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CRITICAL ISSUES IN BRAZIL'S ENERGY SECTOR

DEMOCRACY AND THE DISTRIBUTION OF ELECTRICITY IN BRAZIL, LATIN AMERICA, AND THE NON-OECD WORLD

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Introduction

During the late 1960s, governments in Latin America, Southeast Asia, as well as Africa embarked on what Jeffry Frieden calls third world indebted industrialization: financing rapid industrial growth through increased borrowing from international commercial lenders (Frieden 1987). Under indebted industrialization, commercial banks in the United States and Europe typically lent money to non-OECD countries in the form of loans guaranteed by the public or state sector. According to Frieden, roughly 80 to 90 percent of the loans were made to the public sector with the remainder guaranteed by the state (Frieden 1987, 301). The Mexican experience was typical. In 1978, Mexico obtained $6.5 billion in Eurocurrency credits and bonds. Of that, roughly 86 percent of capital investment was administered by the Mexican state: 40 percent went to public development banks, 34 percent to state-owned utilities and industry, 12 percent to the central government, 11 percent to a number of private industrial companies, and 3 percent to a private bank (Frieden 1987, 301).

In addition to providing funds for investment in new industries, states undertook large-scale infrastructural projects to spur industrialization. Providing cheap electricity was an important part of the strategy. With the new loans, governments provided capitalists with a significant benefit by increasing power generating capacity and providing cheap electricity to industry. Industry was not the only beneficiary; populist governments provided cheap electricity to consumers in hopes of increasing political support (Gay 1994). Electricity is a commodity whose distribution can be closely monitored and tightly controlled. Governments can adopt a variety of strategies delineated by two fundamental choices. Emphasis can be placed on subsidizing industrial development, or government can emphasize the distribution of electricity to wide segments of the population. This study is designed to ascertain whether democracy influences which strategy governments adopt.

Why study democracy and the distribution of electricity? In addition to improving objective living conditions, electricity can transform society through education and

literacy; access to electricity improves schools in addition to making it easier to read at night. Electrification can also influence social capital and civil society. Lighted streets, lighted buildings, and systems of mass transit all increase mobility, giving citizens the ability to participate in community activities. With electrification, individuals can obtain information from the local, national, and international arenas through radio and television. Faxes and computers—the basic tools of Non-governmental Organizations—are only possible with electricity. Despite its importance, there has been relatively little work done on the relationship between politics and electrification in the developing world. This is surprising since politicians have used electricity as an important form of political currency; politicians trade electricity for votes (Gay 1994).

Using time-series cross-sectional data on the consumption of electricity by sector, I will examine the relationship between regime type and the distribution of electricity. Does regime type influence who ultimately consumes electricity? The analysis below will provide an answer to that question.

In section one, I derive a set of hypotheses that can be tested with data on electricity consumption. Section two introduces the model and the variables. Section three presents the results for the non-OECD world. Section four presents the same results for Latin America. Section five gives a brief description of Brazilian politics over the last three decades. Section six presents consumption patterns in Brazil for the past three decades. Section seven provides an interpretation of the results. Section eight concludes the paper.

Theory

I use existing theory on democracy and the provision of public goods to derive several hypotheses on democracy and the distribution of electricity. The debate turns on whether authoritarian politicians are relatively more insulated from societal demands than their democratic counterparts. Although the argument is usually cast in quantitative terms (levels of insulation), it can also be cast in qualitative terms (insulation from who?). In other words, regime type may determine which kinds of groups enjoy access to

politicians rather than having a uniform effect on insulation vis-à-vis society. If regime type influences who gains access to the political process, democracy can hold important consequences for the distribution of electricity.

To the extent it structures the incentives that politicians face, regime type shapes the strategies politicians pursue in their search for political support. The existence of meaningful elections represents just one possible facet of democracy that could influence the room politicians have to maneuver. Given the significant control governments exercise in the production and delivery of electricity, providing subsidies, fixing prices, and investing in new power generation can represent a key component of any electoral strategy. Elections, the argument goes, compel politicians to distribute public goods to a wide segment of the population in order to broaden their electoral support (Olson 1993; Brown 1999; Brown and Hunter 1999). Unlike government spending on education, health, and poverty reduction programs, altering the price of electricity can have an immediate effect. While directing resources towards education or health may not necessarily improve school enrollment or infant mortality, the provision of cheap electricity will have a direct effect on electricity consumption.

Variations on this theme are common. That democratic politicians are unable to ignore popular demands for consumption and make the sacrifices necessary to spur industrialization is a familiar refrain in work of Walter Galenson, Karl De Schweinitz, Samuel Huntington, and Guillermo O'Donnell (Galenson 1959; de Schweinitz 1964; Huntington 1968; O'Donnell 1973). Similar conclusions are found in more recent work by Stephan Haggard, Sebastian Edwards, and Rudiger Dornbusch (Haggard 1990; Dornbusch and Edwards 1991). If democratic regimes are indeed more susceptible to societal demands, democratic politicians might be more likely to support residential consumption at the cost of price supports for industry or agriculture. To the extent that society demands subsidized electricity, a less insulated state may feel pressure to increase the consumption of electricity by its citizens at the expense of industry.

Politicians affect the consumption of electricity by altering its price. States determine which customers enjoy cheap electricity through subsidies, price fixing, or by investing in new generating capacity. By examining the correlation between democracy and the distribution of electricity, we can better understand how political institutions influence the provision of an important resource.

Model and Variables

I will use a statistical model developed by Jonathan Katz and Gary King to examine how regime type influences the distribution of electricity (Katz and King 1999). Katz and King's procedure features several advantages to previous approaches. I employ their procedure to avoid an important problem associated with work on distributional issues. Previous studies on the distribution of public goods—e.g. spending on health, education, social security, defense, public utilities—invariably transforms the categories into a pseudo two-item budget: the category of interest and the remainder. Researchers usually analyze the amount spent in one category versus all others. Another approach amounts to examining a specific good in isolation, ignoring the distributional consequences for other public goods. Both approaches are used simply because they require only the basic use of standard statistical methods. Because these methods are appropriate only when the data are categorized into two categories (e.g. a two party system, or a two-item budget), two serious problems arise: bias and information loss. When studying the consumption of electricity by sector, the standard statistical methods fail to take advantage of interesting and potentially important data. If we follow the standard practice of running separate regressions for each category of consumption, a number of interesting questions remain unanswerable. For example, if residential consumption is higher in democratic countries, does it come at the expense of the transport, commercial-public, or industry sector? Forcing the complex pattern of distribution into a simple dichotomous outcome (residential vs. other) may mask important patterns. As Katz and King argue in their study on electoral processes in Great Britain, “Making methodological decisions merely to accommodate the requirements of familiar statistical methods risks missing the most

distinctive and interesting aspects of the electoral process" (Katz and King 1999). The same applies to the analysis of electricity consumption.

Other problems of estimation emerge when the compositional nature of the data is not taken into account. For a full discussion of the statistical implications of running separate regressions for each component, see (Katz and King 1999). The data analyzed here can best be described as compositional data. Perhaps the best examples of compositional data include work on soil samples in geology (e.g. different soil types are characterized by different compositions of minerals, and sediment), rock samples in geochemistry (e.g. rocks are comprised of a number of different elements), and blood samples in biology (e.g. proportions of white blood cell types to red blood cells in a patient). Political science is full of examples that are compositional in nature yet the proper statistical techniques are rarely used.

Characteristics of Electricity Consumption

Electricity consumption is broken down into a number of different categories: industry, transportation, agriculture, commercial-public, residential, and other. The classification scheme used is based on the International Standard Industrial Classification (ISIC) of all Economic Activities. Consumption by industry refers to all manufacturing including durable and non-durable goods. The industries included in this category range from the production of iron, steel, transport equipment, and non-ferrous metals to mining and quarrying, textile and leather, and construction.[1] Consumption by the transportation sector includes international civil aviation, domestic air transport, road, rail, pipeline transport, and internal navigation. The consumption of electricity by the agricultural sector is defined as all deliveries to users classified as agriculture, hunting, and forestry by the ISIC, and therefore includes energy consumed by such users whether for tractors, power, or heating. The commercial-public categorization is very broad, including hotels and restaurants, the financial sector, real estate, the renting of machinery and equipment,

and a variety of other service-oriented ISIC divisions. Although some overlap exists, an important difference exists between the commercial public and industry sectors. Economic activity within industry generally involves transactions between firms. Transactions within the transportation and commercial-public sectors typically occur between firms and consumers. The categorization of the data lends itself to exploring in a straightforward fashion an interesting question. Does regime type compel politicians to favor one distribution strategy over another? Under democracy, are politicians best served by distributing electricity to wide segments of the population or by catering to more concentrated interests?

Three categories are constructed to distinguish between sectors representing encompassing interests from relatively concentrated interests. Industry and agriculture are combined to represent the consumption of electricity by big business. Agriculture is a residual category that routinely constitutes only 2% of final consumption. Including it in any other category would have little effect on the results since it makes up such a small percentage of total consumption. The transport and commercial-public sectors are combined to represent a more broadly construed set of interests. Finally, a residual category (*other*) is combined with residential consumption to capture use by individuals in their homes.[2] These categories will provide a strong and clearly delineated test of democracy's impact on the patterns of electricity consumption. The test will help us determine whether regime type influences who the winners and losers are with respect to an important area of government policy.

Variables

Democracy: To measure democracy, I use a dichotomized form of the Polity IV data. I follow the work of Londregan and Poole to construct a composite index of the DEMOC

[1] The full list includes iron and steel, chemical and petrochemical, non-ferrous metals, non-metallic metals, transport equipment, machinery, mining and quarrying, food and tobacco, paper, pulp and printing, wood and wood products, construction, textile and leather, and other non-specified activities.

[2] *Other* represents consumption that does not fall under any of the specified categories. Military fuel consumption with the exception of transport fuels is one example. Some categories are just too difficult to distinguish (i.e. some residential uses could be considered agricultural). The *other* category's mean share of total consumption is .12 with a standard deviation of .26. A vast majority of the cases register zero under the *other* category.

score and the AUTOC score (Londegran and Poole 1990). I then dichotomize the variable based on two considerations. First, the distribution of the DEMOC - AUTOC (D-A) score is bimodal; a vast majority of the cases lie at either extreme of a scale that ranges from -10 to +10. In the current debate over dichotomous versus continuous measures of democracy, Collier and Adcock propose taking a practical stance. I adopt one of their justifications here; if the measure's distribution resembles a dichotomous variable anyway (it has a bimodal distribution), dichotomizing the measure is acceptable (Collier and Adcock 1999). A second reason involves the kind of model I employ. A dichotomous variable facilitates the use of an analysis of covariance (ANCOVA) model, allowing us to test directly whether regime type alters the functional relationship between the dependent and independent variables. Although the cutoff point used in the analysis was made at zero, varying the cutoff point between -4 and +4 had relatively little effect on the results. This, of course, is expected since a vast majority of the cases lie at either extreme.

GDP/capita (PPP): As economies develop, patterns of consumption change. Less developed economies tend to be characterized by relatively limited consumption by the residential sector. As an economy develops, individuals purchase certain goods--TVs, washing machines, and air conditioners--that drastically alter the demand for electricity. Since economic development is correlated with democracy as well (Lipset 1960; Apter 1965; Inkeles and Smith 1974), it is important to control for GDP/capita. The measure of GDP/capita was obtained by the World Bank World Indicators and is based on purchasing power parities. The GDP/capita variable is logged so that linear methods can be used in the estimation.

Percentage of the Labor Force in Agriculture: The percentage of the labor force in agriculture is included to account for the population involved in non-industrial production. In countries where the share of agricultural workers is high, we might expect politicians to be less concerned with catering to industrialists. Without controlling for the percentage of workforce in agriculture, it is impossible to ascertain the extent to which cheap electricity for the industrial sector primarily benefits capitalists or benefits workers

through increased employment opportunities and higher wages. If government heavily subsidizes industry when a large segment of the population is employed in the agricultural sector, we know politicians are not concerned with widening their base of political support. The variable for the percentage of the labor force in agriculture was obtained from the World Bank Indicatros 2000 (World Bank 2000).

Model

Armed with the economic and political variables, we can determine whether regime type influences the consumption of electricity. Model (1) below forms the basis of the statistical analysis. The coefficient $_3$ estimates the difference between the intercepts of the democratic and authoritarian regression lines. The equation below estimates the impact regime type has on the share of electricity consumed by the transport and commercial-public sectors, the residential sector, and industry. To calculate the share of electricity consumed by each of the three categories, two regressions are estimated. The dependent variable in regression (1) is the log odds ratio of residential consumption over industry. The dependent variable for regression (2) is the log odds ratio of the commercial-public sector over industry's share of consumption. To calculate the share consumed by industry, I took the predicted values of each regression and subtracted them from one.

(1) $Log(Residential/Industry) = \alpha + \beta_1 GDP/capita + B_2 Labor\ Force\ in\ Agriculture + \beta_3 Democracy\ Dummy + \varepsilon.$

(2) $Log(Commercial\text{-}Public/Industry) = \alpha + \beta_1 GDP/capita + B_2 Labor\ Force\ in\ Agriculture + \beta_3 Democracy\ Dummy + \varepsilon.$

The model is designed to test whether the distribution of consumption varies according to regime type.

Results

Several interesting patterns emerge from the estimates. The predicted values presented below are generated from the two regression models reported in Table 1 (see Appendix). To generate predicted values for the shares of electricity consumption in each category, I followed Katz and King (Katz and King 1999). As Table 1 indicates, the biggest differences between the democratic and authoritarian cases can be observed in Model (1). Let me briefly discuss each model.

The estimated coefficient for GDP/capita is positive but not significant. The coefficient for the labor force in agriculture is negative and not significant. The coefficient for the democratic dummy variable is positive and significant; when all other variables are held constant at zero, democracy has a positive impact on the share consumed by the commercial-public sector relative to industry. Of course, countries never experience zero GDP/capita or any other value of zero in the independent variables. Therefore, its substantive meaning is somewhat ambiguous. It nevertheless has an effect on the predicted values generated by the model.

Several figures reveal the substantive impact democracy has on the distribution of electricity. Figures 1 and 2 (see Appendix) record the shares of consumption by each sector as GDP/capita ranges from its minimum value to its maximum value, holding all other variables constant at their mean values. Figure 1 shows the distribution of consumption for the world's authoritarian regimes. Although the regression results suggest there is an important difference between democratic and authoritarian regimes, Figure 1 shows the difference is not substantively important at all levels. At the lowest income level, the gap between authoritarian and democratic regimes is roughly 3 percentage points. The three-percentage point advantage is maintained until the logged

value of GDP/capita passes its mean where the difference grows to 4 and then 5 percentage points (See Figure 1).

The commercial-public sector consumes relatively less in poor authoritarian countries than in poor democracies: 4% compared to 7%. In authoritarian regimes, the residential sector typically consumes roughly the same as their democratic counterparts (roughly 25%). A slight but observable difference exists between poor authoritarian and democratic regimes in terms of industrial consumption; in democracies, industry consumes roughly 3 percentage points less than industry in authoritarian regimes.

The results reported above are robust. The estimates hold up to a number of different model specifications. I tested the sensitivity of the estimates with various time-series cross-sectional models. I also analyzed the sensitivity of the results to influential cases. I found there were no individual cases or countries that produced results significantly different from the models presented above. The explanatory strength of the models was also satisfactory; model (1) explained 42 percent of the variance while model (2) explained 69 percent of the variance.

Electricity Consumption in Latin America

Patterns of electricity consumption in Latin America are considerably different when viewed separately. Figure 2 shows the consumption of electricity by households for a broad section of Latin American countries: Argentina, Brazil, Chile, Colombia, Costa Rica, and Panama. As the figure indicates, there is a wide range of variance in the distribution to the household sector for all levels of income (See Figure 2).

On one extreme, Brazil and Chile's household sector consumes roughly 17-23 percent of total electricity consumption. At the other extreme, Panama's household sector consumes roughly 80 percent. Costa Rica (approximately 60 percent) and Colombia (approximately 40 percent) represent countries that consume close to the mean percentage. The same figures presented for the entire developing world show some

rather distinct pattern when we consider only the Latin American cases. The differences are greatest between the public and household sectors (See Figure 3 in Appendix).

At the mean value of GDP/capita, the model predicts that the public sector in authoritarian regimes consume roughly 40 percent of the total while their democratic counterparts only 14 percent of the total. In the housing sector, authoritarian regimes consume 10 percent while democratic regimes roughly 35 percent. As with the results for the developing world, the results from the Latin American cases are robust and are not dependent on the model specification.

To check whether the differences are dependent on the model, I ran a simple regression of the percentage of electricity consumed by the public sector on GDP/capita and collected the residuals. I then plotted box plots of the residuals for democratic and authoritarian regimes. The two box plots confirm the compositional analysis; public sectors consume a much higher percentage of electricity than do the public sectors in their democratic counterparts (See Figure 4).

Electricity Consumption in Brazil

Political Background: 1964-1998

Between 1964 and 1985, Brazil witnessed 21 years of military rule marked by significant changes in the level of political repression. The degree of electoral competition during the authoritarian period varied significantly. For our purposes, it is important to draw a distinction between the level of electoral competition before and after 1974. The period before 1974 was characterized by relatively high levels of repression, which left the opposition demoralized and ineffectual (Lamounier, 1989). After 1974, the military government embarked on a gradual transition towards democracy, enabling the opposition to make significant electoral gains.[3] Several characteristics of Brazilian authoritarianism distinguish it from other authoritarian regimes. Unlike other

[3]For two clear accounts of Brazilian political history between 1964 and 1985 see (Skidmore, 1988; Alves, 1985).

authoritarian regimes, the military leadership kept the National Congress open.[4] Elections for the National Congress proceeded relatively uninterrupted; direct elections for the lower house of Congress (Chamber of Deputies) were held at four-year intervals throughout the authoritarian years. Another peculiar facet of the authoritarian regime involved the rotation of the presidency among the top leaders of the armed forces.

Between 1964 and 1967, a moderate faction of the military (the *castelistas*) controlled the presidency. Pledging a quick return to democratic politics, the *castelistas* refrained from the degree of violence associated with similar episodes in Chile and Argentina. In 1967, however, a hard-line faction of the military (the *linha-dura)* captured the presidency. Before 1967, police organizations were responsible for monitoring subversive activity. Student protests, increasing strike activity, and a growing guerrilla movement convinced the military to become directly involved in the war against guerrilla activity (Skidmore, 1988, p. 127). Facing censorship along with imprisonment and torture, opposition politicians and their supporters failed to mount a serious electoral challenge to the military government between 1968 and 1973.

The *castelistas* recaptured the presidency in 1974, promising to liberalize the political arena. Shortly after announcing their plans to liberalize politics, the government party suffered significant losses in the 1974 congressional elections. Perhaps most devastating, the government losses came on the heels of the Brazilian economic 'Miracle'. Having lost a significant share of the seats in both houses of Congress during a period of significant economic growth, the military realized that a booming economy did not necessarily guarantee political support. As a result, the military leadership turned towards the electoral arena to legitimize its participation in politics (Ames, 1987 p. 140). Between 1974 and 1985, then, Brazil underwent a gradual process of political liberalization.[5] Despite the military's attempt to retain support by constantly changing the electoral rules,

[4]Except for a ten-month period in 1968 and a few isolated instances, the National Congress remained open. During the first half of the authoritarian period, the military maintained fairly tight control over congress through its constitutionally mandated ability (through what is known as the Second Institutional Act) to remove politicians from office. The number of politicians removed from office diminished significantly over the last 10 years of military rule.

[5]I do not wish to imply that the process of re-democratization ended in 1985.

opposition politicians made considerable progress.[6] By 1985, the opposition succeeded in installing the first civilian president in roughly twenty years.

Several important developments since 1985 bear noting since they illustrate the ebb and flow of the democratization process. The first years of civilian rule began inauspiciously; the man selected to be Brazil's first civilian president in over 20 years—Tancredo Neves—died just before assuming office. José Sarney, a politician with stronger ties to the former military government and its party, assumed the presidency in his place. To many Brazilians, Sarney represented the same interests and political forces that had dominated the country's politics throughout the dictatorship. Given the strange turn of events, 1985 did not represent a clear break with Brazil's authoritarian past.

Despite Neves's death in 1985, democratization's course was set. Elections for the Senate and Congress scheduled for November 1986 were extremely important since the victors would be charged with writing Brazil's new constitution. With elections due in November, on February 28, Sarney announced a new economic package to combat inflation (the Cruzado Plan). The Cruzado plan placed a one-year freeze on mortgages, rents, and prices in addition to implementing a new wage system. These economic measures immediately began to show tangible results. Price freezes along with higher wages led to a boom in consumption. Unfortunately, the reforms Sarney enacted could not be sustained. Eventually, the President's plan failed to stabilize the Brazilian economy, which began to spiral out of control, generating rampant inflation. Fortunately for Sarney and his coalition partners, the economic difficulties came after the November elections. Politicians belonging to or affiliated with the PMDB, Sarney's most important coalition partner, captured 261 seats of the 487 member lower house along with 22 of 23 governorships (Schneider, 1996).

After protracted deliberation, on 22 September 1988, Brazil's new constitution became law. Although real substantive progress was made on several fronts, the 1988

[6]For an account of the opposition's electoral struggle in the face of constantly changing electoral rules engineered by the military to maintain support, see (Mainwaring, 1986).

constitution succeeded primarily in solidifying the strength of those who benefited from the political institutions already in place. A key feature of the 1988 constitution was the devolution of power from the federal to local government level. During the dictatorship, states and municipalities relied on the federal government for resources. Under the 1967 constitution, a significant portion of tax revenue belonging to the states and municipalities had to first pass through the federal government. With corruption, mismanagement, and inflation, states and municipalities rarely saw the full amount. The constitution of 1988 largely discontinued that practice, giving the state and local levels more control over their revenue.

Finally, Brazil's newly cast democratic institutions weathered a severe test in 1992 when President Fernando Collor was impeached for influence peddling and related crimes. The episode is important for two reasons. First, preoccupied with the daily litany of charges and accusations lodged against Collor and his former campaign treasurer, important problems facing Brazil were put on hold. Addressing income inequality and reforming the health and education systems received scant attention during the almost yearlong affair. On the positive side, the impeachment process never seemed subject to extra-constitutional pressures: the military.

To summarize, the 21-year dictatorship can be characterized by 2 distinct periods. Between 1964 and 1974, a repressed and demoralized opposition could not muster the strength to challenge the military. After suffering a significant loss of support in the 1974 elections, the military leadership began a gradual process of political liberalization. By the early 1980s, the military began to lose control; the military could no longer determine the pace of political liberalization. The years 1985, 1986, and 1988 all represent important dates that mark Brazil's process of democratization, leading eventually, in 1989, to the first direct election of the Brazilian president in over 25 years. Progress since 1990 is more difficult to assess. Although the impeachment of a corrupt president, within the bounds of the constitution, bodes well for Brazilian democracy, progress remains slow on several fronts. Corruption, special interest peddling, and human rights abuses by the federal police represent several areas that require improvement.

Establishing whether Brazil is more democratic now than during the late 1980s requires a more detailed analysis than is given here. Fortunately, I need only make the minimalist claim that during the 1990s, deciding who governs Brazil depended more on electoral success than at any time during the military dictatorship.

Democracy and the Consumption of Electricity in Brazil

Electricity consumption over the last 27 years confirms the overall aggregate pattern we see in the rest of Latin America. Given the proclivity for authoritarian regimes in Latin America to witness relatively high rates of consumption in the public sector, we would expect to see the eventual democratization in Brazil to correspond with subsequent rises in the percentage of electricity consumption devoted to the housing sector. Figure 5 confirms the pattern identified by the compositional analysis (see Appendix).

As Figure 4 indicates, electricity consumption by the household sector hovered around 20 percent during the years most scholars consider to be the authoritarian period (1964-1985). According to Figure 4, electricity consumption by the household sector increased dramatically shortly after Brazilians regained the right to directly elect a president. In two to three short years, electricity consumption by the household sector shot up from 20 percent to 25 percent, roughly a 25% increase. Although political competition increased from 1974 on, dramatic changes in the consumption of electricity did not occur until 1989, when Brazilians first elected a president after roughly 25 years.

Interpretation

With the aid of a few assumptions, we can construct some plausible explanations. First, assume that the consumption of electricity is influenced by its real price: the nominal price ± any government subsidy or tax. Second, assume that the economic factors that determine the price of electricity are captured by per capita income, the percentage of labor force in agriculture, and a variety of factors that are picked up by the country dummy variables included in each regression. The remaining variation in the real price of electricity is in large part determined by politics.

If consumption depends on real prices, and real prices are determined in part by government, several plausible explanations emerge. Given the assumptions made, authoritarian governments must structure prices to favor interests associated with the public sector. The beneficiaries of increased consumption by the commercial-public sector are more diffuse than the beneficiaries associated with industry. Although building new roads, airports, and rails hold obvious benefits for big business, cheaper electricity prices in this sector benefit a much wider segment of the population. At the very least, there is an important difference in strategies adopted by each regime type; one strategy involves providing subsidies to the public sector whereas the other represents a more direct strategy that provides electrification to the household sector.

Politicians, bureaucrats, and public officials in Latin America are more sensitive to demands made by the public sector in dictatorships. Politicians have a choice in determining how electricity is consumed. Under authoritarian rule, a larger share of electricity consumption goes to the public sector, a sector where government agencies maintain control over exactly where energy is distributed, either to enterprises that benefit industry or to businesses that reach a larger sector of the electorate. In either case, when extra resources are allocated to the public sector, politicians, bureaucrats, and technicos maintain some semblance of control. In democracies, relatively more is consumed by the household sector; a sector whose product is consumed directly by consumers. Authoritarianism, therefore, seems to affect the degree of control state actors maintain over the distribution of electricity. Providing electricity to the household sector may benefit politicians associated with particular geographical areas. Providing electricity to the public sector can benefit both industry and public sector enterprises that, in turn, benefit a wide segment of the electorate,

Conclusion

The provision of energy underlies every aspect of our modern lives. How electricity is distributed and consumed can have an important impact on the economy and society. A

significant portion of development in the non-OECD countries has been directed by the state. Political institutions influence how politicians distribute electricity. Aggregate results among the world's developing countries revealed that authoritarian regimes held a slight bias for the industry sector. In Latin America, the commercial-public sector witnessed disproportionate consumption under authoritarian governments, implying that regime type affects the strategy politicians favor in the distribution of benefits.

Finally, a brief look at Brazil confirmed the aggregate pattern observed in the rest of Latin America. Under authoritarian rule, politicians were more likely to distribute electricity to sectors in which government bureaucrats maintained some level of control: the public sector. Under democratic governance, the household sector witnessed relatively high levels of consumption.

Before concluding, it is important to acknowledge the limitations of this study. First, some of the interests that benefit from cheaper energy in one sector indirectly benefit from subsidies in another. Consequently, in some cases it may be difficult to ascertain which groups are being favored by a particular regime. Despite these potential externalities, there are some distinct differences between the sectors. At the very least, the results imply that under varying institutional constraints, politicians adopt different strategies in the allocation of electricity. Democracies favor a direct strategy through emphasizing the household sector, whereas their authoritarian counterparts provide indirect benefits to industry through the public sector.

A second limitation concerns the aggregate nature of the study. Several assumptions were made in lieu of tracing actual government subsidies or programs that affect the price of energy. Again, to the extent that the assumptions hold, the explanations derived from the results follow directly. Nevertheless, this is a study about outcomes rather than outputs. Consequently, explaining the results must rely on some deduction coupled with circumstantial evidence. This is perhaps the most important limitation of the study. Without an empirical examination of the underlying causal mechanisms, this study's contribution lies in identifying where we might look next. A more detailed study of

electricity policy in carefully chosen countries can confirm or challenge the explanations given here.

Regardless of how these results are explained, the empirical patterns summarized above hold important consequences for every day life in non-OECD countries. Regime type influences the extent to which important services are made available to the majority of society. Because subsidies for industry and the public sector can undercut incentives to operate efficiently, the benefits industrialists receive under authoritarianism can impede their ability to compete in the world market, limiting the country's ability to accumulate foreign exchange. Clearly, a number of questions remain regarding politics and the distribution of energy. Nevertheless, the more we know how political institutions affect the distribution and consumption of energy, the more we can understand the relationship between politics and economic development.

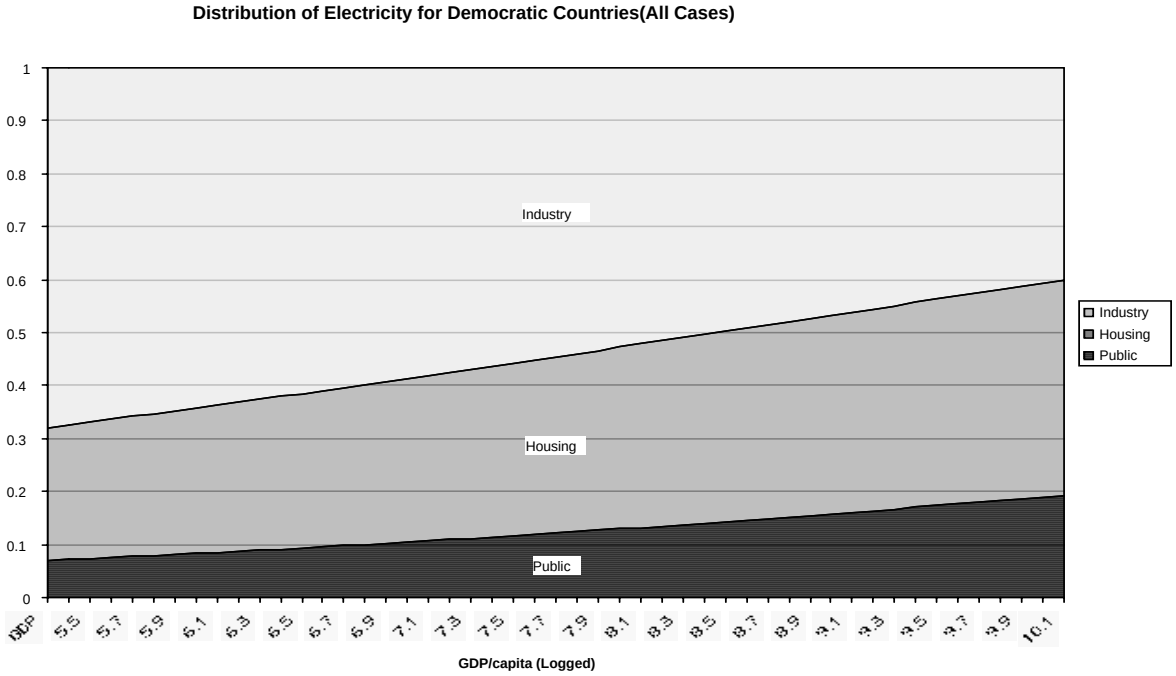
APPENDIX

Table 1
Regressions of the Log Odds Ratios on The Independent Variables

	(1)	(2)
	Log(public/industry)	Log(housing/industry)
Lagged Dependent Variable	0.458 (21.49)**	0.870 (40.44)**
Democracy Dummy Variable (1=Democracy)	0.381 (2.64)**	0.005 (0.07)
GDP/capita (logged)	0.319 (1.68)	0.097 (1.03)
Percentage of Labor force in Agriculture	-0.003 (0.19)	0.009 (1.04)
Constant	-3.362 (1.61)	-1.226 (1.18)
Observations	824	824
R-squared	0.42	0.69

Absolute value of t-statistics in parentheses * significant at 5% level; ** significant at 1% level

Figure 1


Distribution of Electricity for Democratic Countries(All Cases)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Industry
Housing
Public
Industry
Housing
Public
GDP
5.5
5.7
5.9
6.1
6.3
6.5
6.7
6.9
7.1
7.3
7.5
7.7
7.9
8.1
8.3
8.5
8.7
8.9
9.1
9.3
9.5
9.7
9.9
10.1
GDP/capita (Logged)

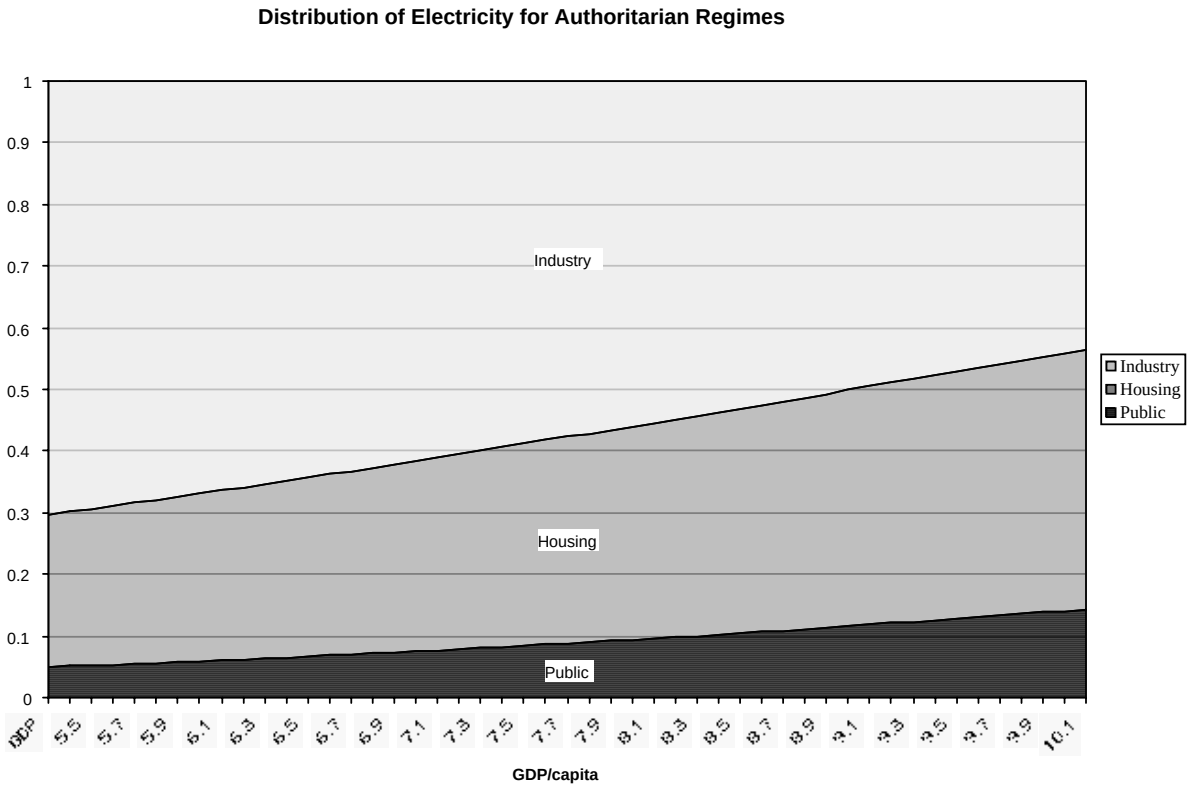

Distribution of Electricity for Authoritarian Regimes
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Industry
Housing
Public
Industry
Housing
Public
GDP
5.5
5.7
5.9
6.1
6.3
6.5
6.7
6.9
7.1
7.3
7.5
7.7
7.9
8.1
8.3
8.5
8.7
8.9
9.1
9.3
9.5
9.7
9.9
10.1
GDP/capita

Table 2
Regressions of the Log Odds Ratios on The Independent Variables

	(1)	(2)
	Log(public/industry)	Log(housing/industry)
Dependent Variable	0.513 (13.20)**	0.768 (15.31)**
Democracy Dummy (1=Democracy)	0.578 (2.93)**	-0.043 (1.28)
GDP/capita (logged)	-0.276 (0.75)	0.035 (0.58)
% of Labor Force in Agriculture	-0.076 (2.73)**	-0.003 (0.66)
Constant	3.688 (1.04)	-0.202 (0.35)
Observations	267	267
R-squared	0.56	0.51

Absolute value of t-statistics in parentheses * significant at 5% level; ** significant at 1% level

Figure 2
Household Consumption of Electricity as a Percentage Of the Total (Assorted Latin American Countries)

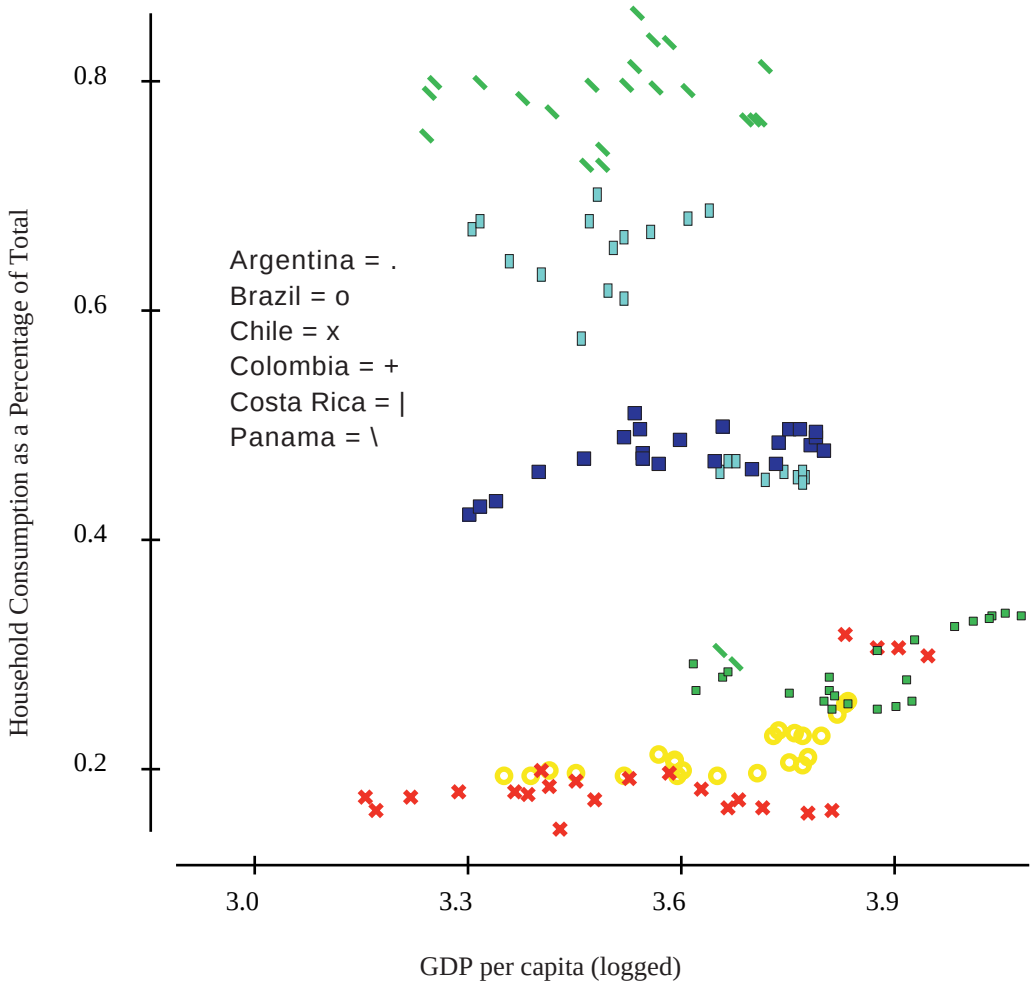
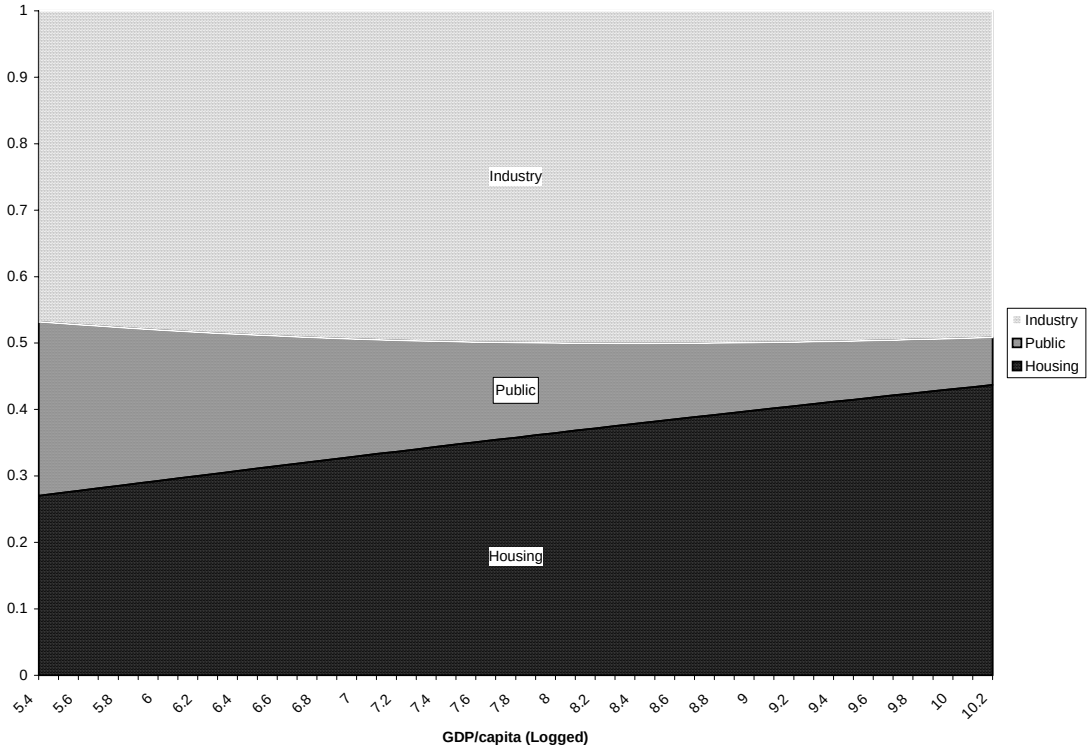


Figure 3

Distribution of Electricity for Democratic Regimes (Latin America)



Distribution of Electricity in Authoritarian Regimes (Latin America)

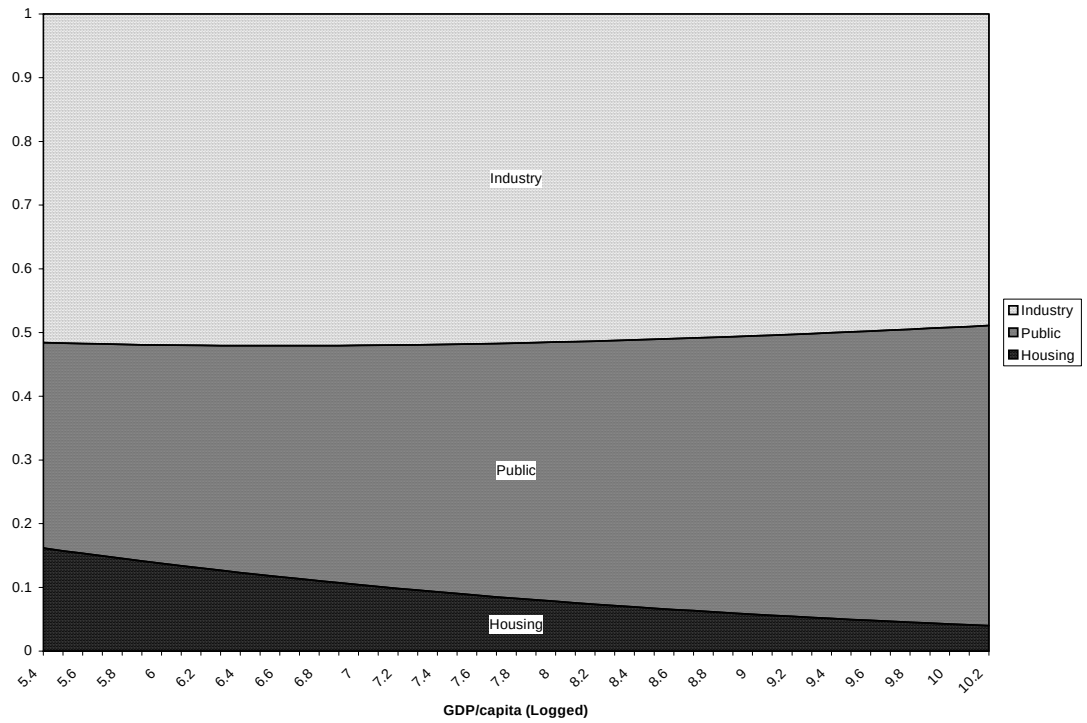


Figure 4
Box Plots of Electricity consumption in the Housing Sector After having removed the Linear Effects of GDP/capita

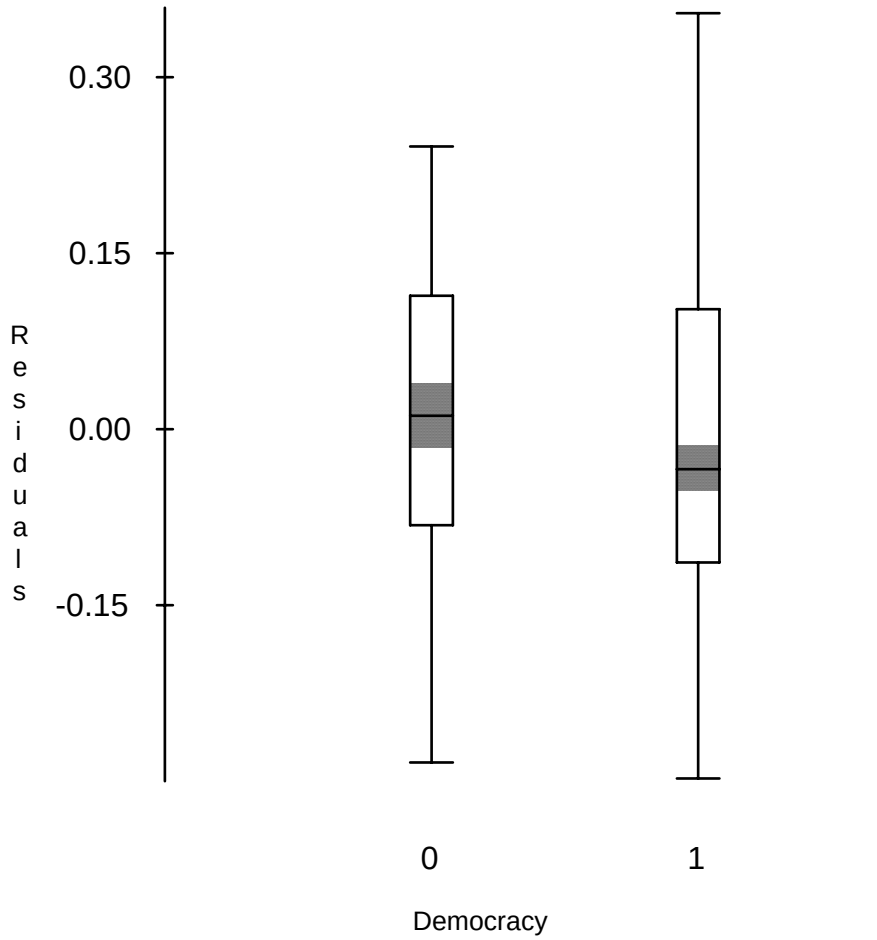
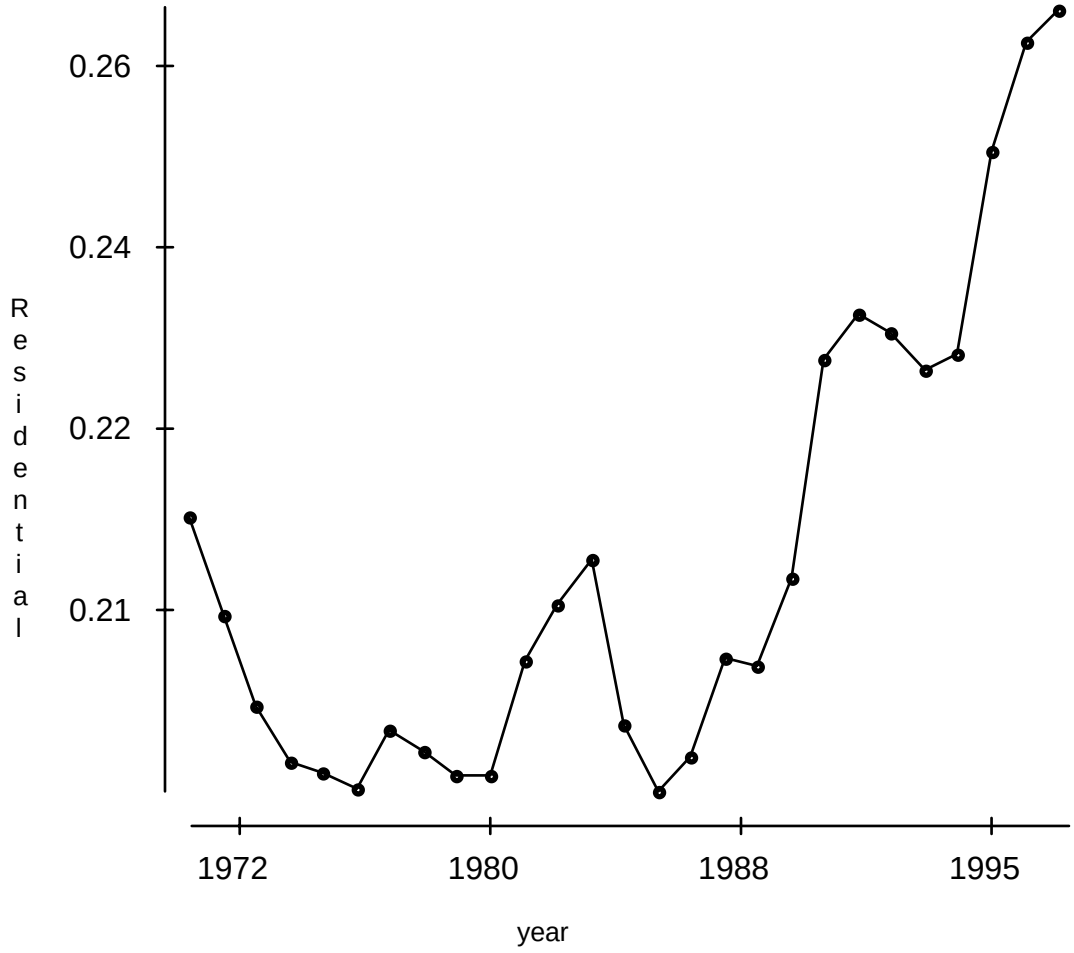


Figure 5
Percentage of Electricity Consumed by the Household Sector



[7]Sensitivity Analysis for Regression Model (1) Reported in Table 1

	(1)	(2)	(3)	(4)	(5)
GDP/capita	-0.458	-1.245	-0.662	-1.253	-0.869
	(0.76)	(4.11)**	(0.77)	(3.70)**	(2.68)**
Labor force in Agr. (%)	-0.156	-0.207	-0.165	-0.207	-0.124
	(2.73)**	(8.49)**	(2.62)**	(7.89)**	(5.98)**
Democracy Dummy	-6.755	-13.301	-8.046	-13.147	-14.535
	(2.05)*	(5.15)**	(2.42)*	(3.51)**	(3.89)**
Democracy * GDP/capita	0.749	1.393	0.875	1.376	1.561
	(2.01)*	(5.07)**	(2.35)*	(3.39)**	(3.86)**
Democracy * Labor in Agr.	0.041	0.079	0.049	0.079	0.082
	(2.55)*	(5.28)**	(2.97)**	(4.23)**	(4.41)**
Constant	10.046	18.981	-7.173	14.883	7.904
Observations	949	949	949	1006	1006
Number of Countries	65	65	65	78	78

(1) Basic Model (Fixed Effects with AR1)
(2) Basic Model without AR1
(3) Basic Model with year dummy variables
(4) Fixed Effects
(5) Random Effects

Panel-corrected z-statistics in parentheses: * significant at 5% level; ** significant at 1% level.

[7]

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