr) lnopen lninc urban depend logpop95;

Instrumental Variables Estimation via GMM  
 Number of obs = 62  
 Root MSE = 10.9545  
 Hansen J = 2.2322  
 Chi-sq( 2) P-val = 0.32755

| tax95    | Coef.     | GMM Std. Err. | z      | P> z  | [95% Conf. Interval] |           |
|----------|-----------|---------------|--------|-------|----------------------|-----------|
| pr9095m  | 17.40667  | 4.422125      | 3.936  | 0.000 | 8.739468             | 26.07388  |
| lnopen   | 20.2887   | 5.381503      | 3.770  | 0.000 | 9.741145             | 30.83625  |
| lninc    | -4.352169 | 3.487482      | -1.248 | 0.212 | -11.18751            | 2.48317   |
| urban    | .168897   | .0935159      | 1.806  | 0.071 | -.0143907            | .3521847  |
| depend   | 28.73479  | 22.24036      | 1.292  | 0.196 | -14.8555             | 72.32509  |
| logpop95 | 6.336231  | 1.925804      | 3.290  | 0.001 | 2.561725             | 10.11074  |
| _cons    | -116.3838 | 56.80926      | -2.049 | 0.040 | -227.7279            | -5.039708 |

Instrumented: pr9095m  
 Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

. ivgmm0 ctax95 (cl9095m = lat pres ethfr) lnopen lninc urban depend logpop95;

Instrumental Variables Estimation via GMM  
 Number of obs = 62  
 Root MSE = 9.2408  
 Hansen J = 0.1977  
 Chi-sq( 2) P-val = 0.90589

| ctax95   | Coef.     | GMM Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|----------|-----------|---------------|--------|-------|----------------------|----------|
| cl9095m  | 13.17768  | 3.316839      | 3.973  | 0.000 | 6.676792             | 19.67856 |
| lnopen   | 12.58703  | 2.897361      | 4.344  | 0.000 | 6.908304             | 18.26575 |
| lninc    | -5.747627 | 3.654986      | -1.573 | 0.116 | -12.91127            | 1.416013 |
| urban    | .0996481  | .0687304      | 1.450  | 0.147 | -.0350611            | .2343573 |
| depend   | 14.43672  | 17.66485      | 0.817  | 0.414 | -20.18574            | 49.05918 |
| logpop95 | 5.052071  | 1.532159      | 3.297  | 0.001 | 2.049094             | 8.055047 |
| _cons    | -43.22273 | 42.70797      | -1.012 | 0.312 | -126.9288            | 40.48336 |

Instrumented: cl9095m  
 Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

. ivgmm0 ctax95 (pr9095m = lat pres ethfr) lnopen lninc urban depend logpop95;

Instrumental Variables Estimation via GMM  
 Number of obs = 62  
 Root MSE = 9.3259  
 Hansen J = 0.9286  
 Chi-sq( 2) P-val = 0.62857

| ctax95   | Coef.     | GMM Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|----------|-----------|---------------|--------|-------|----------------------|----------|
| pr9095m  | 14.49166  | 3.436137      | 4.217  | 0.000 | 7.756957             | 21.22637 |
| lnopen   | 19.43522  | 4.216058      | 4.610  | 0.000 | 11.1719              | 27.69854 |
| lninc    | -4.328359 | 3.148171      | -1.375 | 0.169 | -10.49866            | 1.841943 |
| urban    | .1333346  | .0759944      | 1.755  | 0.079 | -.0156117            | .2822809 |
| depend   | 24.11958  | 17.9934       | 1.340  | 0.180 | -11.14683            | 59.386   |
| logpop95 | 5.35597   | 1.598226      | 3.351  | 0.001 | 2.223505             | 8.488435 |

```

      _cons | -101.0123   47.00007   -2.149   0.032   -193.1307  -8.893849
-----+-----
Instrumented:  pr9095m
Instruments:  lnopen lninc urban depend logpop95 lat pres ethfr
-----+-----

```

```

. /* Table 4 */
> ivgmm0 tax95 (polacct lninc = lat pres ethfr) lnopen urban depend logpop95;

```

```

Instrumental Variables Estimation via GMM          Number of obs =      62
                                                Root MSE      =    9.1257
                                                Hansen J      =    0.1519
                                                Chi-sq( 1) P-val = 0.69674
-----+-----

```

| tax95    | Coef.     | GMM Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|----------|-----------|---------------|--------|-------|----------------------|----------|
| polacct  | 25.94414  | 5.16895       | 5.019  | 0.000 | 15.81319             | 36.0751  |
| lninc    | -8.083221 | 9.185365      | -0.880 | 0.379 | -26.08621            | 9.919763 |
| lnopen   | 6.564511  | 2.476875      | 2.650  | 0.008 | 1.709925             | 11.4191  |
| urban    | .2292538  | .152865       | 1.500  | 0.134 | -.070356             | .5288637 |
| depend   | 8.762907  | 31.82834      | 0.275  | 0.783 | -53.61949            | 71.1453  |
| logpop95 | 3.005905  | 1.177054      | 2.554  | 0.011 | .6989219             | 5.312889 |
| _cons    | -18.54602 | 94.3906       | -0.196 | 0.844 | -203.5482            | 166.4562 |

```

Instrumented:  polacct lninc
Instruments:  lnopen urban depend logpop95 lat pres ethfr
-----+-----

```

```

. ivgmm0 ctax95 (polacct lninc = lat pres ethfr) lnopen urban depend logpop95;

```

```

Instrumental Variables Estimation via GMM          Number of obs =      62
                                                Root MSE      =    7.8093
                                                Hansen J      =    0.7029
                                                Chi-sq( 1) P-val = 0.40180
-----+-----

```

| ctax95   | Coef.     | GMM Std. Err. | z      | P> z  | [95% Conf. Interval] |          |
|----------|-----------|---------------|--------|-------|----------------------|----------|
| polacct  | 19.53481  | 4.573647      | 4.271  | 0.000 | 10.57063             | 28.49899 |
| lninc    | -5.07325  | 8.204758      | -0.618 | 0.536 | -21.15428            | 11.00778 |
| lnopen   | 7.546214  | 1.95421       | 3.862  | 0.000 | 3.716032             | 11.3764  |
| urban    | .151782   | .1325632      | 1.145  | 0.252 | -.1080372            | .4116012 |
| depend   | 9.193455  | 27.73655      | 0.331  | 0.740 | -45.16918            | 63.55609 |
| logpop95 | 2.19558   | 1.005195      | 2.184  | 0.029 | .2254336             | 4.165727 |
| _cons    | -29.99813 | 84.49932      | -0.355 | 0.723 | -195.6138            | 135.6175 |

```

Instrumented:  polacct lninc
Instruments:  lnopen urban depend logpop95 lat pres ethfr
-----+-----

```

```

/* Outliers */
/* ref. to p. 32 */
/* Excl. Turkey */
/* Table 2 */
> reg tax95 polacct lnopen lninc depend urban logpop95, robust;

```

```

Regression with robust standard errors          Number of obs =      61
                                                F( 6, 54) =    26.46
                                                Prob > F      =    0.0000
                                                R-squared     =    0.6981
                                                Root MSE     =    6.6546
-----+-----

```

| tax95    | Coef.    | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|----------|------------------|--------|-------|----------------------|----------|
| polacct  | 12.6121  | 1.837246         | 6.865  | 0.000 | 8.928639             | 16.29555 |
| lnopen   | 3.960704 | 1.93006          | 2.052  | 0.045 | .0911668             | 7.830241 |
| lninc    | 1.034935 | 1.896437         | 0.546  | 0.588 | -2.767192            | 4.837062 |
| depend   | 4.588224 | 11.76002         | 0.390  | 0.698 | -18.98919            | 28.16564 |
| urban    | .1033574 | .0481509         | 2.147  | 0.036 | .0068207             | .1998941 |
| logpop95 | 1.426456 | .6208293         | 2.298  | 0.025 | .1817684             | 2.671144 |
| _cons    | -42.9252 | 26.75456         | -1.604 | 0.114 | -96.56486            | 10.71447 |

```

. ivreg tax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95 , r
> obust;

```

```

IV (2SLS) regression with robust standard errors          Number of obs =      61
                                                F( 6, 54) =    14.94
                                                Prob > F      =    0.0000
-----+-----

```

R-squared = 0.5489  
 Root MSE = 8.1342

| tax95    | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 23.05241  | 4.139002         | 5.570  | 0.000 | 14.75421             | 31.35061 |
| lnopen   | 5.879756  | 2.319385         | 2.535  | 0.014 | 1.229669             | 10.52984 |
| lninc    | -3.564926 | 3.144736         | -1.134 | 0.262 | -9.869743            | 2.73989  |
| urban    | .1527176  | .0652386         | 2.341  | 0.023 | .021922              | .2835131 |
| depend   | 16.75837  | 15.702           | 1.067  | 0.291 | -14.72225            | 48.23898 |
| logpop95 | 2.530684  | .999533          | 2.532  | 0.014 | .5267413             | 4.534627 |
| _cons    | -46.56636 | 36.57486         | -1.273 | 0.208 | -119.8945            | 26.76181 |

Instrumented: polacct  
 Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

. reg ctax95 polacct lnopen lninc depend urban logpop95, robust;

Regression with robust standard errors  
 Number of obs = 61  
 F( 6, 54) = 18.16  
 Prob > F = 0.0000  
 R-squared = 0.6151  
 Root MSE = 6.2713

| ctax95   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 9.236538  | 1.790426         | 5.159  | 0.000 | 5.64695              | 12.82613 |
| lnopen   | 5.460909  | 1.802572         | 3.030  | 0.004 | 1.84697              | 9.074847 |
| lninc    | .3697081  | 1.962358         | 0.188  | 0.851 | -3.564582            | 4.303998 |
| depend   | .670663   | 10.10466         | 0.066  | 0.947 | -19.58796            | 20.92929 |
| urban    | .0808385  | .0468999         | 1.724  | 0.090 | -.0131901            | .1748671 |
| logpop95 | .8723901  | .6278647         | 1.389  | 0.170 | -.3864028            | 2.131183 |
| _cons    | -31.00785 | 27.40509         | -1.131 | 0.263 | -85.95174            | 23.93604 |

. ivreg ctax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95 ,  
 > robust;

IV (2SLS) regression with robust standard errors  
 Number of obs = 61  
 F( 6, 54) = 12.03  
 Prob > F = 0.0000  
 R-squared = 0.4538  
 Root MSE = 7.4707

| ctax95   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 18.29784  | 3.886016         | 4.709  | 0.000 | 10.50685             | 26.08884 |
| lnopen   | 7.126483  | 1.943458         | 3.667  | 0.001 | 3.230085             | 11.02288 |
| lninc    | -3.622581 | 3.270759         | -1.108 | 0.273 | -10.18006            | 2.934897 |
| urban    | .1236789  | .0617499         | 2.003  | 0.050 | -.0001222            | .24748   |
| depend   | 11.23331  | 13.29039         | 0.845  | 0.402 | -15.41232            | 37.87895 |
| logpop95 | 1.830766  | .9292327         | 1.970  | 0.054 | -.0322332            | 3.693766 |
| _cons    | -34.16807 | 34.2892          | -0.996 | 0.323 | -102.9138            | 34.57764 |

Instrumented: polacct  
 Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

/\* Excl. Singapore \*/  
 /\* Table 2 \*/

> reg tax95 polacct lnopen lninc depend urban logpop95, robust;

Regression with robust standard errors  
 Number of obs = 61  
 F( 6, 54) = 28.83  
 Prob > F = 0.0000  
 R-squared = 0.7112  
 Root MSE = 6.5293

| tax95   | Coef.    | Robust Std. Err. | t     | P> t  | [95% Conf. Interval] |          |
|---------|----------|------------------|-------|-------|----------------------|----------|
| polacct | 10.43524 | 1.541722         | 6.769 | 0.000 | 7.34427              | 13.5262  |
| lnopen  | 5.30266  | 1.973643         | 2.687 | 0.010 | 1.345743             | 9.259576 |
| lninc   | 1.658651 | 1.78643          | 0.928 | 0.357 | -1.922925            | 5.240226 |

```

depend | .8363979 11.3597 0.074 0.942 -21.93843 23.61122
urban | .1202045 .0489612 2.455 0.017 .0220431 .2183659
logpop95 | 1.531791 .588312 2.604 0.012 .3522965 2.711286
_cons | -52.60123 24.97234 -2.106 0.040 -102.6678 -2.534701

```

```

. ivreg tax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95 , r
> obust;

```

```

IV (2SLS) regression with robust standard errors      Number of obs =      61
                                                       F( 6, 54) =      12.25
                                                       Prob > F      =      0.0000
                                                       R-squared     =      0.3598
                                                       Root MSE     =      9.7209

```

| tax95    | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 26.4137   | 7.391592         | 3.573  | 0.001 | 11.59446             | 41.23295 |
| lnopen   | 5.469316  | 2.875825         | 1.902  | 0.063 | -.2963666            | 11.235   |
| lninc    | -5.625659 | 4.887114         | -1.151 | 0.255 | -15.42373            | 4.172416 |
| urban    | .1764427  | .0829852         | 2.126  | 0.038 | .0100673             | .3428181 |
| depend   | 19.73533  | 18.59397         | 1.061  | 0.293 | -17.54334            | 57.014   |
| logpop95 | 2.968058  | 1.309094         | 2.267  | 0.027 | .3434834             | 5.592632 |
| _cons    | -39.18993 | 43.08653         | -0.910 | 0.367 | -125.5732            | 47.19336 |

```

Instrumented: polacct
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

```

```

. reg ctax95 polacct lnopen lninc depend urban logpop95, robust;

```

```

Regression with robust standard errors      Number of obs =      61
                                                       F( 6, 54) =      20.56
                                                       Prob > F      =      0.0000
                                                       R-squared     =      0.6445
                                                       Root MSE     =      6.046

```

| ctax95   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 6.936483  | 1.324877         | 5.236  | 0.000 | 4.280265             | 9.5927   |
| lnopen   | 7.057119  | 1.725873         | 4.089  | 0.000 | 3.596951             | 10.51729 |
| lninc    | 1.041841  | 1.835819         | 0.568  | 0.573 | -2.638755            | 4.722436 |
| depend   | -3.316633 | 9.687887         | -0.342 | 0.733 | -22.73968            | 16.10641 |
| urban    | .0999617  | .0462138         | 2.163  | 0.035 | .0073086             | .1926147 |
| logpop95 | 1.000956  | .6021369         | 1.662  | 0.102 | -.2062561            | 2.208167 |
| _cons    | -42.44531 | 26.33788         | -1.612 | 0.113 | -95.24959            | 10.35897 |

```

. ivreg ctax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95 ,
> robust;

```

```

IV (2SLS) regression with robust standard errors      Number of obs =      61
                                                       F( 6, 54) =      10.10
                                                       Prob > F      =      0.0000
                                                       R-squared     =      0.2992
                                                       Root MSE     =      8.489

```

| ctax95   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 20.15776  | 6.553095         | 3.076  | 0.003 | 7.019591             | 33.29592 |
| lnopen   | 7.195018  | 2.247975         | 3.201  | 0.002 | 2.6881               | 11.70194 |
| lninc    | -4.98551  | 4.582971         | -1.088 | 0.282 | -14.17381            | 4.202794 |
| urban    | .1464956  | .0734868         | 1.993  | 0.051 | -.0008365            | .2938277 |
| depend   | 12.32116  | 15.25545         | 0.808  | 0.423 | -18.26418            | 42.9065  |
| logpop95 | 2.189385  | 1.136476         | 1.926  | 0.059 | -.0891134            | 4.467883 |
| _cons    | -31.34823 | 38.16498         | -0.821 | 0.415 | -107.8644            | 45.16795 |

```

Instrumented: polacct
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

```

```

/* Excl. Turkey and Singapore */
/* Table 2 */
> reg tax95 polacct lnopen lninc depend urban logpop95, robust;

```

```

Regression with robust standard errors      Number of obs =      60

```

F( 6, 53) = 27.70  
 Prob > F = 0.0000  
 R-squared = 0.7092  
 Root MSE = 6.5498

| tax95    | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |           |
|----------|-----------|------------------|--------|-------|----------------------|-----------|
| polacct  | 11.16745  | 1.697102         | 6.580  | 0.000 | 7.763499             | 14.57141  |
| lnopen   | 5.290246  | 1.96242          | 2.696  | 0.009 | 1.354131             | 9.226361  |
| lninc    | 1.481152  | 1.788308         | 0.828  | 0.411 | -2.105739            | 5.068043  |
| depend   | 2.041409  | 11.72328         | 0.174  | 0.862 | -21.47252            | 25.55534  |
| urban    | .1177939  | .0490247         | 2.403  | 0.020 | .0194629             | .216125   |
| logpop95 | 1.538875  | .5942704         | 2.590  | 0.012 | .3469199             | 2.730831  |
| _cons    | -52.33486 | 25.15463         | -2.081 | 0.042 | -102.7887            | -1.881065 |

. ivreg tax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95 , r  
 > obust;

IV (2SLS) regression with robust standard errors      Number of obs = 60  
 F( 6, 53) = 14.24  
 Prob > F = 0.0000  
 R-squared = 0.5371  
 Root MSE = 8.2641

| tax95    | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 23.33481  | 5.487035         | 4.253  | 0.000 | 12.32921             | 34.3404  |
| lnopen   | 5.360125  | 2.582655         | 2.075  | 0.043 | .1799742             | 10.54028 |
| lninc    | -3.621169 | 3.45429          | -1.048 | 0.299 | -10.5496             | 3.307259 |
| urban    | .1464326  | .0646021         | 2.267  | 0.028 | .0168572             | .2760081 |
| depend   | 17.39671  | 17.06421         | 1.019  | 0.313 | -16.82975            | 51.62317 |
| logpop95 | 2.465523  | 1.008818         | 2.444  | 0.018 | .4420906             | 4.488956 |
| _cons    | -43.11272 | 37.87485         | -1.138 | 0.260 | -119.08              | 32.8546  |

Instrumented: polacct  
 Instruments: lnopen lninc urban depend logpop95 lat pres ethfr

. reg ctax95 polacct lnopen lninc depend urban logpop95, robust;

Regression with robust standard errors      Number of obs = 60  
 F( 6, 53) = 19.84  
 Prob > F = 0.0000  
 R-squared = 0.6427  
 Root MSE = 6.0754

| ctax95   | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|----------|-----------|------------------|--------|-------|----------------------|----------|
| polacct  | 7.51276   | 1.445499         | 5.197  | 0.000 | 4.613456             | 10.41206 |
| lnopen   | 7.047349  | 1.701249         | 4.142  | 0.000 | 3.635076             | 10.45962 |
| lninc    | .9021445  | 1.853419         | 0.487  | 0.628 | -2.815344            | 4.619633 |
| depend   | -2.368255 | 9.854522         | -0.240 | 0.811 | -22.13392            | 17.39741 |
| urban    | .0980645  | .0462415         | 2.121  | 0.039 | .0053158             | .1908132 |
| logpop95 | 1.006531  | .6032174         | 1.669  | 0.101 | -.2033697            | 2.216432 |
| _cons    | -42.23567 | 26.34851         | -1.603 | 0.115 | -95.08409            | 10.61275 |

. ivreg ctax95 (polacct = lat pres ethfr) lnopen lninc urban depend logpop95 ,  
 > robust;

IV (2SLS) regression with robust standard errors      Number of obs = 60  
 F( 6, 53) = 12.08  
 Prob > F = 0.0000  
 R-squared = 0.4528  
 Root MSE = 7.5188

| ctax95  | Coef.     | Robust Std. Err. | t      | P> t  | [95% Conf. Interval] |          |
|---------|-----------|------------------|--------|-------|----------------------|----------|
| polacct | 18.20773  | 5.047891         | 3.607  | 0.001 | 8.082947             | 28.33252 |
| lnopen  | 7.108772  | 2.062231         | 3.447  | 0.001 | 2.97246              | 11.24508 |
| lninc   | -3.582743 | 3.522246         | -1.017 | 0.314 | -10.64747            | 3.481987 |
| urban   | .1232376  | .0602401         | 2.046  | 0.046 | .0024113             | .2440639 |



|          |  |           |          |        |       |           |          |
|----------|--|-----------|----------|--------|-------|-----------|----------|
| depend   |  | 11.12889  | 14.35108 | 0.775  | 0.442 | -17.65573 | 39.91352 |
| logpop95 |  | 1.821045  | .9245853 | 1.970  | 0.054 | -.0334383 | 3.675528 |
| _cons    |  | -34.12951 | 35.03169 | -0.974 | 0.334 | -104.3942 | 36.13516 |

-----  
Instrumented: polacct  
Instruments: lnopen lninc urban depend logpop95 lat pres ethfr  
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. end