WPS3902

Political Institutions, Inequality, and Agricultural Growth: The Public Expenditure Connection

Hunt Allcott[1]
Daniel Lederman[2]
Ramón López[3]

Abstract. This paper brings together the literatures on the political economy of public expenditures and the determinants of economic growth. Based on a new dataset of rural public expenditures in a panel of Latin American economies, the econometric evidence suggests that non-social subsidies reduce agricultural GDP. Furthermore, the evidence suggests that political and institutional factors as well as income inequality are determinants of the size and structure of rural public expenditures, through which they have large and significant effects on agricultural GDP.

JEL Classification: H11, E62, O11, N56.
Keywords: Political economy, public exepnditures, agricultural growth.

World Bank Policy Research Working Paper 3902, April 2006

1 Harvard University.
2 Development Economics Research Group and Office of the Chief Economist for Latin America and the Caribbean, World Bank.
3 University of Maryland at College Park. We are indebted to Marcelo Olarreaga (World Bank) for detailed comments on an earlier version of this paper. Numerous participants in seminars at the World Bank and FAO (Santiago, Chile) provided insightful comments and suggestions. Financial support from the World Bank's LCR Regional Studies Program is gratefully acknowledged.

I. Introduction

Agricultural growth, and therefore good economic policy in the rural sector, is crucial to national welfare. Rural areas in Latin America are especially underdeveloped: rural poverty rates are twice as high as in the cities, illiteracy and school dropout rates are substantially higher, and access to safe drinking water is 30% lower. A large portion of the total population in Latin America (especially the poor) directly or indirectly depends on agriculture and related rural activities for its sustenance (López and Valdés 2000). Furthermore, growth in the rural agricultural economy has strong growth linkages to other sectors (de Ferranti *et al* 2005, Ravallion 1996, Timmer 2002).

Much popular and academic attention to the rural economy has focused on the impact of trade policy and of other government interventions that directly distort relative prices. Less is understood, however, about the impact of other domestic policies that do not directly distort markets. One such policy is the way in which governments spend public revenues, including the size of expenditures devoted to rural areas and the composition of those expenditures.

This paper examines the effects of the size and composition of rural expenditures on agricultural gross domestic product (GDP) for 15 Latin American countries between 1985 and 2001. Specifically, our measure of the composition of government expenditures is the share devoted to the provision of non-social subsidies, or private goods. In our rural public expenditure data, this category included all spending on export subsidies, internal commercialization, forestry subsidies, and targeted rural production subsidies. Other categories were in practice not possible to fully define as non-social subsidies, as the actual public projects executed were of varying types. One-half of expenditures on

irrigation, integrated rural development, and land purchases and expropriations were thus categorized as non-social subsidies. The remaining expenditures include public goods satisfying the non-excludability and non-rivalry criteria as well as other spending that mitigates the effects of evident market failures, such as investment in R&D, plant and animal disease control, and environmental protection. This binary classification is intended to represent whether or not expenditures fulfill the classical role of government, although some expenditures classified as private non-social subsidies could have significant social returns when the subsidized activities have externalities. For instance, export subsidies could have high social returns if the act of exporting by one firm leads other firms to learn how to export. If these ambiguities exist in the data, then the empirical analyses should pick them up and we should not find evidence that the two types of expenditures have differential effects on agricultural production.

To the extent that public goods can only be supplied by the state and are likely to be complementary with private investment, whereas government-provided private goods can be supplied by the private sector, a plausible hypothesis is that public expenditure patterns that are biased in favor of private goods or subsidies may be deleterious to economic growth. A corollary is that the effectiveness of government expenditures in generating growth diminishes with a higher share of private goods in such expenditures. We will test the prediction that switching government expenditures from public to private goods hampers economic growth.

The paper begins in the traditional framework of cross-country growth regressions such as Barro (1991) and Easterly and Rebelo (1993) and then deals with common concerns with such analyses. We carefully deal with unobserved and observed

heterogeneity across countries and measure the political and institutional factors that shape economic policy. This approach addresses the potential endogeneity of rural public expenditures with respect to agricultural GDP by using instruments for such variables that are consistent with the analyses of Persson (2002), Milesi-Feretti *et al* (2001), Engerman and Sokoloff (2002), and Esteban and Ray (2006). The resulting analysis thus addresses Rodrik's (2005) critique of cross-country growth regressions that do not explicitly model the policymaking process. This approach can also ameliorate estimation biases due to any measurement errors in the expenditure data.

The empirical evidence indicates that, while keeping total expenditures constant, governments can boost agricultural GDP by decreasing the share of their expenditures devoted to non-social subsidies and increasing the share of expenditures for rural public goods and social services. The results provide quantitative estimates of the effects of economic and political institutions on that share. While the findings are intuitive, the paper contributes to the literature in two ways. First, it takes the traditional growth literature and applies it to the rural sector using a new dataset showing the importance of not only the size but especially of the composition of public expenditures on the growth rate of agricultural income. Second, it bridges the gap between research in political economy and growth by exploring the political and institutional determinants of public rural expenditures.

The subsequent section reviews the existing literature in the fields of growth empirics and political economy of public expenditures. Section III introduces the production function and econometric approach that bring the two fields together. The dataset is described in Section IV. The regression results are presented in section V,

which begins with cross-country regressions on agricultural GDP per capita and finishes with the results from a three-stage least squares estimation that uses political economy variables as instruments for the endogenous public rural expenditure variables. The paper concludes with a summary of the results and a discussion of a broader research agenda.

II. Fiscal Policy and Economic Growth: Conceptual and Empirical Issues

Two fundamental issues have been addressed in the literature: the effects of fiscal policy on growth and the determinants of fiscal policy. Though the former literature has been concerned about the possible endogenous nature of fiscal policy and have often used instrumental variables, they have not used structural models to analyze the emergence of fiscal policy patterns. The second literature has used political economy and institutional models to study how fiscal policy arises.

How Fiscal Policy Affects Economic Growth

Drawing on the pioneering study of Barro (1991), several empirical studies have subsequently examined the effects of government expenditures on growth (Anschauer 1989; Easterly and Rebelo 1993; Evans and Karras 1994; Devarajan, Swaroop, and Zou 1996; Kneller, Bleaney, and Gemmell 1999; Bose, Haque, and Osborne 2003)[4].

[4] Devarajan, Swaroop, and Zou (1996), Bose, Haque, and Osborn (2003), and Easterly and Rebelo (1993) use cross-country panel data with government expenditures disaggregated by sector, but get conflicting results. Bose *et al* find positive growth effects from government capital expenditures and education expenditures, while Devarajan *et al* find that current expenditures speed growth while defense and capital expenditures slow it down. Easterly and Rebelo found that only transportation and communication investments significantly increase growth.

Another segment of the literature attempts to define government expenditures as productive or unproductive depending on whether they enter a private-sector production function. Kneller, Bleaney, and Gemmell (1999) use a panel of 22 OECD countries from 1970 to 1995 to test the growth implications of the financing and allocation of fiscal expenditures. They find that productive government expenditures, including education, health, and defense spending, enhance growth, whereas unproductive expenditures,

Government expenditures have been categorized according to various criteria: current vs. capital expenditures, productive versus unproductive expenditures, and disaggregated into sectors such as transportation, health care, social security, and education. Despite conceptual reasons for dividing government expenditures into public versus private goods, we are aware of only one previous study that has used such a dichotomy (López 2005). The cross-country growth framework has previously been applied to the agricultural sector, for example in Mundlak (1997). López (2005) does so as well, focusing on the influence of rural government expenditures, including their composition in terms of public goods and private goods, using an earlier version of the FAO data. The present paper begins with a similar approach but also considers the political economy and institutional determinants of the composition of government expenditures. The consideration of the political and institutional factors that shape public expenditures follows Rodrik's (2005) recommendation that research should seriously consider the motivations of policymakers, which is seldom done in cross-country work. Our approach allows us to obtain insights on why some governments are more or less prone to spend on public goods. At the same time, this allows us to deal with the endogenous nature of government expenditures in a structural approach rather than using ad-hoc instruments.

In sum, there is a fairly extensive body of literature addressing the effects of fiscal variables on economic growth. There is, however, little agreement on exactly which expenditures promote growth, there is a smaller literature on public expenditures in the

---

such as social security, do not. Itit is not clear *a priori* in some cases which outlays should be viewed as "productive." Defense expenditures, for example, would not enter any standard private sector production function, but Kneller *et al* follow Barro in claiming that such outlays are "productive" because they aid the maintenance of property rights. Several studies use datasets other than cross-country panels to examine the effects of the disposition of public expenditures (Anschauer 1989, Glaeser, Scheinkman, and Shleifer 1995, Evans and Karras 1994).

rural sector, and there is no literature that breaks down fiscal expenditures into public goods versus private goods while considering their institutional and political roots.

Political Economy Determinants of Public Expenditures

There is significant theoretical and empirical literature in political economy that examines the role of institutional, economic, and demographic variables in shaping the size of government and the composition of expenditures. This literature relies on two types of theories. The first focuses on structural characteristics of the political constitution as exogenous determinants of government spending. This literature includes electoral competition models and legislative bargaining models. The second strand of the literature investigates how historical distribution of wealth may affect the influence of economic groups on government policies and expenditures, for example through lobbying.[5] Although the distribution of wealth can act through the first model by affecting broader political institutions, there are direct mechanisms through which wealth distribution may affect government policies. That is, similar political institutions may engender different government policies under different wealth distribution conditions.

Electoral Competition Models. Electoral competition models assume that candidates make promises to voters and financial supporters in order to maximize their chances of election. Much of this literature focuses on the effects of the degree of "proportionality," which is the degree to which the representation of political parties in government reflects the percentages of the national vote that they garnered.

[5] In addition, another literature focuses on the relationships between public expenditures and certain economic variables such as (lagged) per capita GDP (Wagner's law), business fluctuations, unemployment and others (Kneller *et al* 1999*;* Devarajan and Zan 1996.; Evans and Karras 1994).

Milesi-Ferretti, Perotti, and Rostagno (2001) compare a theoretical "majoritarian" system, in which a group of politicians from the same "social group" represent different geographical constituencies, to a fully proportional system, in which multiple "social groups" represent the same national constituency. In the former case, politicians more easily agree on expenditures targeted on their favored social groups than on geographically-targeted public goods, so the electorate has the incentive to vote for politicians who have stronger preferences for geographically-targeted public goods. The opposite incentives hold for the proportional system, resulting in relatively more spending on transfers targeted at social groups. Using a dataset of 20 OECD and 20 Latin American countries, the authors find that those with the most proportional systems have the lowest expenditure share on public goods. [6]

A subset of the electoral competition theory models political business cycles, under the hypothesis that policy will change as an election nears, because politicians have a more immediate need to garner support, and voters discount other events happening in the past or future (Persson 2002; Alesina et.al. 1997). The magnitude of these policy changes should increase as the election draws nearer or the outcome becomes more in doubt. [7]

[6] By contrast, Persson and Tabellini (1999) develop a distinct model showing that majoritarian elections require parties to target expenditures more specifically, not just on marginal voters but on marginal voters in marginal districts. This increased need for targeting in majoritarian systems reduces expenditures on public goods, which they view as being less targetable and define somewhat differently from Milesi-Ferretti *et al*. They then show more transfers in majoritarian systems with cross-sectional data from 50 countries.

[7] Persson (2002) finds fiscal changes over the election cycle for 61 countries over 39 years and larger expenditures on targeted programs in election years in majoritarian systems. In a time series study of the United States, however, Alesina, Roubini, and Cohen (1997) find no relationship between transfers or economic growth and the timing of the next election.

Legislative Bargaining Models. The legislative bargaining model focuses on the effects of the makeup of parliament on fiscal policy, independent of promises made before the election. Given that each party in the legislature has its own favored projects targeted at its constituency, the model predicts that a coalition of parties sufficient to pass a budget will include more expenditures and a higher proportion of targetable outlays. Empirical specifications are similar to tests of the electoral competition models. Scartascini and Crain (2002), for example, use cross-country panel data to show that the number of political parties increases both the size of government and the percentage of expenditures that are subsidies and transfers as opposed to public goods. Significantly, they find that proportional representation systems result in relatively more expenditures on public goods.

Collective Action and Accountability Models. There is in addition a literature on collective action, which is the process by which interest groups pursue specific policy goals to benefit their members. In a review of the theory on the provision of public goods to the poor, Keefer and Khemani (2005) write that the political incentives to provide public services require that voters have good information about public services and that they are able to organize collectively to exert their preferences in voting or lobbying. Freedom of the press, the number of newspapers and other media outlets, and the literacy rate should influence information, while the ethnic, linguistic or geographical fractionalization of the populace and the size of electoral districts can influence ability to organize. This fundamentally represents the extent to which policymakers are accountable to the populace.[8]

[8] Keefer and Khemani (2005) additionally emphasize the importance of credibility of political promises, which is related to the time preferences of voters and politicians. The time horizons and discount rates are

Wealth Distribution Models. Wealth distribution is a factor often linked to economic growth. The earlier literature generally postulated a negative relationship between equality and economic growth (Okun 1975). Until recently, this conclusion had been rarely supported by solid empirical evidence. Alesina and Rodrik (1994), Perotti (1996), and Persson and Tabellini (1994), among others have used cross-country reduced-form econometric estimates to show that wealth and income concentration tend to depress subsequent economic growth.[9] Aghion et. al (1999) concluded that while the earlier literature on economic development emphasized exactly the opposite effect of inequality on growth, the available cross-country evidence is quite unambiguous in showing a negative effect of inequality on growth. Explanations for this result focus on how inequality may magnify the negative effects of credit market failures on asset accumulation and, therefore, on growth (Aghion et.al. 1999).

In addition, Alesina and Rodrik (1994) and Persson and Tabellini (1994) advance a political economy link: Assuming that elections are won by a representative voter it follows that more inequality leads to elected officials that favor higher taxes and other distributive fiscal policy to "do something" about inequality as the representative voter is poorer when income is more concentrated. Higher taxes, according to these authors, are bad for investment and therefore for growth. This story, however, suggests that redistributive fiscal policy reduces growth which, as pointed out by Aghion et.al. (1999),

---

important, as capital expenditures, which might be weighted toward public goods, provide benefits over time. Thus political stability, tenure of politicians, and the timing of the election cycle are important variables.

[9] In addition, casual empirical evidence of the role of wealth distribution on economic growth exists. Engerman and Sokoloff (2002) have compared the historical experience of North America versus that of Latin America and the Caribbean suggesting that wealth distribution differences are mainly explained by deep historical events early on in colonial times and that such differences have remained in time over several centuries and have explained in part why British North America has been economically successful while the rest of the Americas has not. World Bank (1993) also provided such casual evidence in the context of East Asia.

is inconsistent with existing empirical evidence. In particular, several studies have shown that various fiscal measures of redistribution, such as social spending and marginal versus average tax rates, if anything induce faster economic growth (Easterly and Rebelo 1993, Perotti 1996).

In this study we empirically test another political economy explanation for the negative correlation between growth and inequality: inequality allows the capture of politicians and voters such that more private goods are provided and aggregate growth consequently declines. Wealth concentration means that the lobbying by the elites to capture politicians will be greater than that of the non-elite as long as lobbying expenditures are proportional to income. In addition, voters can be captured to re-elect politicians or parties that favor the elite. This hypothesis is the opposite of the Alesina-Rodrik view, suggesting that inequality may allow the elite to influence the rest of the electorate through the media, think tanks, professional organizations, and the like. If inequality allows the elite more political influence, then inequality should be positively correlated with non-social subsidies, of which the elites are able to appropriate a significant part, and less correlated with expenditures on public goods, of which the elites might appropriate a smaller share.[10] If non-social subsidies hamper economic growth, we will thus have shown an additional pathway through which inequality slows the economy. Indeed, our empirical model discussed below is consistent with Esteban and Ray (2006), who present a theoretical model where inequality distorts public resource allocation as a consequence of political lobbying by vested interests, even when there is not corruption in government.

[10] López (2003) provided indirect inductive evidence supporting the view that wealth concentration leads to public policies that tend to be systematically biased against the poor, including public expenditures characterized by meager investments in public goods.

In summary, the literature is in agreement that a set of institutional, demographic, and economic variables affect the size and composition of public expenditures: political accountability, institutions such as proportionality, time horizons of governments, electoral fiscal cycles, and political economy processes arising from the wealth distribution. There is, however, disagreement as to the expected direction of influence of the above factors on economic growth. This paper is thus a cross-over between two areas that have been explored before – the influence of public finance on growth, and the political economy of fiscal expenditures – where there is an accepted set of questions and methodologies but little agreement on conclusions.

III. Methodology

This paper seeks to determine the influence of the share of rural expenditures devoted to subsidies on agricultural GDP growth and to test various hypotheses about the determinants of the structure of public expenditures. This section describes the theoretical background and the empirical strategies used to estimate our model.

We model the agricultural GDP as a Cobb-Douglas function in steady state, but allow for an interaction between total rural public expenditures and the exponential of its share of non-social expenditures. This specification allows for an intuitive interpretation of the empirical model. More formally, the proposed GDP function can be written as:

$$Y = A \cdot e^{\xi * s} \cdot G^{\gamma} \cdot N^{\lambda} \cdot X^{\rho} , \qquad (1)$$

where Y is agricultural GDP per capita (in rural areas); A is the level of technical efficiency, S is the share of non-social subsidies in total public rural expenditures, G represents total government expenditures per capita in rural areas; and N is the hectares of arable land per rural capita. Finally, X is a vector of controls such as agricultural prices, soil quality, and weather conditions. The superscripts are coefficients to be estimated. Rewriting equation (1) in log-linear form results in the following empirical model:

$$lnY = ln\, A + \xi\, S + \gamma\, ln\, G + \theta\, ln\, N + \rho\, ln\, X \qquad (2)$$

We estimate equation (2) using the following time series specification,

$$lnY_{i,t} = ln\, A + \xi\, S_{i,t} + \gamma\, ln\, G_{i,t} + \theta\, ln\, N_{i,t} + \rho\, ln\, X'_{i,t} + n_i + T_t + \varepsilon_{i,t} \quad , \qquad (3)$$

where X' is the time-varying, observable subset of X. $ln\, A$ is again a parameter reflecting overall technical efficiency of agricultural production that is common across all countries in the sample, and is thus captured by the intercept or constant in the econometric estimations. n_i represents country-specific characteristics that might result in cross-country heterogeneity in the estimated levels of technical efficiency. T_t represents a time effect that is common to all countries, which allows for over-time variation in technical efficiency. $\varepsilon_{i,t}$ is a standard white-noise error, with $f\,(\,\varepsilon_{i,t} \mid \{lnA, S, lnG, lnN, lnX\}\,) =$ Normal (0,1). In this setup, the estimated coefficients are assumed to be homogenous across all countries, which mean that in practice we are estimating the average effects of the explanatory variables on agricultural GDP per rural capita for our sample of Latin

American countries.[11] This model can be restated by using land instead of rural population (labor force) as the denominator in *Y* and *G*, as well as labor per hectare of arable land instead of land per rural capita, and we report results for this specification with various estimators in the Appendix.

We apply four estimators to test the sensitivity of the coefficients to various restrictions and assumptions. The first country fixed-effects estimator relies on the assumption that n_i is unobservable. The second is the random effects estimator, with the identifying restriction that $n_i = 0$. To take advantage of the efficiency of the random effects estimator while addressing cross-country heterogeneity, we then estimate the model in a quasi-fixed effects framework, where n_i is approximated by a vector of time-invariant variables capturing geography and weather that influence the level of agricultural GDP per rural capita. Fourth, to test the consistency of the estimators given the potential autoregressivity of *Y*, we use a dynamic version of the empirical models that includes the lagged dependent variable as a regressor. This dynamic model estimated with the GMM system estimators proposed by Arellano and Bover (1995) and Blundell and Bond (1998) use the second lag of the dependent variable as an instrument for its first lag.[12]

These specifications echo López (2005), but use a broader and updated dataset covering 15 instead of 10 countries. We then depart from López (2005) by explaining *G* and *S* through a more structured political economy model rather than merely using ad-hoc

[11] It is possible that there might be international heterogeneity in the coefficients, but allowing for this extreme form of heterogeneity for all relevant parameters makes the estimation of consistent parameters with instrumental variables implausibly complicated.

[12] The system estimator is a weighted average of two simultaneous equations. One is the model in differences with levels of $Y_{i,t-2}$ as an IV for the change in $Y_{i,t-1}$. Note that $E(\Delta\varepsilon_{i,t}, Y_{i,t-2}) = 0$. The second equation is in levels, but the IV is $\Delta Y_{i,t-1}$. Note that $E(\varepsilon_{i,t}, \Delta Y_{i,t-1}) = 0.$

instruments to control for the likely endogenous nature of such variables. This allows us to empirically test the hypotheses discussed in the previous section on political institutions and wealth distribution.

The political economy literature discussed in the previous section suggests six potential factors determining the size and composition of rural public expenditures. For the reasons discussed in the previous section, the wealth inequality hypothesis suggests that, *given* the above political and institutional factors, a more unequal society will lead to a greater share of subsidies in government expenditures. For total rural expenditures, the effect of income inequality is in general ambiguous, depending on the significance of rural wealth in total wealth. The greater is the size of the rural wealth vis-à-vis total wealth the more likely is that the elites will be dominated by the rural interests and, hence, the more likely is, ceteris paribus, that rural expenditures increase with greater economic inequality.

The Electoral Competition theory suggests the use of two types of factors explaining fiscal expenditures. The political budget cycle theory suggests that expenditures, as well as the share of subsidies directed toward key electoral groups, will be higher as elections approach. Longer time horizons should induce politicians to make more investments in public goods, which have payoffs that are delayed, instead of investing in immediate transfers such as non-social subsidies. The Rules channel suggests that the proportional electoral systems will have different public expenditure outcomes than majoritarian systems, and presidential regimes will have different outcomes than parliamentary systems.

The Accountability channel suggests that governance will improve as politicians are held accountable for their actions, so accountability should increase the provision of public goods and social services relative to non-social subsidies that are often targeted at wealthier landowners. In addition, we consider a technocracy factor intended to capture the extent to which policy makers are technically trained, which might cause fiscal policy to more closely reflect economic theory.[13]

We test the influence of these channels in a random effects framework using control variables suggested by the literature, such as the share of population over 65 years old, trade over GDP ratio, and per capita GDP, that also may influence the share of subsidies and the magnitude of public expenditures. Our empirical model is:

$$\{G\ ,\ S\} = \beta_0 + \beta_1 \cdot \text{Elections}_{i,t} + \beta_2 \cdot \text{Wealth Distribution}_{i,t} + \beta_3 \cdot \text{Time Horizon}_{i,t} + \beta_4 \cdot \text{Rules}_{i,t} + \beta_5 \cdot \text{Accountability}_{i,t} + \beta_6 \cdot \text{Technocracy}_{i,t} + \beta_7 \cdot \text{Controls}_{i,t} + \varepsilon_{i,t} \qquad (4)$$

In turn, we use three-stage least squares (3SLS) to assess the determinants of *G* and *S* as well as their effects on *Y*. The 3SLS regressions simultaneously estimate three equations: equation (4) with both *G* and *S* as the dependent variables, and equation (3). This system of equations is over-identified, and the identification of the effects of *G* and *S* on *Y* comes from the differential effects of the instrumental variables on these endogenous variables. Furthermore, this approach combined with the quasi-fixed effects provide consistent

[13] There is a substantial literature on the influence of foreign-trained economists on Latin American public policies. See, for example, Dominguez (1997).

estimates in a context where most of the cross sectional variation in agricultural GDP is explained by the control variables.[14]

IV. Data and Empirical Implementation

With the exception of the rural public expenditure data, the variables in equation (3) are straightforward. As mentioned, the normalizing variable is the total rural population. Some measure of rural labor force, as opposed to population, would be preferable, but there are few ages or groups of people that do not do some sort of work in rural economies, so total rural population is a reasonable proxy. The vector *X* of controls comprises several variables: non-agricultural GDP, which is used to capture country-specific macroeconomic shocks that affect demand and supply of agricultural goods (e.g., balance of payments and financial crises), openness (or the ratio of trade to GDP), and the divisia price index for each country's agricultural production. This annual price index was calculated for each country by combining agricultural production data with world commodity prices from the World Bank. The final time-varying variable in the vector *X* is a dummy variable for observations affected by Hurricane Mitch; it takes the value 1 in 1999 for Nicaragua, Honduras, and Panama and 0 for all other observations.

The quasi-fixed effects specification of equation (3) calls for a vector n_i of exogenous, static variables that explain cross-country variation in agricultural GDP per capita. Drawing from the literature on geography and economic growth, especially Gallup and Sachs (1999) and Sachs and Warner (1997), we include six variables. The percent of land area in every country suitable for each of six staple crops was measured

[14] Two-stage least squares (2SLS) estimations yielded virtually identical results as the 3SLS. This suggests that potential biases in the 3SLS (caused by model mis-specification or measurement errors in the data) coefficients in equations (3) and (4) are not severe. In this context, 3SLS is preferable over 2SLS.

based on soil characteristics, and soil quality was measured by including the highest and second highest of the six percentages. Also included were percent of land area in the geographical tropics, the average elevation in meters, the log of the average precipitation observed between 1980 and 2000, and a measure of ethno-linguistic fractionalization to capture risks of social instability which can be a source of economic uncertainty. In random effects regressions, these six variables alone explain 79% of the variation between countries in agricultural GDP per capita.

The variables *G* and *S* form the cornerstone of this analysis. They are derived from an expanded and revised version of the Rural Public Expenditures dataset provided by the United Nations Food and Agriculture Organization (FAO). Spending is disaggregated into 33 categories, with annual data for 20 countries going back to 1985. The first version of the data, made available at the end of 2003, contained ten countries and was used by López (2005). The most recent dataset contains more countries and changes the data for some of the original ten (see Rural Expenditures Data Appendix for more details about the new data).

Table I presents descriptive statistics of all the variables. Appendix I lists all data sources and definitions. Table II (see also Chart I) shows that rural government expenditures per rural capita range from a low of $17 per year in Honduras to $1,154 per year in Uruguay, with subsidies comprising a minimum average share of 8% of expenditures (in Honduras) and a maximum of 84% (in Brazil). On average, governments reduced the share of expenditures devoted to non-social subsidies over the period, moving from 40-45% in the late 1980s to 30% in 2001. Average rural public expenditures increased from $130 to $190 per capita over the period.

Each concept in equation (4) could be represented by a number of data series. For wealth distribution we use a proxy for the initial level of wealth inequality, namely the national average of the Gini index for all available observations predating our sample period. These data come from Deininger and Squire (1996). It is noteworthy that these authors found little significant variation over time in the Gini index within countries. This suggests a high level of persistence in income distribution over the course of history. This persistence is, in turn, also consistent with Engerman and Sokoloff's (2002) view that inequality in the Americas was heavily influenced by factor endowments during colonial times.

For Elections, we used a dummy that takes the value of 1 in presidential election years and 0 otherwise. This proved to be equally predictive as the number of years until the next election and a dummy that takes the value of 1 in the year before the presidential election. Time Horizon was represented by the Years of Democratic Stability of the country, assuming that politicians in more stable countries would have longer time horizons, while those in unstable countries might be more prone to engage in short-term, targeted spending. We used the square root of the number of years of consecutive democratic rule to represent the potential declining marginal impact of stability. Limitations in degrees of freedom requires the imposition of some structure on this variable, and since some data points have zero years of democratic rule, the natural log function could not be used.

Two separate measures were included in the vector of Rules. As in Persson's research, we used a dummy variable that takes the value 1 in presidential regimes and 0 in parliamentary systems. In our sample of Latin American and Caribbean countries after

the mid-1980s, only Jamaica has a parliamentary regime for the entire period. This coefficient may thus be biased by other unobserved factors in Jamaica. The second measure of electoral Rules is Proportionality. We derived our Proportionality variable by multiplying a dummy that takes the value 1 in countries with proportional electoral systems with a variable that captures the average number of seats in each national legislative electoral district.[15] The empirical and theoretical findings in Persson (2002) suggest that Presidential regimes have smaller governments and more spending on targeted non-social subsidies. The Proportionality variable should have the opposite effects.

Accountability was also captured by a vector of variables intended to capture the extent to which the populace can influence policy outcomes. Ethno-linguistic Fractionalization should be inversely related to the ability of the populace to organize and influence policy, and thus might be inversely related to rural spending and positively related to provision of subsidies. Freedom of the Press, as rated by the NGO Freedom House, and the extent of Political Competition, as determined by the Database of Political Institutions, should improve Accountability and thus have the opposite effects as Ethno-linguistic Fractionalization.

We measure the strength of the Technocracy with the proportion of students that was educated in the United States. Specifically, we divided the number of students from a country enrolled in US colleges and universities by its working-age population. Our variable was the average of that proportion lagged 20-24 years, which is the approximate

[15] Specifically, the average number of seats in each electoral district was calculated by averaging the mean district size in the national house with the mean district size in the national senate, as reported by the Database of Political Institutions. In the United States, this variable would take the value 1.5, as the mean House and Senate district sizes are 1 and 2, respectively. Since the U.S. does not have proportional representation, the Proportionality variable would take the value 0.

time that an individual might take to go from being a student to having the most significant influence on economic policy.

V. Results

Table III shows the results for equation (3) using the four different estimators, with variables normalized by rural population. In all cases, the results indicate that a higher share of non-social subsidies reduces agricultural GDP, although the coefficients vary substantially. Other variables also have the expected signs: government spending dedicated to rural areas, non-agricultural GDP, agricultural land, and not suffering from a hurricane are all associated with higher agricultural GDP. The signs on the agricultural price index and openness are not stable across the different estimators.

Tests to assure the validity of the different estimators have satisfactory results. First, normalizing by land area instead of rural population gives coefficients of very similar magnitudes, especially for the subsidy variable (compare Table III with Table AIII in the Appendix). Second, the random effects specification passes the Hausman test when normalized by population, and the estimated coefficients of the two rural expenditures variables are very similar in fixed effects and random effects. Third, the GMM-system estimator passes both the Sargan test for the validity of the instruments and the test for second-order autocorrelation. [16]

Though the instruments in the GMM-system estimator seem appropriate, we focus now in a more systematic and structural analysis of the simultaneous determination of per capita GDP and the fiscal variables. Table IV shows the results from the 3SLS

[16] The null of the Sargan test is that the instruments (namely, the second lag of agricultural GDP per capita) are correlated with the regression errors. The null of the serial correlation test is that the errors are serially correlated. In both cases a p-value greater than 0.05 suggests that the estimates are consistent.

estimator. An important result is that the coefficients on both the subsidy share in rural expenditures and total expenditures per capita retain their signs, and moreover their magnitudes are greater and their significance stronger than the corresponding OLS estimates. This is evidence that these variables are not exogenous. Growth in agricultural GDP per capita seems to decrease government expenditures in the rural sector, thus biasing downward the coefficient in the one-stage regressions. It similarly appears that growth in agricultural GDP increases the subsidy share in rural expenditures, biasing the absolute value of the coefficient downward. It is also possible that the use of instrumental variables may have helped to address attenuation bias caused by classical measurement errors in the rural public expenditures dataset, which would bias the absolute value of both coefficients downward.

Wealth inequality and several of the political and institutional instruments are important determinants of the level and structure of government expenditures in rural areas. We confirm our hypothesis that inequality raises the share of subsidies in total expenditures as shown by the positive and highly significant coefficient of inequality on the subsidy share, which is consistent with the theoretical predictions of Esteban and Ray (2006). In addition, greater inequality causes, ceteris paribus, a rise in the total government allocation to the rural sector. This may suggest that the economic power of the national elites associated with greater wealth concentration may be at least shared by the rural elites, so that the share of subsidies may be associated not only with substitution of subsidies for rural public goods but also to incremental or new expenditures in the rural sector.

Table AIV in the Appendix reports the first stage regressions. One interesting feature of these regressions, as well as the third stage regressions, is the negative coefficient of log Agricultural Price Index on both government subsidy share and total rural expenditures. This is consistent with the use of subsidies and rural expenditures to counter the effects of adverse price changes and may partially explain the lack of significance of the log Agricultural Price Index variable in the single-equation regressions. Hence it is possible that counter-cyclical expenditures and subsidies with respect to fluctuations of relative prices are used by Latin American and Caribbean governments as a form of insurance for agricultural producers.[17] But this benign interpretation of the use of private subsidies is only valid if the private sector does not provide insurance or if credit markets are imperfect. Nevertheless, the fact that the share of subsidies in public rural expenditures has a negative effect on agricultural output implies that the provision of subsidies is an inefficient form of insurance.

Table V summarizes the effects of all the explanatory variables, including quasi-fixed effects variables and slow-moving institutional variables, on agricultural GDP per capita, which are due to direct effects (first column) or to indirect effects that act through the influence of the explanatory variables on the value of total rural public expenditures per capita or on its share of private subsidies. The P-Value column indicates the statistical significance of a test that the total effect of each variable on agricultural GDP per capita in the 3SLS specification is different from zero. The subsequent columns show the means and standard deviations of each variable in the sample used for the estimations.

Of the time-invariant variables, Percent Land Area in Tropics has the greatest influence on between-country differences in agricultural GDP per capita. In some cases,

[17] We thank Marcelo Olarreaga for raising this issue.

the instrumental variables affect per capita agricultural GDP through channels that we did not predict *a priori*. For example, Ethno-linguistic Fractionalization directly increases agricultural GDP per capita, but also reduces subsidies and reduces rural public expenditures. The latter effect outweighs the former two, and an increase of one cross-country standard deviation (21%) in Ethno-linguistic Fractionalization is associated with a 17% decrease in agricultural GDP per capita. When the president's party controls all houses, both rural subsidies and total expenditures decrease, with the latter channel dominating the effect on agricultural GDP. This may be evidence of an anti-rural bias at the national level: when presidents have had more control over policy, they have reduced rural spending, thereby reducing agricultural production. The results summarized in Table V also suggest that the effects of public expenditure choices can be substantial. The evidence implies that a reduction in the share of subsidies in rural expenditures by one (within-country) standard deviation can increase agricultural GDP per capita by 5%. Increasing per capita rural government expenditures by one (within-country) standard deviation increases per capita agricultural GDP by 12%. In contrast, trade openness has a negligible effect on per capita agricultural GDP, although trade policy issues related to agriculture have received tremendous public attention.

VI. Discussion and Conclusion

The calculation above is an important highlight of this paper. As one would expect, rural government expenditures are associated with growth in per capita agricultural GDP. The net effect of rural expenditures on national income, however, can be negative if the additional dollar spent in the non-rural sector would have yielded at

least as large an increase in (non-agricultural) GDP. The results regarding the effects of the structure of public expenditures are therefore more important in practice. The empirical analysis indicates that, even without changing overall expenditures, governments can improve the economic performance of their agricultural sectors by devoting a greater share of those expenditures to social services and public goods instead of non-social subsidies.

We found no direct or indirect effects on agricultural GDP of generating a technocracy by educating students in the U.S., but we did find that the political economy of rural expenditures in Latin America is important for understanding the behavior of agricultural production. The results suggest that factors such as proportionality, presidential system, control of all houses of legislature by the president's party, and ethno-linguistic fractionalization have large and significant effects on agricultural GDP through their influence on fiscal policy. Indeed, these effects are larger than those of some of the strictly economic variables, such as agricultural prices and openness.

Income inequality has an important effect on agricultural GDP through fiscal policy, independently of the above political and institutional factors. Inequality is associated both with more non-social subsidies and higher rural government expenditures. Our estimates in Table V suggest that the positive rural expenditure level effect dominates the negative expenditure composition effect.

In sum, reducing the share of non-social subsidies is important for per capita agricultural GDP, and political economy factors as well as income inequality significantly influence the subsidy-public good allocation of government expenditures. Further data collection would be necessary to test whether these findings hold outside of

Latin America and the Caribbean. Knowing the rural public expenditures of a broader sample of countries would allow a more robust test of the effects of proportionality and presidential systems. But this research agenda should continue to explicitly characterize the incentives faced by policymakers to obtain both consistent and interpretable elasticities of income with respect to public expenditures.

References

Aghion, P., E. Carol, and C. García-Penalosa. 1999. “Inequality and Economic Growth: The Perspective of the New Growth Theory.” *Journal of Economic Literature* December: 1615-60.

Alesina, A., N. Roubini and G. D. Cohen. 1997. *Political Cycles and the Macroeconomy*. MIT Press, Cambridge, MA.

Alesina, A., R. Baqir, and W. Easterly. 1999. “Public Goods and Ethnic Divisions.” World Bank Working Paper 2108, Washington, DC.

Alesina, A., and D. Rodrik. 1994. “Distributive Politics and Economic Growth.” *Quarterly Journal of Economics* 109 (3): 465-90.

Aschauer, D. 1989. “Is Government Spending Productive?” *Journal of Monetary Economics* 23:177-200.

Barro, R. 1991. "Economic Growth in a Cross Section of Countries." *The Quarterly Journal of Economics* 56 (425): 407-443.

Beck, T., G. Clarke, A. Groff, and P. Keefer. 2005. “New Tools and Tests in Comparative Political Economy: the Database of Political Institutions.” World Bank, Washington, DC.

Bose, N., M. E. Haque, and D. R. Osborn. 2003. “Public Expenditure and Economic Growth: A Disaggregated Analysis for Developing Countries.” Mimeo, University of Manchester.

Collier, P, and A. Hoeffler. 1998. “On the Economic Causes of Civil War.” *Oxford Economic Papers* 50: 563-573.

Congleton, R. 1991. “Ideological Conviction and Persuasion in the Rent-Seeking Society.” *Journal of Public Economics* 44: 65-86.

De Ferranti, D., G. Perry, W. Foster, D. Lederman, and A. Valdés. 2005. *Beyond the City: The Rural Contribution to Development*. World Bank, Washington, DC.

De Mello, L. 2003. “Public Finance, Government Spending, and Economic Growth: The Case of Local Governments in Brazil.” *Journal of Applied Economics* 34: 1876-1883.

Deacon, R., and S. Saha. 2005. “Public Good Provision by Dictatorships: A Survey.” Mimeo, University of California at Santa Barbara.

Devarajan, S., V. Swaroop, and H. Zou. 1996. “The Composition of Public Expenditure and Economic Growth.” *Journal of Monetary Economics* 37 (2-3): 313-344.

Dominguez, J. I. 1997. “Technopols: Ideas and Leaders in Freeing Politics and Markets in Latin America in the 1990s.” Chapter 1 in *Technopols: Freeing Politics and Markets in Latin America in the 1990s*, edited by J.I. Dominguez. University Park: Pennsylvania State University Press.

Downs, A. 1957. *An Economic Theory of Democracy*. Harper and Row, New York.

Easterly, W., and S. Rebelo. 1993 “Fiscal Policy and Economic Growth: An Empirical Investigation.” NBER Working Paper No. 4499, Cambridge, MA.

Engerman, S., and K. Solokoff. 2002. “Factor Endowments, Inequality, and Paths of Development Among New World Economies.” NBER Working Paper No. 9259, Cambridge, MA.

Esteban, Joan, and Debraj Ray. 2006. “Inequality, Lobbying, and Resource Allocation.” *American Economic Review* 96(1): 257-279.

Evans, P. and G. Karras. 1994. “Are Government Activities Productive? Evidence from a Panel of U.S. States.” *Review of Economics and Statistics* 76 (1) 1-11.

Freedom House Country Ratings. 2005. http://www.freedomhouse.org/ratings/index.htm.

Gallup, J. L. and J. D. Sachs, with A. Mellinger. “Geography and Economic Development.” Center for International Development Working Paper No. 1, March 1999.

Gastos Publicos Rurales dataset. 2005. United Nations Food and Agriculture Organization. Santiago, Chile.

Gardner, B. 2003. “Causes of Rural Economic Development.” Elmhirst Lecture. Durban, South Africa.

Glaeser, E., J. Scheinkman, and A. Shleifer. 1995. “Economic Growth in a Cross-Section of Cities.” *Journal of Monetary Economics* 36 (1): 117-143.

Grossman, G., and E. Helpman. 1994. “Protection for Sale.” *American Economic Review* 84 (4): 833-850.

Holtz-Eakin, D. 1994. “Public-Sector Capital and the Productivity Puzzle.” *The Review of Economics and Statistics* 76 (1): 12-21.

Keefer, P. and S. Khemani. 2005. "Democracy, Public Expenditures, and the Poor: Understanding Political Incentives for Providing Public Services." *World Bank Research Observer* 20(1):1-27

Kneller, R., M. F. Bleaney, and N. Gemmell. 1999. “Fiscal Policy and Growth: Evidence from OECD Countries.” *Journal of Public Economics* 74: 171-190.

Lake, D. A., and M. A. Baum. 2001. “The Invisible Hand of Democracy: Political control and the Provision of Public Services.” *Comparative Political Studies* 34(6): 587-621.

Levine, R., and Renelt, D. 1992. “A Sensitivity Analysis of Cross-Country Growth Regressions. *American Economic Review* 82 (5): 942–963.

Lizzeri, A., and N. Persico. 2001. “The Provision of Public Goods under Alternative Electoral Incentives.” *American Economic Review* 91 (1): 225-239.

Lledo, V. 2002. “Electoral Systems, Legislative Fragmentation and Public Spending: A Comparative Analysis of Brazilian States.” Mimeo, Universidad de Los Andes.

López, Ramón. 2003. “The Policy Roots of Socioeconomic Stagnation and Environmental Implosion: Latin America 1950-2000.” *World Development* 31:

259-79.

López, Ramón. 2005. “Why Government Should Stop Non-Social Subsidies: Measuring their Consequences for Rural Latin America.” World Bank Policy Research Working Paper 3609, Washington, DC.

López, Ramón, and A. Valdés. 2000. *Rural Poverty in Latin America*. New York: MacMillan Press and Saint Martin’s Press.

López, Rigoberto. 2001. "Campaign Contributions and Agricultural Subsidies." *Economics and Politics* 13 (3): 257-279.

Milesi-Ferretti, G. M., R. Perotti, and M. Rostagno. 2002. “Electoral Systems and Public Spending.” *Quarterly Journal of Economics* 117 (2): 609-657.

Mitchell, T.D., and P.D. Jones. 2005. "An improved method of constructing a database of monthly climate observations and associated high-resolution grids." *International Journal of Climatology* 25: 693–712.

Morrison, C., and A. Schwartz. 1996. “State Infrastructure and Productive Performance.” *American Economic Review* 86 (5): 1095-1111.

Mundlak, Y., D. Larson, and R. Butzer. 1997. “The Determinants of Agricultural Production: A Cross-Country Analysis.” Policy Research Working Paper 1827, World Bank, Washington, DC.

Open Doors Database. 2005. Institute for International Education. http://opendoors.iienetwork.org/

Olson, M. 1971. *The Logic of Collective Action.* Cambridge, MA: Harvard University Press.

Paternostro, S., A. Rajaram, and E. Tiongson. 2005. “How Does the Composition of Public Spending Matter?” World Bank Policy Research Working Paper 3555, Washington DC.

Perotti, R. 1996. “Income Distribution, Fiscal Policy, and Delayed Stabilizations.” *Journal of Policy Reform* 1(4): 335-55.

Persson, T., and G. Tabellini. 1994. “Is Inequality Harmful for Growth?” *American Economic Review* 84: 600-621.

Persson, T., G. Roland, and G. Tabellini. 2000. "Comparative Politics and Public Finance." *Journal of Political Economy* 108 (6): 1121-1161.

Persson, T., and G. Tabellini. 2001. “Political Institutions and Policy Outcomes: What Are the Stylized Facts?” Center for Economic Policy Research Discussion Paper No. 2872, London, England.

Persson, T. and G. Tabellini. 1999. “The Size and Scope of Government: Comparative Politics with Rational Politicians.” *European Economic Review* 43: 699-735.

Persson, T. 2002. "Do Political Institutions Shape Economic Policy?" *Econometrica* 70(3): 883-905.

Ravallion, M., and S. Chen. 2004. “China’s (Uneven) Progress Against Poverty.” Mimeo, Development Research Group, World Bank, Washington, DC.

Ravallion, M., and G. Datt. 1996. “How Important to India’s Poor Is the Sectoral Composition of Economic Growth?” *World Bank Economic Review* 10: 1-26.

Rodrik, D. 2005. “Why We Learn Nothing from Regressing Economic Growth on Policies.” Mimeo, Harvard University, Kennedy School of Government, Cambridge, Massachusetts.

Sachs, J., and A. Warner. 1997. “Geography and Economic Growth.” Harvard Center for International Development Working Paper.

Scartascini, C., and W. M. Crain. 2002. "The Size and Composition of Government Spending in Multi-Party Systems." Mimeo, George Mason University.

Schultz, Christian. 1995. "The Politics of Persuasion When Voters Are Rational." *Scandinavian Journal of Economics* 97 (3): 357-68.

Shi, M., and J. Svensson. 2002. “Conditional Political Budget Cycles.” Center for Economic Policy Research Discussion Paper 3352, London, England.

Stromberg, D. 2004. “Mass Media Competition, Political Competition, and Public Policy.” *Review of Economic Studies* 71 (1): 265-295.

Timmer, P. 2002. “Agriculture and Economic Development.” In Bruce Gardner and Gordon Rausser (eds.), *Handbook of Agricultural Economics. Vol. 2A Agricultural and Food Policy*. Amsterdam, the Netherlands: Elsevier Press.

“The Rural Poverty Trap.” Oxfam Briefing Paper 59, June 2004. www.oxfam.org.uk/what_we_do/issues/trade/downloads/bp59_unctad.pdf

Polity IV Database. 2005. University of Maryland. http://www.cidcm.umd.edu/inscr/polity/index.htm

Rural Subsidies Data Appendix

The Food and Agriculture Organization's Rural Public Expenditure dataset contains rural expenditures from 1985 through 2001 in a panel of 18 countries. We aggregated the 33 categories of expenditures into our two fiscal policy variables: Rural Gov't Expenditures per Capita and Rural Subsidies Share. One can imagine the difficulty that the FAO's consultants faced in tracking down information on rural government expenditures, given that some of the data reflect ill-recorded situations in conflicted areas of developing countries nearly twenty years ago. The engaged in an extensive process to check and clean the data, and we further scrutinized and modified the dataset after receiving it.

Expenditures at their most disaggregated levels were often non-smooth, and we engaged in a substantial process to identify outlying expenditures. Upon identifying a data point as unusual, we discussed it with the FAO and their consultants to determine whether the data reflected actual expenditures or problems with the recording or reporting process. In many cases significant changes occurred to expenditures as the result of changes in ruling party, shifts from autocracy to democracy, and civil unrest. In some cases, the data likely did not reflect actual spending, either due to unavailability of records or because continuous programs shifted to different departments and could not be tracked consistently from year to year. In these cases, data points were dropped. Appendix II summarizes the results of the data cleaning effort; the final sample that we used has 15 countries with an average of 15.8 observations per country.

After cleaning the data, we then calculated the percent share of the expenditures devoted to non-social subsidies. This category included all spending on export subsidies,

internal commercialization, forestry subsidies, and targeted rural production subsidies. Other categories were in practice not possible to fully assign to one group or the other, as the actual public projects executed were of varying types. One-half of expenditures on irrigation, integrated rural development, and land purchases and expropriations were thus categorized as non-social subsidies.

Table I
Descriptive Statistics

Variable	*Mean*	*σ-Overall*	*σ-Between*	*σ-Within*	*Min*	*Max*
log Ag GDP per Capita	6.7	0.8	0.8	0.2	5.3	8.8
log Ag GDP per Hectare	5.3	0.9	0.9	0.1	3.1	6.9
Government / GDP	0.20	0.08	0.07	0.04	0.08	0.58
National Public Goods Share	0.24	0.09	0.08	0.04	0.05	0.42
log Rural Gov't per Capita	4.3	1.2	1.1	0.5	-0.2	7.3
Rural Subsidies Share	0.37	0.22	0.21	0.10	0.02	0.91
log Ag Area per Capita	1.38	1.23	1.26	0.06	-0.90	4.06
log Ag Population per Hectare	-1.38	1.23	1.26	0.06	-4.06	0.90
log Non-Ag GDP per Capita	8.7	1.2	1.2	0.2	6.8	11.2
Openness	0.59	0.34	0.32	0.11	0.12	1.99
log Agricultural Price Index	-0.09	0.12	0.06	0.11	-0.45	0.16
Mitch Dummy	0.01	0.09	0.02	0.09	0.00	1.00
Years of Democratic Stability	3.1	2.2	2.0	1.0	0.0	9.1
Suitable Soil - Best Crop	14.1	9.3	9.5	0.0	2.2	36.1
Suitable Soil - 2nd Best Crop	26.4	6.9	7.1	0.0	10.6	39.2
Percent Land Area in Tropics	0.79	0.36	0.37	0.00	0.00	1.00
Average Elevation	688.0	492.9	506.5	0.0	18.1	1871.1
log Average Precipitation	7.4	0.5	0.5	0.0	6.4	7.9
Ethnolinguistic Fractionalization	25.3	20.9	21.4	0.0	4.0	68.0
Election Year Dummy	0.21	0.41	0.07	0.41	0.00	1.00
Gini Coefficient	48.15	5.20	5.34	0.00	41.61	57.28
Presidential Party Has All Houses	0.4	0.5	0.4	0.3	0.0	1.0
Political Competition	8.12	1.89	1.14	1.53	1.00	10.00
Presidential Regime Dummy	0.91	0.28	0.24	0.16	0.00	1.00
Proportionality	1.8	1.1	1.2	0.4	0.0	4.8
Freedom of the Press	40.4	20.5	17.1	11.9	11.0	96.0
Students in U.S. 20-24 Years Ago	5.3	1.1	1.0	0.3	2.7	7.6
Federal Country Dummy	0.2	0.4	0.4	0.0	0.0	1.0
Population Percent Seniors	5.0	2.3	2.3	0.4	2.6	12.6
GDP per Capita	7.7	0.6	0.7	0.1	6.5	9.1

Table II
Descriptive Statistics by Country

Country	*Average Agricultural GDP per Capita*	*Average of Annual Changes in Agricultural GDP per Capita*	*Average of Percent Subsidies*	*Average of Rural Government Expenditures per Capita*	*Average of Total Government Expenditures per Capita*
Argentina	$2,895	2.4%	59%	$115	$1,078
Bolivia	$313	2.8%		$17	$223
Brazil	$1,482	4.7%	84%	$230	$1,254
Chile	$2,257	4.5%			$902
Columbia	$1,258	1.1%			$390
Costa Rica	$913	2.4%	47%	$185	$511
Dominican Republic	$537	3.3%	28%	$94	$218
Ecuador	$955	2.1%	40%	$37	$277
Guatemala	$571	0.1%	10%	$53	$155
Honduras	$233	1.9%	8%	$17	$151
Jamaica	$347	1.2%	57%	$28	$847
Mexico	$618	1.0%	46%	$214	$599
Nicaragua	$339	-0.5%	19%	$72	$135
Panama	$520	1.7%	49%	$84	$742
Peru	$599	3.7%	39%	$51	$396
Paraguay	$943	2.1%	26%	$31	$244
Uruguay	$4,728	3.7%	13%	$1,154	$1,617
Venezuela	$1,254	1.9%	30%	$136	$692

Table III

FE, RE, QFE, and Arellano-Bond Estimators of Agricultural GDP Per Capita

Dependent variable: log of Agricultural GDP per Rural Capita

Specification	*Fixed Effects*	*Random Effects*	*Quasi-FE*	*Arellano-Bond*
Lag of log Ag GDP per Capita				0.846 (0.000)**
Rural Subsidies Share	-0.125 (0.104)	-0.128 (0.070)*	-0.287 (0.001)**	-0.062 (0.080)*
log Rural Gov't per Capita	0.038 (0.015)**	0.034 (0.024)**	0.028 (0.158)	0.019 (0.018)**
log Ag Area per Capita	0.359 (0.015)**	0.235 (0.002)**	0.160 (0.000)**	0.031 (0.016)**
log Non-Ag GDP per Capita	0.521 (0.000)**	0.450 (0.000)**	0.303 (0.000)**	0.046 (0.037)**
Openness	0.083 (0.201)	0.063 (0.306)	-0.213 (0.000)**	-0.037 (0.121)
log Agricultural Price Index	-0.073 (0.505)	-0.083 (0.441)	0.495 (0.012)**	0.149 (0.113)
Mitch Dummy	-0.084 (0.189)	-0.090 (0.161)	-0.201 (0.137)	-0.103 (0.059)*
R^2				
Within	0.611	0.607	0.430	
Between	0.832	0.830	0.958	
Overall	0.823	0.822	0.942	
Observations	239	239	239	218
Sargan Test P-Value				0.235
Arellano-Bond AR(2) Test P-Value				0.585

P-values are in parenthesis.

* Signficant at 10%

** Significant at 5%

Lagged values of all independent variables were used, except for the log Agricultural Price Index and the Mitch Dummy

Table IV
Three-Stage Least Squares Estimation of Agricultural GDP Per Capita

Dependent Variable	*Log(Ag. GDP p.c.)*	*Private-subsidy share*	*log(Public Rural Exp.)*
Independent Variables			
log Rural Gov't per Capita	0.188 (0.000)**		
Rural Subsidies Share	-0.529 (0.000)**		
log Ag Area per Capita	0.193 (0.000)**	0.129 (0.002)**	0.206 (0.315)
log Non-Ag GDP per Capita	0.157 (0.000)**	0.072 (0.010)**	1.460 (0.000)**
Openness	-0.176 (0.029)**	0.180 (0.010)**	0.496 (0.145)
log Agricultural Price Index	0.591 (0.007)**	-0.203 (0.064)*	-1.212 (0.034)**
Mitch Dummy	-0.115 (0.390)	0.025 (0.707)	0.176 (0.620)
Years of Democratic Stability	0.123 (0.000)**		
Suitable Soil - Best Crop	0.018 (0.000)**		
Suitable Soil - 2nd Best Crop	0.055 (0.000)**		
Percent Land Area in Tropics	0.441 (0.059)*		
Average Elevation	-0.001 (0.000)**		
log Average Precipitation	-0.545 (0.000)**		
Ethnolinguistic Fractionalization	0.019 (0.000)**	0.006 (0.000)**	-0.015 (0.025)**
Election Year Dummy		-0.007 (0.696)	0.000 (0.996)
Gini Coefficient		0.015 (0.025)**	0.150 (0.000)**
Years of Democratic Stability		0.033 (0.000)**	-0.195 (0.000)**
Political Competition		0.027 (0.005)**	0.066 (0.150)
Presidential Regime Dummy		-0.092 (0.024)**	0.888 (0.000)**
Proportionality		0.043 (0.035)**	0.141 (0.138)
Freedom of the Press		-0.002 (0.000)**	-0.008 (0.006)**
Students in U.S. 20-24 Years Ago		0.124 (0.000)**	0.318 (0.006)**
Federal Country Dummy		0.326 (0.000)**	-1.549 (0.000)**
Population Percent Seniors		-0.088 (0.001)**	-0.712 (0.000)**
R^2	0.951	0.850	0.818
Observations	218	218	218

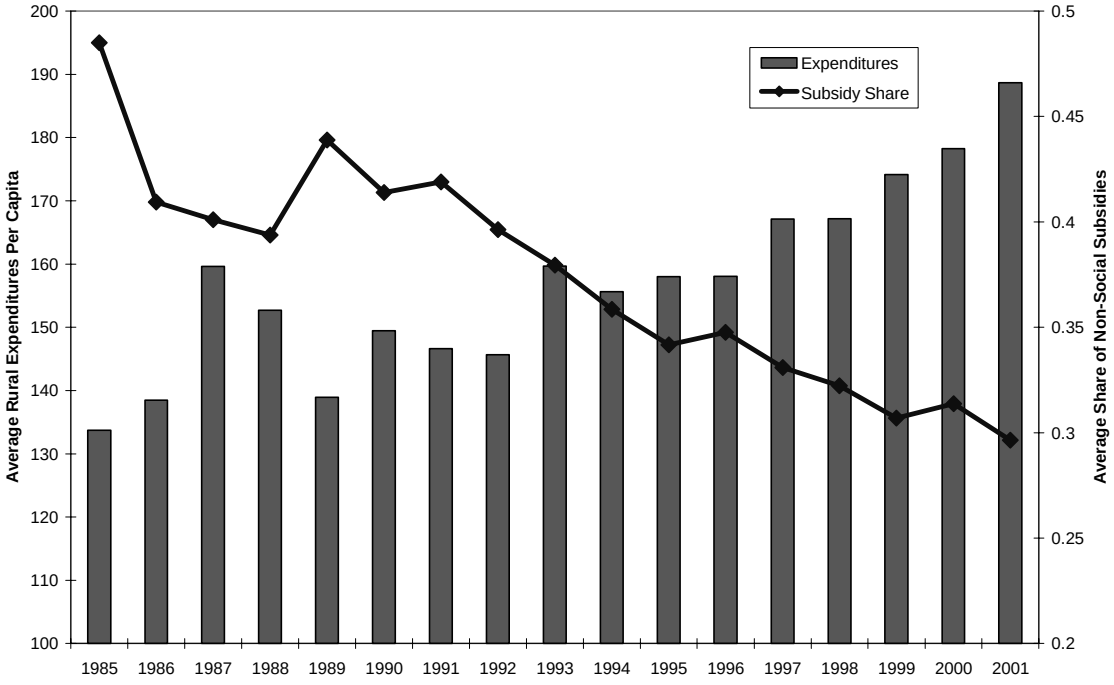
P-values are in parenthesis, based on robust small-sample standard errors.
* Signficant at 10%
** Significant at 5%

Table V.

Influence of Explanatory Variables on (log of) Agricultural GDP per Rural Capita

Variable Name	Direct	Through Rural Subs Share	Through Rural Exp.	Overall	Pvalue	Mean	σ-Overall	σ-Between	σ-Within
log Rural Gov't per Capita	0.188			0.188	0.000	4.290	1.212	1.142	0.469
Rural Subsidies Share	-0.529			-0.529	0.000	0.366	0.224	0.209	0.104
log Ag Area per Capita	0.193	-0.068	0.039	-0.030	0.004	1.383	1.230	1.262	0.060
log Non-Ag GDP per Capita	0.157	-0.038	0.274	0.236	0.000	8.750	1.163	1.178	0.197
Openness	-0.176	-0.095	0.093	-0.002	0.068	0.589	0.335	0.324	0.114
log Agricultural Price Index	0.591	0.107	-0.228	-0.121	0.015	-0.089	0.120	0.057	0.107
Years of Democratic Stability	0.123	-0.017	-0.037	-0.054	0.000	3.086	2.216	2.025	1.013
Mitch Dummy	-0.115	-0.013	0.033	0.020	0.431	0.009	0.093	0.020	0.091
Suitable Soil - Best Crop	0.018	-0.019	0.043	0.024	0.001	14.060	9.270	9.525	0.000
Suitable Soil - 2ndBest Crop	0.055	-0.024	0.029	0.005	0.000	26.398	6.871	7.060	0.000
Percent Land Area in Tropics	0.441	-0.532	0.033	-0.498	0.836	0.788	0.356	0.365	0.000
Average Elevation	-0.001	0.000	0.000	0.000	0.000	687.991	492.904	506.452	0.000
log Average Precipitation	-0.545	0.210	0.247	0.458	0.443	7.363	0.466	0.479	0.000
Ethnolinguistic Fractionalization	0.019	-0.003	-0.003	-0.006	0.000	25.278	20.876	21.450	0.000
Election Year Dummy		0.004	0.000	0.004	0.822	0.213	0.410	0.066	0.405
Gini Coefficient		-0.008	0.028	0.020	0.010	48.155	5.196	5.339	0.000
Political Competition		-0.014	0.012	-0.002	0.832	8.121	1.889	1.141	1.529
Presidential Regime Dummy		0.049	0.167	0.216	0.000	0.912	0.283	0.241	0.159
Proportionality		-0.023	0.026	0.004	0.847	1.824	1.094	1.164	0.374
Freedom of the Press		0.001	-0.001	0.000	0.804	40.398	20.467	17.139	11.859
Students in U.S. 20-24 Years Ago		-0.065	0.060	-0.006	0.830	5.272	1.052	1.039	0.295
Population Percent Seniors		0.047	-0.134	-0.087	0.012	5.013	2.268	2.299	0.371

Figure I. Trends in Rural Public Expenditures



Appendix I
Variables in Rural Subsidies Dataset

Variable	*Definition*	*Source*
Dependent Variables		
log Ag GDP per Capita	Log of agricultural GDP per rural capita	WDI
log Ag GDP per Hectare	Log of agricultural GDP per hectare of agricultural land	WDI
Government / GDP	Consolidated government expenditures as a share of GDP	FAO, IMF
National Public Goods Share	Share of public goods in national government expenditures	
Independent Variables		
log Rural Gov't per Capita	Log of rural public expenditures per rural capita	FAO
Rural Subsidies Share	Shrare of subsidies in rural expenditures	FAO
log Ag Area per Capita	Log of agricultural land area (hectares) per capita	FAO
log Non-Ag GDP per Capita	Log of total non-agricultural GDP per rural capita	WDI
Openness	(Imports + Exports) / GDP	WDI
log Agricultural Price Index	Log of the divisia price index of agricultural production	Authors
Mitch Dummy	Dummy in 1999 for countries affected by Hurricane Mitch	Authors
Quasi-Fixed Effects Variables		
Suitable Soil - Best Crop	Percent of land area suitable for best of six major crops	Gallup
Suitable Soil - 2nd Best Crop	Percent of land area suitable for second best of six major crops	Gallup
Percent Land Area in Tropics	Percent of land area in the geographical tropics	Gallup
Average Elevation	Country mean elevation (meters above sea level)	Gallup
Ethnolinguistic Fractionalization	Ethnolinguistic fractionalization	Collier
log Average Precipitation	Log of average precipitation (cm/year) from 1980-2000.	Mitchell
Instrumental Variables		
Election Year Dummy	Election year dummy	DPI
Gini Coefficient	Average of Gini coefficients across studies	Various
Political Competition	Political competition rating	Polity
Presidential Regime Dummy	Presidential regime dummy	DPI
Proportionality	Proportional electoral system interacted with district size	DPI
Freedom of the Press	Freedom of the press rating by Freedom House	Freedom
Students in U.S. 20-24 Years Ago	log of the average number of students per million population enrolled in US colleges and universities between 20 and 25 years before	Open Doors
Years of Democratic Stability	The square root of the number of years of consecutive democratic rule	Polity
Federal Country Dummy	Federal country dummy	Authors
Controls in political economy regressions		
Population Percent Seniors	Multiple terms	WDI
GDP per Capita	log of country GDP per capita	WDI
Sources		
WDI	World Development Indicators, World Bank	
FAO	United Nations Food and Agricultural Organization	
Mitchell	Mitchell T.D. and Jones P.D. 2005. "An improved method of constructing a database of monthly climate observations and associated high-resolution grids." International Journal of Climatology, 25: 693–712.	
Gallup	Gallup, John L. and Jeffrey D. Sachs, with Andrew Mellinger. "Geography and Economic Development" CID Working Paper no. 1, March 1999.	
Collier	Collier, P. and A. Hoeffler, 1998, On economic causes of civil war. Oxford Economic Papers 50, 563–573.	
Freedom	Freedom House Country Ratings. http://www.freedomhouse.org/ratings/index.htm	
DPI	Database of Political Institutions. Beck, T, G Clarke, A Groff, P Keefer, and P Walsh. New Tools and New Tests in Comparative Political Economy: The Database of Political Institutions. World Bank Working Paper 2283.	
Polity	University of Maryland Polity IV Database. http://www.cidcm.umd.edu/inscr/polity/index.htm	
Open Doors	Institute for International Education. http://opendoors.iienetwork.org/	

Notes

All figures are in real 1995 United States dollars.
"L" beginning a variable name indicates a lagged value
"C" ending a variable name indicates normalization by population
"H" ending a variable name indicates normalization by land area
"l" beginning a variable name indicates a log

Appendix II

Country-Level Revisions to FAO Rural Public Expenditures Dataset

Country	*Years*	*Problem*	*Change*
DR, Ecuador, Honduras, Panama, Uruguay, Venezuela	All	Uncertain of revisions made between 2003 and 2005	2003 FAO data used
Bolivia, Columbia	All	Data not disaggregated	Dropped PSubM observations
El Salvador, Cuba	All	Insufficient data	Dropped country
Chile	All	FAO re-estimating data	Dropped country
All	All	Reported sums do not equal category sums	Used sums of expenditures in each category
Brazil	1985	Low outlier	Dropped observation
Brazil	2000, 2001	Accounting system changed	Dropped observations
Jamaica	1985, 1986, 2001	Expenditures not disaggregated	Dropped observations
Jamaica	1990, 1991	Expenditures not disaggregated	PSubM interpolated between surrounding values
Mexico	1985, 1986	Accounting system changed	Dropped observations
Paraguay	1985, 1986	Spending by decentralized entities not available	Dropped observations

Table AIII

FE and RE, QFE, and Arellano-Bond Estimators of Agricultural GDP Per Hectare

Dependent variable: log of Agricultural GDP per Agricultural Hectare

Specification	*Fixed Effects*	*Random Effects*	*Quasi-FE*	*Arellano-Bond*
Lag of log Ag GDP per Hectare				0.825 (0.000)**
Rural Subsidies Share	-0.120 (0.115)	-0.119 (0.088)*	-0.281 (0.001)**	0.071 (0.004)**
log Rural Population per Hectare	0.083 (0.518)	0.286 (0.000)**	0.027 (0.182)	-0.078 (0.033)**
log Rural Gov't per Hectare	0.039 (0.012)**	0.035 (0.021)**	0.513 (0.000)**	0.020 (0.018)**
log Urban GDP per Hectare	0.497 (0.000)**	0.434 (0.000)**	0.298 (0.000)**	0.049 (0.032)**
Openness	0.101 (0.114)	0.079 (0.194)	-0.212 (0.000)**	-0.038 (0.118)
log Agricultural Price Index	-0.069 (0.527)	-0.077 (0.474)	0.501 (0.011)**	0.159 (0.102)
Mitch Dummy	-0.080 (0.207)	-0.086 (0.177)	-0.201 (0.142)	-0.102 (0.072)*
R^2				
Within	0.614	0.609	0.437	
Between	0.685	0.819	0.956	
Overall	0.669	0.807	0.939	
Observations	239	239	239	218
Sargan Test P-Value				0.377
Arellano-Bond AR(2) Test P-Value				0.553

P-values are in parenthesis.

* Signficant at 10%

** Significant at 5%

Lagged values of all independent variables were used, except for the log Agricultural Price Index and the Mitch Dummy

Appendix IV

First Stage of 3SLS Estimation of Agricultural GDP Per Capita

Dependent Variable	*log Ag GDP per Capita*	*Rural Subsidies Share*	*log Rural Gov't per Capita*
Independent Variables			
log Ag Area per Capita	0.167 (0.001)**	0.129 (0.002)**	0.202 (0.361)
log Non-Ag GDP per Capita	0.485 (0.000)**	0.070 (0.013)**	1.314 (0.000)**
Openness	0.028 (0.738)	0.174 (0.013)**	0.167 (0.647)
log Agricultural Price Index	0.269 (0.042)**	-0.197 (0.072)*	-0.891 (0.122)
Mitch Dummy	-0.079 (0.332)	0.025 (0.712)	0.150 (0.674)
Years of Democratic Stability	0.036 (0.001)**	0.034 (0.000)**	-0.143 (0.003)**
Suitable Soil - Best Crop	0.044 (0.000)**	0.036 (0.000)**	0.223 (0.000)**
Suitable Soil - 2nd Best Crop	0.041 (0.000)**	0.045 (0.000)**	0.185 (0.000)**
Percent Land Area in Tropics	-0.061 (0.785)	1.006 (0.000)**	0.185 (0.851)
Average Elevation	0.000 (0.000)**	0.000 (0.000)**	-0.001 (0.083)*
log Average Precipitation	0.338 (0.004)**	-0.409 (0.000)**	0.640 (0.209)
Ethnolinguistic Fractionalization	0.008 (0.000)**	0.007 (0.000)**	-0.009 (0.207)
Election Year Dummy	0.014 (0.504)	-0.007 (0.684)	-0.016 (0.861)
Gini Coefficient	-0.002 (0.839)	0.016 (0.020)**	0.184 (0.000)**
Political Competition	0.001 (0.921)	0.027 (0.006)**	0.060 (0.240)
Presidential Regime Dummy	0.189 (0.000)**	-0.092 (0.026)**	0.930 (0.000)**
Proportionality	-0.039 (0.110)	0.044 (0.031)**	0.210 (0.051)*
Freedom of the Press	-0.002 (0.009)**	-0.002 (0.000)**	-0.005 (0.114)
Students in U.S. 20-24 Years Ago	-0.181 (0.000)**	0.128 (0.000)**	0.598 (0.000)**
Federal Country Dummy	-0.433 (0.000)**	0.325 (0.000)**	-1.597 (0.000)**
Population Percent Seniors	-0.135 (0.000)**	-0.087 (0.001)**	-0.636 (0.000)**
R^2	0.983	0.850	0.836
Observations	218	218	218

P-values are in parenthesis, based on robust small-sample standard errors.
* Signficant at 10%
** Significant at 5%