The Political Economy of Health Services Provision in Brazil

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I. Introduction

In developing countries, health care is often publicly provided and subsidized by the government. This is sometimes used as an instrument to redistribute income and to assure that the poor receive at least some minimum level of health services. A notable example is Brazil's Unified and Decentralized Health Care System (SUS), one of the largest public health programs in the world, established in 1988 with the goal of providing access to health care for all citizens, regardless of income. Financed by transfers from the federal government, as well as contributions from states and counties, the SUS is the main source of medical treatment for the poor.

This article reports the political economy correlates of the distribution of publicly provided health services across *municipios* (counties) of Brazil. We ask whether voter preferences, as measured by the share of uninsured in the county, are associated with greater provision of doctors, nurses, and clinics. We use data on voting rates to examine whether the poor can hold politicians accountable by voting. We are also interested in the role of political connections in determining the level of health services, given the importance of transfers

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from state to county governments. Do politicians at the state and federal levels reward popular mayors or mayors who are of the same party with larger transfers? How does this translate into health services? As a step toward understanding whether political considerations figure prominently in public health service allocation, we examine the systematic correlates of the numbers of public clinics, doctors, and nurses per capita across roughly 4,000 counties in Brazil in 1998.

We use a probabilistic voting model (Foster and Rosenzweig 2001; Grossman and Helpman 2001) of redistribution to guide the choice of control variables in our empirical models. Two parties compete for the votes of citizens who favor public provision of health care (e.g., the uninsured) and those who do not (e.g., the insured). In a voting equilibrium, the level of public services provided reflects the shares of the two groups of citizens in the voting population and is limited by the size of the public budget. The model implies that provision of public health care should increase with average incomes (since this raises the level of tax revenues in the public budget constraint) and with the share of uninsured in the population of voters. It should also be increased by higher voter turnout by persons favoring publicly provided health care.

The funds available for SUS services are also affected by transfers to the county from the state and federal governments. We hypothesize that these transfers will be larger, the greater the political power of local officials and their influence with state and federal officials. Specifically, political alignment between the county mayor and state governor should increase transfers, as should a higher vote share for the county mayor in the last election. An interesting question is whether these transfers are used to provide more salient services, for example, clinics and consultation rooms, or to increase the number of doctors and nurses who work at SUS clinics. The use of "pork" and preferential allotment of services as political currency have figured prominently in the theoretical and descriptive literatures on Brazilian politics (Alston and Mueller 2006) and on public service delivery worldwide (World Bank 2004, chap. 9). We provide some systematic empirical evidence on the role of clientelism and patronage in the allocation of health services using Brazilian county-level electoral data.

Measuring the causal impact of these factors on SUS services or on transfers from higher levels of government is problematic since past allocations of health inputs may themselves affect political outcomes such as the popularity of the elected leader, whose effect on the allocation of health services we seek to measure. The voting rate may also be correlated with other unobserved characteristics of the county that affect health care. To build confidence in these estimated relationships, we report some auxiliary regressions on changes in

spending after elections that limit the influence of reverse causality. We show that counties with strong local leaders and higher voting rates not only provide more health inputs in the cross section, but once the election outcomes are determined, those counties also experience larger increases in budgets over the next 5 years. We also present some instrumental variables (IV) results.

We exploit regional variation in the history of party politics to create an instrument for electoral competition. Many parties in Brazil have strong regional identities and region-specific bases of loyalty stemming from a history of civil conflicts and have limited presence outside their region (Fleischer 1998).[1] As a result, the number of parties competing for office in different regions has varied historically. We use the number of parties that competed for office in a county in 1982 (when Brazil was governed by a military regime, before the democratic constitution of 1988 and the system of regular elections introduced thereafter) as an instrument for the winner's vote share in the 1996 county mayor elections. The historical lack of presence of competitors turns out to be a strong predictor of the vote share captured by the county mayor.

Our results indicate that voter preferences and incomes are correlated with SUS clinics, doctors, and nurses. All three inputs are higher in counties with a higher percentage of poor persons in the population (a higher Gini coefficient, holding per capita income constant) and a higher percentage of citizens favoring redistribution (as measured by the share of votes going to the left-leaning candidate in the 1998 presidential election). They are also higher in counties with higher per capita incomes since this increases the public budget constraint, a result borne out by our health budget equations.

The importance of political factors depends on the health inputs examined. Clinic and clinic consultation rooms are greater, the higher the percentage of the population that votes and the higher the mayor's vote share in the 1996 elections. (This is also true of the 2000 per capita health budget.) However, the same is not true for less salient health services, namely, the number of SUS doctors and nurses per capita. Neither the proportion of the county that votes nor the popularity of the mayor explains variation in these health inputs across counties. Similarly, connections between the county mayor and the governor—whether they hold the same party affiliation or not—affect clinics and clinic consultation rooms but not doctors and nurses. This suggests that the salience of the service is important: political pressures and political connections may encourage politicians to deliver health inputs, but they are more

[1] For example, the electorate in the southern states of Brazil, with a history of civil wars, holds stronger party loyalties, and two strong national parties have experienced meager results in this area because they were considered traitors as they split from other parties with strong local bases of support (Fleischer 1995).

likely to deliver inputs that are more visible, a result consistent with Mani and Mukand (2007).

Our results build on a literature on the political economy of intergovernmental transfers (e.g., Inman 1988; Grossman 1994; Case 2001; Khemani 2003) and local service delivery (e.g., Betancourt and Gleason 2000; Foster and Rosenzweig 2001; Besley and Burgess 2002; Banerjee 2004; Zhang et al. 2004). Since our models examine only one of many goods provided publicly by local governments, these results do not necessarily imply that governments facing certain democratic pressures (e.g., greater participation) either perform better or are more accountable since constituents may like a different public service on which we do not have data (e.g., more police or greater access to clean water) even better than publicly provided health care.

The next section discusses the administrative structure of the health care system in Brazil and recent reforms. Section III presents our theoretical model. In Section IV, we describe empirical models to explain variation in the number of SUS doctors, nurses, and clinics across counties. Section V presents empirical results, and Section VI concludes.

II. The Health Care System in Brazil

Under the military regime (1964–85), public health care provision in Brazil was heavily concentrated in the rich areas of the south and southeast, with preferential access openly granted to certain professionals and public sector employees (Lobato 2001). The 1988 "Citizens' Constitution," which marked the new period of democratic rule, decreed that all citizens should have universal and equal access to health actions and services, regardless of income or occupation (Vajda, Carvalho Zimbres, and Tavares de Souza 1998). To fulfill constitutional requirements, the Unified and Decentralized Health Care System (SUS) was established in 1990 to make health care available free of charge to all users.

Currently, a fully private system coexists with SUS. It is funded mostly through private health insurance plans and provides much higher-quality care than the public SUS system (Alves and Timmins 2003). Premiums for private insurance plans are relatively costly for most Brazilians, and only about 25% of the population (mostly those with higher incomes or with employer-provided coverage) had private health insurance in 1998–99 (Alvarez 1998). These individuals generally make little use of the SUS system, unless they require highly complex health care services that private plans do not cover. Our theoretical and associated empirical strategy is premised on the idea that the uninsured value SUS health services relatively more than the insured do, but the actual situation may be a bit more complicated. The severely ill uninsured

may prefer not to spend any money on a low-quality public system that effectively provides only basic care (Leonard and Leonard 2004). Leonard and Leonard (2004) also point out the converse: that the wealthy, who rarely visit public facilities, may still benefit from their existence when private insurance cannot cover all expenses or when their circumstances change. We have only imperfect empirical measures of the aggregate size of the uninsured group in each county, with no differentiation by illness severity or other relevant demand characteristics, and are thus forced to abstract from these issues.

This article focuses on health care provision through the SUS system, which is publicly financed. The following sections discuss the ownership and administration of facilities in the SUS system and how public health care is financed.[2]

A. Ownership and Administration of Facilities in the SUS System

Although the SUS system is fully publicly financed, many health care establishments providing SUS services are privately owned. The remainder are federal, state, and county facilities. In 1999, 67% of all SUS hospitals were privately owned, while state and county governments accounted for 8% and 23% of hospitals, respectively. In contrast, county governments owned 69% of clinics, while only 27% were private (IBGE 1999).

Irrespective of ownership, all SUS facilities are administered by either state or county governments. The 1988 Constitution required that the administration of public health care provision should gradually devolve to county governments, with financial and technical assistance provided by the federal and state governments (Lobato and Burlandy 2001). Currently, 80% of all counties manage the provision of basic or primary health care (while the state retains management of more complex and specialist care), and a further 8% of counties manage both basic and complex care.[3]

B. Financing of the SUS System

About 70% of health care services provided under SUS are ultimately financed by transfers from the federal government, of which there are two types: those for basic health care and those for complex care. The 88% of partially or fully decentralized counties administer basic care transfer funds. These transfers are divided into two categories: (i) "fixed" population-based transfers, where the per capita amount transferred is the same for most counties, and (ii) various

[2] Much of the discussion of the SUS system is based on World Bank (1999, 2003), Lobato (2001), and Lobato and Burlandy (2001).

[3] Visits to family doctors as well as some other types of clinical care are considered basic or primary health care; complex procedures and visits to specialists are not.

types of "variable" transfers for primary health programs tailored to the poor, often requiring additional payments or cofinancing by states or counties.

Only fully decentralized county governments can handle transfers for complex care. These transfers are meant solely for the reimbursement of SUS providers for services rendered and are subject to two constraints: (i) they must follow a fee-for-service schedule maintained by the federal government, and (ii) there is an annual ceiling on the total amount of transfers that each subnational government can disburse. The amount of the ceiling is determined by political negotiations between the federal and subnational governments. Political factors that affect the nature of these negotiations, thus, may play a key role in determining provision patterns for complex care. For example, SUS allocations may be favorable for counties that are politically important or politically allied to the state in some form.

Each state and county government managing these federal transfers imposes, in turn, a ceiling on transfers to each licensed SUS provider in its jurisdiction. The government in charge also has the right to determine which providers qualify to participate in the SUS system. The subnational governments may supplement these federal transfers with their own funds. About 30% of the payments to SUS providers come from subnational government revenues. The states and counties have taxing authority over land, property, and transportation and also receive "general purpose" transfers from the federal government.

III. Theoretical Model

In Brazil, publicly financed health care is, effectively, a publicly provided private good. The level of basic health care provision is chosen by the county, as is the level of complex health care services in the case of full decentralization.[4] Because county officials in Brazil are democratically elected, it is natural to use a voting model of redistribution through a public good as a framework for our empirical analysis. We adapt the two-party strategic voting model (Foster and Rosenzweig 2001; Grossman and Helpman 2001) that examines the preferences for a publicly provided good that we call "health care" paid for through tax revenues, where the key assumption is that the poor differentially benefit from the good relative to the rich.[5]

The population of each county is normalized to 1. A fraction r of the county

[4] This is true for 88% of counties, i.e., those who have attained Basic Assistance or Full System Management status.

[5] Brazil is a multiparty democracy, and the number of candidates competing for office often exceeds two. However, for *municipio* mayor elections, there is a second-round runoff if one candidate fails to gain a majority in the first round. We thus view the two-party model as a sensible approximation.

population is "rich," while the remainder ($1 - r$) is "poor." Our aim here is to draw a distinction between two classes of people who differentially benefit from public health services. Throughout, the superscript u represents the upper-income group, the superscript l the lower-income group, and y^g, where $g = u, l$, denotes the income of each group. All individuals within an income group have identical incomes.

Public revenues for the county come from two sources: transfers from the state government, T, which are determined through political negotiations between the county and the state, and local tax revenues from taxing the incomes of the rich and the poor at a common rate t. These revenues are used either to finance public health services or to provide another public good (e), which we refer to as education, for concreteness. Each unit of effective health service per capita is denoted h, and it is delivered at a per-unit cost p_h.[6] The unit cost of the other public good is p_e. The public budget constraint is thus

$$T + t(1 - r)y^l + try^u - p_h h - p_e e = 0. \quad (1)$$

Two parties, denoted A and B, have fixed positions on a set of issues and choose the amount of effective health service (h), education (e), and tax rate (t) to offer, in order to compete for the votes of both rich and poor households. The parties can credibly commit to carry out their platforms in the event that they win the election. Each voter recognizes that his vote will slightly increase the subjective probability that the party he has chosen will win the election. His dominant strategy is to vote for the party he prefers since this slightly raises his expected welfare. We assume that all rich people vote, while a fraction v of the poor vote, with $0 \leq v \leq 1$.[7]

Voters receive utility $W^g(h, e, c)$ from the public health service (h), education (e), and a private consumption good, c. Since all after-tax income is spent on c, the utility of a voter in group g is given by $W^g(h, e, y^g(1 - t))$. Utility W^g is assumed to be increasing and concave in all arguments and additively separable in consumption and the two public goods. We expect $W_h^u(\cdot) < W_h^l(\cdot)$, which means that the poor enjoy greater marginal benefits from public health services than do the rich. Each voter's welfare from voting for a particular

[6] This effective health service should be interpreted as the actual service received by the consumer. It incorporates not just the amount of services offered (e.g., the number of clinics) but also their placement within a county and the types of procedures offered at each location; h is, of course, a function of health inputs such as clinics, doctors, and nurses.

[7] This assumption is not crucial to the results, but it reflects empirical observations about voting patterns in Brazil. Voting is compulsory in Brazil; however, people who do not work in the formal sector (and are therefore less likely to have insurance) are also more likely to escape being fined if they do not vote.

party depends on the (h, e, t) combination offered by that party as well as his preferences over the fixed (e.g., ideological) positions of that party. A person i in income group g votes for party A over party B if

$$W^g(h_A, e_A, y^g(1 - t_A)) - W^g(h_B, e_B, y^g(1 - t_B)) + \delta\varepsilon_{Ai} - \delta\varepsilon_{Bi} \geq 0, \quad (2)$$

where $\varepsilon_{.i}$ is the individual-specific preference for the fixed platforms of each party, and δ is the relative weight placed on such ideological considerations. If the relative ideological preference of a voter for party A over party B ($\varepsilon_{Ai} - \varepsilon_{Bi}$) is distributed uniformly over the interval [−1/2, 1/2], then the expected number of votes for party A is given by

$$EV_A = r\left[\frac{1}{2} - \frac{W^u(h_B, e_B, y^u(1 - t_B)) - W^u(h_A, e_A, y^u(1 - t_A))}{\delta}\right] + v(1 - r)\left[\frac{1}{2} - \frac{W^l(h_B, e_B, y^l(1 - t_B)) - W^l(h_A, e_A, y^l(1 - t_A))}{\delta}\right]. \quad (3)$$

Each party proposes a tax rate (t_A or t_B) and an amount of effective public health service and education (per capita) to be delivered, (h_A, e_A) or (h_B, e_B), to maximize its expected vote share (EV_A or EV_B), given the (h, e, t) choice of the other party and subject to the public budget constraint. The first-order condition for h from the Lagrangian of this maximization problem is $r(\partial W^u/\partial h_A) + v(1 - r)(\partial W^l/\partial h_A) - \lambda p_h \delta = 0$, where λ is the Lagrange multiplier associated with the public budget constraint. This states that each party's choice of h equates the weighted marginal utility of the two groups to the marginal cost of provision, where the weights are the proportions of each group in the voting population. The complete first-order conditions for party A's maximization problem are given in the appendix. Party B's maximization problem and first-order conditions are identical, which implies that in the unique Nash equilibrium, both parties offer the same tax–public goods policy. The h that emerges in equilibrium is the same, regardless of which party wins the election.

We use the model to investigate the impact of changes in the proportion of rich persons in the population (r), the proportion of poor who vote (v), and the size of transfer (T) on the amount of publicly provided health care. By totally differentiating the first-order conditions, it is possible to examine the impacts of changes in the parameters of the model on the quantity of effective per capita health care (h) delivered in equilibrium.

An increase in r (proportion of people who are rich) has an ambiguous effect on h. When the marginal utility of consumption is approximately constant, the effect of a change in r is proportional to

$$\frac{dh}{dr} = \left(\frac{\bar{y}}{p} W_h^u - y^u W_c^u h\right) - v\left(\frac{\bar{y}}{p} W_h^l - y^l W_c^l h\right)$$

$$+ \left(\frac{y^u - y^l}{p_h}\right)(rW_h^u + v(1-r)W_h^l), \tag{4}$$

where $\bar{y} = ry^u + (1-r)y^l$. The first term on the right-hand side of (4) is the net marginal benefit of health services to the rich (net of consumption costs), while the second term is net marginal benefits of h to the poor multiplied by their voting rate. If the net marginal benefits of public health accruing to the poor are sufficiently larger than those accruing to the rich, then the sum of the first two terms is negative, which causes h to decrease with r. This is an effect of party platforms: with an increase in the proportion of rich people in the population, the (h, t) combination offered by each party caters more to the preferences of the rich segment of the population. The positive last term is due to a relaxation of the public budget constraint that is associated with an increase in the rich segment of the population. An increase in r raises average incomes and tax revenues, and the parties can afford to offer a larger amount of public health care.

The two distinct and opposite impacts of an increase in r on h are thus (1) the effect of a changing composition of the voting population, which alters policy in favor of the rich, and (2) the effect of increasing average income, which leads to greater public service delivery. In our empirical work, we seek to distinguish these two effects by measuring the proportion of poor/uninsured in the population separately from average incomes. Holding the proportion of poor constant, the model predicts that an increase in average income should have a positive impact on the amount of effective health care (per capita) delivered by the county. And, holding average income constant, an increase in the proportion of poor/uninsured in the population should also have a positive impact.

The model predicts that an increase in the voting rate of the poor (v) will increase public health care provision as long as the marginal benefits to the poor of an extra dollar of tax (in terms of the extra health services that a tax dollar will provide) exceed its marginal consumption cost. As shown in the appendix, $[(\bar{y}/p) W_h^l - y^l W_c^l](1-r) > 0$ guarantees that $dh/dv > 0$. An increase in v causes politicians to alter policy in favor of poor people's preferences, and if the poor prefer that tax rates be raised to fund more public health care, then that is what will happen.

Finally, the effect of greater transfers from the state to the county (T) is straightforward: it simply relaxes the public budget constraint and allows the

political parties to offer more public health care for any given level of tax revenues. For every extra dollar that the county is able to bring in from the state through the intergovernmental political negotiations process, h increases since the political party can increase its vote share by spending more on h. It is important to note that an exogenously given T that is common to both parties is a simplistic assumption in this model. In the empirical work, we allow political party identity to affect the level of T.

The effective level of health care per capita, h, is unobservable. What we can observe are the levels of inputs—doctors, nurses, and clinics—used to produce health care. The amount of effective health care per capita is dependent on the placement of health inputs vis-à-vis the population, as well as on how efficiently these inputs are managed. We assume that h is a constant-returns-to-scale function of doctors, nurses, and clinics (or clinic rooms) per capita, as well as descriptors of the geographic distribution of the population (P) including population density (d):

$$h = f(D, N, C; P, d). \tag{5}$$

Once h is determined as an outcome of the political process, health care inputs are chosen to minimize the cost of achieving h. This implies that doctors, nurses, and clinics per capita will depend on the factors affecting h in the voting model, as well as on the geographic distribution of the population, which affect the amount of effective health care provided by a given vector of health inputs.

IV. Political Economy Correlates of SUS Doctors, Nurses, and Clinics

We estimate how the factors described in the previous section are correlated with variation in the level of public health inputs—SUS doctors, nurses, and clinics (or clinic rooms) per capita—across counties. In estimating these equations, we use data for 4,338 counties for 1998. Although one might suspect that current levels of health care inputs were predetermined by historic factors, there is some margin for SUS inputs to respond to current political conditions. This is because SUS contracts out a large portion of its services to private facilities, which makes the provision of clinics and health care workers somewhat elastic, as private providers can be moved in and out of the SUS system.

The fact that we study the cross-sectional variation in health inputs leads to concerns that political outcomes whose effects on service delivery we intend to study are themselves influenced by the quality of health services delivered. To deal with this, we instrument for mayor popularity (i.e., the mayor's vote share in the 1996 election), a variable for which concerns about endogeneity and reverse causality are particularly strong. We also estimate models to explain

the per capita health budget in 2000 and the change in the health budget between 1995 and 2000 to see whether the provision of health inputs grew faster in response to certain political outcomes in the years after an election. We first describe the measurement of the control variables in the cross-sectional models of health inputs and then describe our instruments for mayor popularity.

A. Voter Preferences and Incomes

In the model presented in Section III, the amount of public health care provided depends on the size of the public budget constraint and on the distribution of voter preferences within the community. Because public health care is financed in part out of local tax revenues, we expect the quantity of health services provided to increase with per capita income in the county ($\bar{y}$). It should also increase with the size of transfers received from state and federal governments. These may depend on political factors, which are discussed more fully below.

Preferences for publicly provided health care should increase with the percentage of uninsured people in the county. This should be correlated with the percentage of households falling below a given income level. Holding mean income constant, the percentage of households below a given income threshold is increasing in the Gini coefficient for the county. Other variables that might be correlated with the demand for public health care include the percentage of households living in slums and the racial composition of the population (e.g., population shares of the indigenous and the nonwhite).

Voters' desires for redistribution may also play a role in determining outcomes. If this desire is strong and if governments respond accordingly, provision levels and access—especially for the poor—may be higher. Our (albeit imperfect) measure for this is the proportion of county residents who voted for either of the two clearly left-leaning candidates in the 1998 presidential elections—Lula and Ciro Gomes.[8] These two candidates accounted for about 35% of the votes, on average, across the sample counties.

B. Voter Turnout

According to the model of Section III, the amount of public health care provided depends on the proportion of voters in a county who favor public health care. Although, by law, voting is compulsory for literates in all elections, in practice the penalties for noncompliance are not large, and average voter turnout (77% in the 1996 elections) is significantly less than 100%. Our proxy

[8] Lula—Brazil's current president—has been a key figure in the Worker's Party, a party that has fashioned itself as left leaning. Aside from Lula, the only candidate in the 1998 presidential elections who ran on a clearly leftist platform was Ciro Gomes, of the ex-communist Popular Socialist Party.

for political participation by persons favoring public health care (v) is the proportion of residents in each county who voted in the 1996 county elections. Because people employed in the informal sector are more likely to be able to escape the penalty for not voting, variation in participation rates is likely a result of variation in the voting rate of those without formal sector jobs (the segment of the population more likely to use SUS services). We also include the fraction of the county population that is illiterate since this may also explain variation in the voting rate.

C. *Factors Affecting Transfers*

Although not captured in the model of Section III, political factors are likely to play a key role in determining the size of transfers to counties from the state and federal governments. SUS allocations and other transfers may be favorable for counties that are politically important or that have close ties to the state capital (Lima 2002). These counties may also be favored in other ways, such as through special training programs, preferential access to the services of medical staff, and the location of better state-owned health care facilities in the county. We include three variables as proxies for political connections: (1) the distance of each county from the state capital, (2) a measure of political alliance indicating whether the mayor of the county elected in 1996 and the state governor elected in 1994 were from the same party,[9] and (3) the winner's vote share in the 1996 mayoral election. The winner's vote share is included because locally elected officials with a strong popularity base possibly have greater political capital to expend in their negotiations with state legislators over the size of their health budget. It is important for state politicians to keep strong local leaders happy. Note that this is the inverse of the extent of political (electoral) competition across parties and candidates. The effect of mayor popularity (i.e., lack of competition) is thus indistinguishable from the effect of electoral competition. We interact the popularity measure with the political alliance variable since we expect the effect of a popular local politician on funds transfers to be stronger when the state and county politicians are in a coalition. However, it is possible that the two measures of influence work as substitutes, not complements.

[9] This occurs in 13.6% of counties in our sample. We do not use 1998 gubernatorial election results because the new governor elected in 1998 would take office in 1999. Our dependent variables are measured in 1998 and 1999, and we are allowing for a time lag since we expect political actions to have a delayed rather than immediate impact on provision. We also expanded the definition of the political connections variable to indicate whether the state governor's party and county mayor's party formed a coalition in that state, but the qualitative results do not change under this alternative definition.

D. Variables Influencing the Effectiveness of Public Health Inputs

This "effective health service" should be interpreted as the actual service received by the consumer. It incorporates not just the amount of services offered (e.g., the number of clinics) but also their placement within a county and the types of procedures offered at each location. The effective level of public health care received by residents of a county depends on the geographic distribution of these services within the county. Other things equal, a given number of doctors per person is likely to be less effective, the more dispersed the population. Geographic controls added to capture this phenomenon include (i) the proportion of county residents living in urban areas, (ii) population density, and (iii) a dummy for counties officially classified as belonging to a major metropolitan area.

E. Instruments

It is reasonable to be concerned about endogeneity on a number of right-hand-side variables in our specifications, which implies that the OLS regression results should be interpreted as a set of conditional correlations. We are most concerned about the endogeneity of popularity of the county mayor since a simple reverse causality story (i.e., past levels of provision may affect the vote share garnered by the elected mayor) can explain the correlation. We create an instrument for this variable, using the history of party politics in Brazil, which creates some regional variation in current political outcomes. Party identity in Brazil is most often regional rather than national (Fleischer 1998), and party loyalty is similarly region specific (Fleischer 1995). This implies that the numbers and identities of parties operating in different regions have varied historically.

Brazil became a representative democracy in 1945, after a long period of military rule, but this lasted only until 1964, when military rule was reestablished. The military government started liberalizing slowly in the 1980s and allowed the direct election of state governors in 1982. The liberalization process culminated in the democratic constitution of 1988, and a regular schedule of federal, state, and municipal elections was established in the 1990s. We were able to gather data on the parties competing for the local elections held in 1982, which took place under a different political regime 14–16 years before the elections whose effects on health service delivery are the focus of this article. We use the number of parties competing for office in each county in the 1982 election, whose variation is largely driven by the historical presence of each party in that region, as an instrument for the vote share won by the county mayor elected in 1996. The number of parties competing in 1982 may signify the long-term level of political competition in a region, but as indicated

before, intensity of electoral competition is precisely the mechanism we are trying to capture with our "vote share of the elected mayor" variable. In other words, popularity of the elected mayor is the direct inverse of political competition. These two mechanisms are indistinguishable because popularity signifies a lack of competition.

The first stage of the IV estimation in table 1 shows that the historical lack of party operations in a region effectively implied that the mayor faced much less competition in 1996. This turns out to be a strong predictor of the vote share garnered by the mayor and is highly statistically significant. For each additional party competing in the county in 1982, the vote share of the elected mayor decreases by about 2 percentage points (7% at the mean) in 1996.

If party dominance in 1982 in a locality leads to more favorable transfers from upper-level governments, which allows those parties to provide better services to their constituents (which in turn allows them to remain dominant in the 1990s), then our instrument does not provide completely exogenous variation to tackle this difficult identification problem. Our IV identification assumption, thus, relies on the fact that the 1982 elections were a special event that occurred under "a different set of rules" during the authoritarian regime, which imposed strict restrictions on electoral competition. Elections in the 1990s took place under a completely new democratic paradigm. In fact, the most popular party in 1982 (Social Democratic Party [PDS]—the party of the dictatorship), which held power in two-thirds of counties that year, essentially disappeared from the urban political scene and won less than a quarter of the votes in the 1985 mayoral elections. The electoral landscape, party identities, and candidate affiliations, thus, looked very different by the 1990s. Using the competition instrument from 1982, thus, helps us break (or at least substantially weaken) the bidirectional causal links between mayor popularity and public service delivery.

V. Empirical Results

Table 2 presents summary statistics for the counties used to estimate our health care input models. Our sample consists of the 4,338 counties (out of approximately 5,000) for which data on the variables in the first column were available. The average county in our sample has about 1 doctor and 1.4 nursing professionals working at SUS facilities, and approximately 0.3 clinics or 2.3 SUS clinic consultation rooms per 1,000 residents.

We report regression results for these four main indicators of health inputs—doctors, nurses, clinics, and consultation rooms—in tables 3 and 4. Table 3 reports only equations for clinics, and the first three specifications examine whether results are robust to changes in the set of conditioning variables.

TABLE 1

RESULTS OF FIRST-STAGE INSTRUMENTAL VARIABLE REGRESSION ANALYSIS

	Winner's Vote Share in 1996 Mayor Election: Model 1	Winner's Vote Share × Mayor and Governor from Same Party: Model 2
Per capita GDP (logged)—2000 R$	.0176***	.00354**
	(.00287)	(.00144)
Gini coefficient of income	−.0255	−.0104
	(.0215)	(.00978)
Share of 1998 presidential election votes cast for a left-leaning candidate	−.0106	−.00317
	(.0113)	(.00494)
Proportion of population living in slums (improvised housing)	−.266***	.0178
	(.0693)	(.0221)
Proportion of municipal population that is white	.0320***	−.00714**
	(.00890)	(.00327)
Proportion of municipal population that is indigenous	−.134**	−.0791**
	(.0542)	(.0338)
Political participation in 1996 mayoral election	.117***	.0283***
	(.0225)	(.00854)
Proportion of the municipal population that is illiterate	−.0194	−.00120
	(.0176)	(.00717)
Municipios where the state governor and *municipio* mayor are from the same party	.0218**	.365***
	(.0107)	(.00969)
Distance to the state capital (100 km)	.00405***	.00207***
	(.000904)	(.000431)
Population density	.00514*	−.000617
	(.00282)	(.000647)
Proportion of *municipio* population living in urban areas	−.0601***	−.0103***
	(.00734)	(.00282)
Dummy for major metropolitan region	−.0300***	−.00460*
	(.00663)	(.00274)
Number of parties competing in 1982 municipal elections[a]	−.0247***	.00141***
	(.00187)	(.000442)
Interaction: no. of parties in 1982 × mayor and governor from same party[a]	−.00491	−.0298***
	(.00433)	(.00376)
Constant	.127***	−.0378**
	(.0346)	(.0150)
Observations	4,076	4,076
Adjusted R^2	.36	.92
F-statistic on excluded instruments in first stage (Pr > *F*)	104.2	37.59
	.00	.00

Note. Heteroskedasticity-corrected standard errors are in parentheses; state dummies are included.

[a] Instruments excluded from second stage.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

TABLE 2
SUMMARY STATISTICS—COUNTY-LEVEL VARIABLES

Variable	Mean (SD)	Range
Public doctors and specialists per 1,000 people	.972 (.954)	0–21.55
Public nurses per 1,000 people	1.358 (1.114)	0–16.81
Public clinics per 1,000 people	.345 (.26)	0–2.67
Public clinic consultation rooms per 1,000 people	2.34 (1.472)	0–13.02
Per capita county health budget, 2000 (2000 R$)	88.06 (54.38)	0–766.5
Change in county health budget per capita, 1995–2000 (2000 R$)	49.7 (42.58)	−173.1–553.9
Per capita GDP (logged)—2000 R$	7.694 (.813)	4.77–11.34
Gini coefficient of income	.541 (.064)	.32–.84
Share of 1998 presidential election votes cast for a left-leaning candidate	.352 (.14)	.06–.91
Proportion of population living in slums (improvised housing)	.004 (.013)	0–.38
Proportion of county population that is white	.506 (.28)	0–1
Proportion of county population that is indigenous	.003 (.023)	0–.74
Political participation in 1996 mayoral election	.771 (.086)	.34–.96
Proportion of the county population that is illiterate	.351 (.179)	.02–.87
Winner's vote share in 1996 mayoral election (popularity of elected mayor)	.299 (.089)	.08–.78
Counties where the state governor and county mayor are from the same party	.136 (.342)	0–1
Interaction: mayor's vote share × mayor and governor from same party	.04 (.107)	0–.78
Distance to the state capital (100 km)	2.287 (1.505)	0–13.32
Population density	.098 (.526)	0–12.41
Proportion of county population living in urban areas	.587 (.224)	.02–1
Dummy for major metropolitan region	.041 (.199)	0–1

Note. County sample of 4,338 observations.

Model 3 contains a parsimonious specification that includes only those variables that should affect b in the voting model of Section III. Model 4 adds other political variables, while model 5 is the full model that expands the list of variables that might affect the allocation of resources in the SUS system. Finally, model 6 instruments for mayor popularity (i.e., lack of political competition) with the 1982 party presence instrument. Table 4 presents the results of estimating the full instrumented model 6 for three other health inputs—nurses, clinics, and clinic consultation rooms.

To provide an additional test of the impact of political variables on transfers, table 5 reports equations for the per capita health budget in each county in 2000, as well as the change in the per capita budget between 1995 and 2000 (with the dependent variable in first-difference form). The per capita health budget includes SUS transfers from the state and federal governments, as well as revenues raised by the county that are allocated to health. The mean health budget in 2000 was R$88; the mean change between 1995 and 2000 was R$50.

In tables 3–5, the independent variables are grouped by the roles they play in the model of Section III. We organize the discussion of results by the independent variables of interest, paying particular attention to the effects of

TABLE 3

COUNTY-LEVEL REGRESSIONS OF CLINICS PER 1,000 PEOPLE

	OLS			IV Model 6—Mayor Popularity Instrumented
	Model 3	Model 4	Model 5	
Voter preferences and incomes (y_u, y_l, r):				
Per capita GDP (logged)—2000 R$	−.0136*	−.0134*	.0116	.00402
	(.00733)	(.00756)	(.00936)	(.00980)
Gini coefficient of income	−.118*	−.116*	.0977	.0709
	(.0640)	(.0642)	(.0875)	(.0749)
Share of 1998 presidential election votes cast for a left-leaning candidate		−.00101	.115***	.144***
		(.0342)	(.0430)	(.0409)
Proportion of population living in slums (improvised housing)			−.202	.487*
			(.279)	(.263)
Proportion of municipal population that is white			−.0544	−.0981***
			(.0352)	(.0322)
Proportion of municipal population that is indigenous			.419	.374*
			(.370)	(.200)
Voting rate (v):				
Political participation in 1996 mayoral election	.414***	.413***	.346***	.273***
	(.0598)	(.0598)	(.0751)	(.0761)
Proportion of the municipal population that is illiterate			−.0143	−.131**
			(.0697)	(.0589)
Transfers from state (T):				
Winner's vote share in 1996 mayoral election (popularity of elected mayor)[a]	.802***	.768***	.594***	1.713***
	(.0546)	(.0587)	(.0603)	(.260)
Municipios where the state governor and *municipio* mayor are from the same party		−.0516	−.0235	.182***
		(.0389)	(.0457)	(.0701)
Interaction: mayor's vote share × mayor and governor from same party[a]		.208	.0896	−.627**
		(.141)	(.161)	(.254)
Distance to the state capital (100 km)			−.00107	−.0117***
			(.00329)	(.00318)
Health production function shifters (d, P):				
Population density			−.0122***	−.0154***
			(.00362)	(.00506)
Proportion of *municipio* population living in urban areas			−.424***	−.248***
			(.0375)	(.0334)
Dummy for major metropolitan region			−.0214*	−.0202
			(.0129)	(.0186)
Constant	−.209	−.201	.159	−.228**
	(.158)	(.158)	(.205)	(.105)
Observations	4,338	4,338	4,338	4,076
Adjusted R^2	.21	.21	.30	.19

Note. Heteroskedasticity-corrected standard errors are in parentheses; state dummies are included in all specifications.

[a] Number of parties competing in 1982 elections (before 1988 democratization) used as instrument for the popularity of local mayor in model 6.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

TABLE 4

COUNTY-LEVEL REGRESSIONS OF CLINIC CONSULTATION ROOMS, DOCTORS, AND NURSES PER 1,000 PEOPLE

	Consultation Rooms: Model 7	Doctors: Model 8	Nurses: Model 9
Voter preferences and incomes (y_u, y_l, r):			
Per capita GDP (logged)—2000 R$	.109**	.128***	.178***
	(.0523)	(.0309)	(.0385)
Gini coefficient of income	.970**	.561***	.924***
	(.410)	(.200)	(.301)
Share of 1998 presidential election votes cast for a left-leaning candidate	.572**	.230*	.377**
	(.227)	(.127)	(.166)
Proportion of population living in slums (improvised housing)	3.432*	−.716	−2.182*
	(1.793)	(.506)	(1.151)
Proportion of municipal population that is white	−.543***	.147	−.000177
	(.184)	(.101)	(.127)
Proportion of municipal population that is indigenous	2.193	−.437	.845
	(1.364)	(.384)	(.997)
Voting rate (v):			
Political participation in 1996 mayoral election	1.483***	.286	.329
	(.397)	(.176)	(.287)
Proportion of the municipal population that is illiterate	−.548*	−.971***	−.960***
	(.314)	(.146)	(.230)
Transfers from state (T):			
Winner's vote share in 1996 mayoral election (popularity of elected mayor)[a]	12.35***	.591	−2.605**
	(1.193)	(.840)	(1.102)
Municipios where the state governor and *municipio* mayor are from the same party	1.183***	.257	−.177
	(.420)	(.207)	(.284)
Interaction: mayor's vote share × mayor and governor from same party[a]	−3.992***	−.580	.862
	(1.502)	(.658)	(.963)
Distance to the state capital (100 km)	−.0433**	−.0191*	.0436***
	(.0178)	(.0104)	(.0141)
Health production function shifters (d, P):			
Population density	−.147***	−.0687***	−.0513*
	(.0375)	(.0153)	(.0310)
Proportion of *municipio* population living in urban areas	−.344**	.252**	.174
	(.166)	(.101)	(.121)
Dummy for major metropolitan region	−.0466	−.211***	−.439***
	(.115)	(.0670)	(.112)
Constant	−2.724***	−.891***	−.303
	(.539)	(.277)	(.404)
Observations	3,814	3,814	3,814
Adjusted R^2	.18	.20	.15

Note. Results are for popularity of mayor, instrumented. Heteroskedasticity-corrected standard errors are in parentheses; state dummies are included in all specifications.

[a] Number of parties competing in 1982 elections (before 1988 democratization) used as instrument for the popularity of local mayor in all specifications.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

political outcomes—the percentage of the poor who vote and the role of political power/connections in facilitating transfers—which are the focus of this article.

A. Voter Preferences

The models indicate that voter preferences matter. Holding per capita income constant, counties with a less equal distribution of income—suggesting a greater proportion of persons relying on the SUS—are likely to have more SUS clinic rooms and, especially, more doctors and nurses.[10] A 1 SD change in the Gini coefficient increases SUS doctors by about 3.5%, nurses by 4%, and clinic rooms by 2.5%. Counties where voters express greater redistributive preferences are also more likely to have more SUS services. When the vote share for the two left-leaning candidates in the 1998 presidential election increases by 1 SD (i.e., 14 percentage points), provision of doctors, nurses, and clinics and rooms increases by 3.3%, 4.1%, and 6.5%, respectively.

B. Political Participation

The provision of SUS inputs and health budgets is greater in counties where a higher fraction of persons who are likely to favor public health care vote; however, this effect is greater for clinics and consultation rooms, which are more visible inputs. A 1 SD (or 8.6 percentage point) increase in the percentage of persons voting in the 1996 mayoral election increases clinics by about 7%–10% (table 3) and clinic consultation rooms by about 6% at their means. The association between political participation and clinics is positive and statistically significant across specifications but gets smaller once we control for the illiteracy rate.[11] The association remains positive for doctors and nurses but loses statistical significance. Effects of the voting rate on county health budgets are also large and statistically significant.

Counties with a 1 SD larger voting rate have a 7% larger health budget and also experience about a 6% larger increase in their health budgets subsequent to the 1996 elections. This makes it unlikely that the association is driven entirely by reverse causality. Understanding the causal effect of changes in the voting rate is complicated by the fact that counties with higher voting

[10] As expected, counties with higher average incomes have more SUS doctors, nurses, and clinics per capita. This effect is large: a 1 SD increase in per capita income increases doctors and nurses per capita by about 11% and clinic rooms per capita by 7%.

[11] As we argue above, variation in the voting rate (holding literacy constant) is likely to reflect an increase in the percentage of uninsured persons voting since persons in the informal sector (who are less likely to be insured) are less likely to be penalized for not voting. The illiteracy rate itself has large negative impacts on the allocation of health inputs and changes in health budgets.

TABLE 5
REGRESSIONS OF COUNTY HEALTH BUDGET ALLOCATION (2000 R$)

	Per Capita Health Budget, 2000		Change in Per Capita County Health Budget, 1995–2000	
	OLS Model 10	IV Model 11—Mayor Popularity Instrumented	OLS Model 12	IV Model 13—Mayor Popularity Instrumented
Voter preferences and incomes (y_u, y_l, r):				
Per capita GDP (logged)—2000 R$	22.04***	19.57***	11.47***	12.14***
	(2.242)	(2.202)	(1.769)	(1.882)
Gini coefficient of income	−62.57***	−60.35***	−31.42**	−36.00***
	(14.36)	(15.20)	(12.65)	(13.95)
Share of 1998 presidential election votes cast for a left-leaning candidate	−.484	−3.125	−12.88*	−14.04*
	(8.073)	(7.801)	(7.014)	(7.401)
Proportion of population living in slums (improvised housing)	139.2**	158.9**	65.22	72.45
	(59.07)	(78.95)	(56.15)	(73.92)
Proportion of municipal population that is white	−20.21***	−17.87***	−7.932	−2.561
	(5.881)	(6.202)	(5.341)	(5.912)
Proportion of municipal population that is indigenous	58.13	32.60	34.14	25.53
	(36.37)	(46.12)	(33.29)	(44.62)
Voting rate (v):				
Political participation in 1996 mayoral election	69.81***	73.16***	32.22***	42.84***
	(12.63)	(14.32)	(11.32)	(11.99)
Proportion of the municipal population that is illiterate	−32.47***	−20.68*	−35.77***	−22.81**
	(10.53)	(10.82)	(9.534)	(9.900)

Transfers from state (*T*):				
Winner's vote share in 1996 mayoral election (popularity of elected mayor)[a]	120.6***	151.2***	45.34***	−.0578
	(11.69)	(45.60)	(10.90)	(50.60)
Municipios where the state governor and *municipio* mayor are from the same party	−9.816	22.62	−6.882	−10.04
	(9.787)	(38.89)	(7.480)	(30.95)
Interaction: mayor's vote share × mayor and governor from same party[a]	27.21	−76.91	24.30	36.97
	(32.70)	(125.9)	(25.67)	(101.0)
Distance to the state capital (100 km)	1.593***	1.889**	1.278**	1.780**
	(.618)	(.790)	(.558)	(.707)
Health production function shifters (*d*, *P*):				
Population density	3.239	1.930	2.038	1.029
	(2.464)	(2.390)	(1.880)	(1.843)
Proportion of *municipio* population living in urban areas	.723	10.71*	2.704	5.980
	(4.635)	(5.765)	(4.041)	(5.404)
Dummy for major metropolitan region	−7.909	−8.783*	−8.570*	−11.50**
	(5.175)	(5.314)	(4.605)	(4.910)
County health budget per capita—initial year (1995)			−.178***	−.187***
			(.0550)	(.0721)
Constant	−199.8***	−123.3***	−82.79***	−52.79***
	(44.44)	(23.66)	(23.29)	(19.77)
Observations	3,796	3,352	3,701	3,266
Adjusted R^2	.28	.29	.08	.07

Note. Heteroskedasticity-corrected standard errors are in parentheses; state dummies are included in all specifications.

[a] Number of parties competing in 1982 elections (before 1988 democratization) used as instrument for the popularity of local mayor in models 11 and 13.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

rates may have other characteristics (average level of education, demand for health) that have independent effects on health care provision. We control for some of these other characteristics of counties (e.g., we include the proportion of the population that is illiterate since, among other things, voting is only compulsory for literates), but some relevant characteristics may be unobservable.

C. Political Connections and Transfers from the State

The health input equations indicate that proxies for a county's political leverage in negotiations with higher levels of government are often significant and increase the level of public health inputs. Again, this effect is greater for more salient inputs than for ones that are less visible. A popular local mayor who wins with a large vote share is generally viewed as a more powerful local politician who can leverage greater political capital, and this may be useful in negotiating transfers from federal and state governments. In the OLS equation with all control variables (model 5), a 1 SD (or 9 percentage point) increase in the mayor's vote share is associated with 15% more clinics at the mean. The effect in the IV regression is a larger (44%) increase at the mean, which translates into an allocation of an extra clinic for every 6,500 people. In table 5, we also find that counties where the mayor won a 1 SD larger share of the vote in the 1996 elections have a 12% larger health budget and, moreover, experienced an 8% increase in their health budget between 1995 and 2000. The latter effect disappears in the IV regression, indicating the possibility that reverse causality may be driving some results.

These correlations are consistent with Finan (2003), who reports that federal deputies in Brazil reward counties where they win larger vote shares by making greater public investments in those areas. Table 4 indicates that the positive association between mayor popularity and public health services is strongest for clinics and consultation rooms, loses statistical significance in the doctors specification, and disappears altogether for nurses once popularity is instrumented. This may reflect a difference in the visibility and patronage associated with different types of public services (Mani and Mukand 2007).

The fact that the county mayor and state governor are of the same party may also increase the county's leverage in negotiations with the state. Again we find a positive association between this measure of intergovernmental political connections in the equations for clinics and consultation rooms, the effect is less significant for doctors, and it disappears for nurses. It should, however, be noted that the county mayor and state governor being of the same party appears to be a substitute, rather than a complement, for the mayor's popularity: evaluated at the mean value of the mayor's vote share, the impact

of the mayor and governor being from the same party is approximately zero. The same party effect increases as the mayor's vote share declines. These results somewhat disagree with a more descriptive study by Lima (2002), who finds that total federal transfers to states for all purposes are significantly larger in Brazilian states that are politically aligned with the federal government.

VI. Conclusions

This article has addressed three questions: (1) Do the preferences of citizens matter in the allocation of SUS clinics, doctors, and nurses in Brazil? Specifically, is the allocation of these health care inputs higher in counties where a higher fraction of the population is uninsured? (2) Holding population characteristics constant, are health inputs greater in counties where a higher fraction of the poor/uninsured vote? (3) Does political power/patronage matter in the allocation of SUS transfers from state to county governments? Are transfers likely to be higher in counties with a popular mayor or in counties where the mayor is of the same party as the state governor? How do these transfers translate into health services?

Even as a nascent democracy in the 1990s, citizen preferences appear to be well reflected in the spatial distribution of an important publicly provided good across Brazil. Counties with a higher proportion of voters who are likely to rely on the SUS system have more SUS clinics and consultation rooms, as well as more SUS doctors and nurses. This is consistent with the results of Foster and Rosenzweig (2001), who find that districts in India with a higher proportion of poor voters receive more propoor public goods. Furthermore, local governments appear to be more responsive to the uninsured's demands when a higher fraction of them vote, at least for the more visible health infrastructure type of inputs. The importance of political voice in public goods allocation has been documented in other contexts (Betancourt and Gleason 2000; Besley and Burgess 2002; Stromberg 2004), and the differential responsiveness of more visible public goods is predicted by the model developed in Mani and Mukand (2007). Consistent with our findings, Banerjee (2004) reports in a review paper that politically disempowered groups lack access to public services in India. We also show that a higher voting rate among the uninsured translates into larger increases in county health budgets subsequent to the election, which is comforting in the sense that the reported correlation is not spuriously driven by unobserved covariates in the cross section.

While local politicians appear responsive to electoral demands, we also find evidence of clientelism and patronage politics in the allocation of health services. Political variables that proxy the power of the county mayor—his share of the vote in the mayoral election and whether he is of the same party as the

state governor—also positively affect the provision of visible health inputs. These results continue to hold after the (lack of) political competition (i.e., the elected mayor's vote share) is instrumented. Interestingly, our results show that the effect of democratization on service delivery is conditional on the particular aspect of democracy—raising participation or political competition—being considered. Local politicians are responsive to electoral pressures (as documented by Ferraz and Finan 2009), but having strong local leaders who might receive preferential treatment by upper-level governments and can bring constituents "pork" also benefits the citizens of the county. This last finding is consistent with the Alston and Mueller's (2006) description of politics in Brazil.

Appendix

Data

Data on the number of doctors (including specialists), nurses, clinics, and clinic consultation rooms (SUS as well as non-SUS) came from the Pesquisa Assistencia Medico-Sanitaria, a survey of all health facilities in Brazil conducted in 1998–99. For county-level GDP data, we rely on estimates for 1996 constructed by IPEA (2001) on the basis of the censuses of population, industry, agriculture, and services. These censuses are administered by the Brazilian national statistical institute (Instituto Brasileiro de Geografia e Estatistica: IBGE).[12] All public finance data used (per capita health budget for the county and yearly changes in the budget) were collected from IPEA (Instituto de Pesquisa Economica Aplicada).

The proportion of white and indigenous people in the population and the Gini coefficient measure of income inequality were computed using data from the 1991 demographic census. Data on the proportion of residents living in temporary housing or slum areas, the proportion urban, and population density are from the Base do Informações Municipais (BIM), 1996, produced by IBGE. The distance from each county to the state capital was computed from latitude and longitude coordinates for the center of each county, also taken from BIM. It was assumed that each degree of latitude or longitude spans the same length of about 110 kilometers. This is approximately correct for Brazil, where all points are located less than 20° from the equator, although the exact correspondence between a degree of longitude or latitude and distance in kilometers differs slightly at different geographical locations (Meeus 1999).

[12] The geographic boundaries of some counties do not stay constant over time. We normalize all relevant variables by population data (obtained from IBGE) for the exact time frame for which the numerator was obtained .

All political variables were computed from the database maintained by Brazil's Superior Election Court. This database reports the names and characteristics of all candidates running for office and the number of votes received by each candidate in each county for presidential, state gubernatorial, and county mayoral elections held since 1992. Elections are held at 4-year intervals, and county elections are staggered by 2 years (1992, 1996, 2000) relative to state and federal elections (1994, 1998). Constrained by the years for which health data are available, we concentrate on the 1994 and 1996 elections.

Our political participation variable is calculated as the number of votes cast in the 1996 mayoral elections (excluding null and blank votes) in each county, as a fraction of the county population. We chose to normalize by population, rather than by the number of registered voters, because the former definition gives us a more accurate measure of voting rates among those (the poor and the uninsured, who are more likely to not be employed in the formal sector) who would benefit from public health services.

Theory

We derive the comparative static results presented in Section III. The first-order conditions for party A are given by equations (A1)–(A4):

$$\frac{r}{\delta}\frac{\partial W^u}{\partial h} + \frac{v(1-r)}{\partial}\frac{\partial W^l}{\partial h} - P_h\lambda = 0, \tag{A1}$$

$$\frac{r}{\delta}\frac{\partial W^u}{\partial e} + \frac{v(1-r)}{\delta}\frac{\partial W^l}{\partial e} - P_e\lambda = 0, \tag{A2}$$

$$\frac{r}{\delta}\frac{\partial W^u}{\partial c}(-y^u) + \frac{v(1-r)}{\delta}\frac{\partial W^l}{\partial c}(-y^l) + \lambda\bar{y} = 0, \tag{A3}$$

$$T + t\bar{y} - P_h h - P_e e = 0, \tag{A4}$$

where $\bar{y} \equiv t(1-r)y^l + try^u$.

The second-order conditions require that principal minors of X alternate in sign, with $|X| < 0$:

$$X = \begin{bmatrix} B & 0 & 0 & -P_h \\ 0 & D & 0 & -P_e \\ 0 & 0 & F & \bar{y} \\ -P_h & -P_e & \bar{y} & 0 \end{bmatrix}, \quad |X_3| > 0, \quad \text{and} \quad |X_2| < 0.$$

Variables B, D, and F are defined below. The second-order conditions are satisfied by $B \leq 0$, $D \leq 0$, and $F \leq 0$.

Totally differentiating equations (A1)–(A4) with respect to r, v, T and h, e, t, and λ yields

$$\begin{bmatrix} B & 0 & 0 & -P_h \\ 0 & D & 0 & -P_e \\ 0 & 0 & F & \bar{y} \\ -P_h & -P_e & \bar{y} & 0 \end{bmatrix} \begin{bmatrix} dh \\ de \\ dt \\ \lambda \end{bmatrix} = \begin{bmatrix} -A & -\left[(1-r)/\delta\right] W_h^l & 0 \\ -C & -\left[(1-r)/\delta\right] W_e^l & 0 \\ -E & -\left[(1-r)/\delta\right] W_c^l y^l & 0 \\ -G & 0 & -1 \end{bmatrix} \begin{bmatrix} dr \\ dv \\ dT \end{bmatrix},$$

where

$$A \equiv \frac{W_h^u}{\delta} - v\frac{W_h^l}{\delta}, \qquad B \equiv \frac{r}{\delta}\frac{\partial^2 W^u}{\partial h^2} + \frac{v(1-r)}{\delta}\frac{\partial^2 W^l}{\partial h^2},$$

$$C \equiv \frac{W_e^u}{\delta} - v\frac{W_e^l}{\delta}, \qquad D \equiv \frac{r}{\delta}\frac{\partial^2 W^u}{\partial e^2} + \frac{v(1-r)}{\delta}\frac{\partial^2 W^l}{\partial e^2},$$

$$E \equiv \frac{W_e^u}{\delta}(-y^u) - v\frac{W_e^l}{\delta}(-y^l) + \lambda(y^u - y^l)t,$$

$$F \equiv \frac{r}{\delta}\frac{\partial^2 W^u}{\partial c^2}(y^u)^2 + \frac{v(1-r)}{\delta}\frac{\partial^2 W^l}{\partial c}(y^l)^2,$$

$$G \equiv t(y^u - y^l).$$

The effect of a change in r on h is given by

$$\frac{dh}{dr} = \frac{1}{|X|}\begin{vmatrix} -A & 0 & 0 & -P_h \\ -C & D & 0 & -P_e \\ -E & 0 & F & \bar{y} \\ -G & -P_e & \bar{y} & 0 \end{vmatrix}$$

$$= \frac{1}{|X|}\left[-A\begin{vmatrix} D & 0 & -P_e \\ 0 & F & \bar{y} \\ -P_e & \bar{y} & 0 \end{vmatrix} - P_h\begin{vmatrix} -C & -E & -G \\ D & 0 & -P_e \\ 0 & F & \bar{y} \end{vmatrix}\right]$$

$$= \frac{1}{|X|}[-A(-D\bar{y}^2 - FP_e^2) - P_h(-CP_eF - DE\bar{y} + DFG)]$$

$$= \frac{1}{|X|}\left[\frac{D\bar{y}}{P_h}\left(A\frac{\bar{y}}{P_h} + E\right) + F(AP_e^2 + CP_eP_h + DGP_h)\right].$$

If $F = 0$, sign (dh/dr) = sign $[A(\bar{y}/P_h) + E]$ and

$$\frac{dh}{dr} = \frac{1}{|X|}\left[\frac{D\bar{y}}{P_h}\left(A\frac{\bar{y}}{P_h} + E\right)\right].$$

With the use of (A1), this reduces to equation (4).

The effect of a change in v on h is given by

$$\frac{dh}{dv} = \frac{1}{|X|}\begin{vmatrix} -\alpha W_h^l & 0 & 0 & -P_h \\ -\alpha W_e^l & D & 0 & -P_e \\ -\alpha W_c^l y^l & 0 & F & \bar{y} \\ 0 & -P_e & \bar{y} & 0 \end{vmatrix}, \quad \alpha \equiv \frac{1-r}{\delta}$$

$$= \frac{1}{|X|}\left[-\alpha W_h^l \begin{vmatrix} D & 0 & -P_e \\ 0 & F & \bar{y} \\ -P_e & \bar{y} & 0 \end{vmatrix} - P_h \begin{vmatrix} -\alpha W_e^l & D & 0 \\ -\alpha W_c^l y^l & 0 & F \\ 0 & -P_e & \bar{y} \end{vmatrix}\right]$$

$$= \frac{1}{|X|}[-\alpha W_h^l(-D\bar{y}^2 - P_e^2 F) - P_h(-\alpha W_e^l P_e F + D\bar{y}y^l \alpha W_c^l)]$$

$$= \frac{1}{|X|}[\alpha D\bar{y}P_h\left(\frac{W_h^l \bar{y}}{P_h} - W_e^l y^l\right) + \alpha W_h^l P_e^2 F + \alpha W_e^l P_h P_e F].$$

$$\alpha D\bar{y}P_h < 0; \qquad \left(\frac{W_h^l \bar{y}}{P_h} + W_c^l y^l\right) > 0 \left(\text{guarantees} \frac{dh}{dv} > 0\right);$$

$$\alpha W_h^l P_e^2 F < 0; \qquad \alpha W_e^l P_h P_e F < 0.$$

The effect of a change in t on h is given by

$$\frac{dh}{dt} = \frac{1}{|X|}\begin{vmatrix} 0 & 0 & 0 & -P_h \\ 0 & D & 0 & -P_e \\ 0 & 0 & F & \bar{y} \\ -1 & -P_e & \bar{y} & 0 \end{vmatrix}$$

$$= -\left(-1 \begin{vmatrix} 0 & 0 & -P_h \\ D & 0 & -P_e \\ 0 & F & \bar{y} \end{vmatrix} / |X|\right) = -\frac{-DF_{p_h}}{|X|} > 0.$$

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